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Our 56th Year

PROCEEDINGS
of the Marine Safety Council

Special Summer Edition 1999 Vol. 56, No. 2

Advances in Pollution Response

FEATURES

DEPARTMENTS

Assistant Commandant's Perspective

By RADM Robert C. North
Assistant Commandant For Marine Safety & Environmental Protection

Preparing For Our Best Response

The Coast Guard has always cultivated a workforce rich in results-oriented people. Individuals whose sheer drive and energy have made the Coast Guard what it is today; an agency highly respected for our ability to manage our five core missions with innovation and continuous improvement. In that spirit, the last several years have seen a host of initiatives to improve our service to the public, and to measure exactly what we do.

Throughout my assignment as the Assistant Commandant for Marine Safety and Environmental Protection, I have stressed the importance of the Government Performance and Results Act and challenged my directors to provide the best return to the American public on their investment. The Office of Response, responsible for coordinating Marine Safety preparedness and response policy, has accepted this challenge by asking the questions, "How do we define and measure the success of a response?" and "How prepared are we to respond"? Today, more than ever before, these two questions drive the activities of the Office of Response as we assess the response needs of the future.

We are in the process of refining the target (what is success?). This will ultimately help us develop a method for determining our level of readiness to perform our response mission. I am excited about these efforts because they show a serious commitment to achieving an optimum approach to our response posture. Clearly much work remains to be done. By reading this issue of Proceedings of the Marine Safety Council you should begin to get a sense of where the future of the Coast Guard environmental response and preparedness lies. Please lend us your support and comments as we explore these challenging issues.

Best Response

This issue of Proceedings of the Marine Safety Council is divided into eight sections. Individual sections are color-coded based on the "Picket Fence" you will find at the beginning of each article. In the first of those sections we explain the cornerstone concept of Best Response and briefly tell you how that ties in with the last article, the Preparedness Assessment Model. In between, you will find articles on the key business drivers that support Best Response. In addition, you will find many pieces of related information that may help you understand the overall relationship to the Best Response concept. Under the first section we have included a short description of the Best Response Surveys and an example of the forms so you can see how this works in application. With Best Response we seek to provide you with the "target" for success and practical suggestions to help your day-to-day business of Response and Preparedness.

Coming up in the Next Issue: Risk Managment

Measuring Response: A Balanced Response Scorecard for Evaluating Success

By Capt J. Kuchin CCGD5 (AM) and Capt L. Hereth, G-MOR, USCGHQ, Washington, DC

For many years there has been an ongoing discussion of how to define success in emergency response. This article presents an update of work in the U.S. Coast Guard to identify the principal measures used to determine success in emergency response and to establish a methodology to evaluate effectiveness in each of those areas.

This article begins with a discussion of the U.S. National Response System (NRS). It identifies the goal of that system and introduces the concept of "Best Response." The "Best Response" model graphically represents the business of emergency response. It is followed by a description of the methodology used to develop a measurement plan. The measurement plan relies on the concepts of key business drivers, critical success factors and a survey instrument to evaluate the complex process of crisis response.

Although survey norms will evolve over time, three immediate benefits for the "Best Response" measurement scheme and survey are offered:

(1) to improve response community alignment,

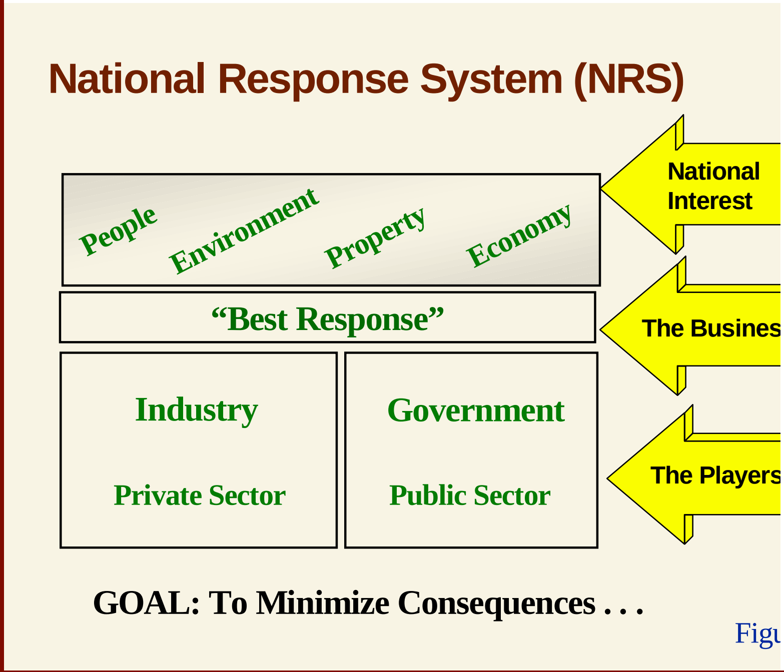
(2) to serve as a guide or part of a "Balanced Response Scorecard" during a response, and

(3) to serve as a post response self-evaluation tool.

The article elaborates on the use of these concepts during a response and proposes their use as part of a Balanced Response Scorecard. Using the "Best Response" measurement scheme, the suggested scorecard blends traditional operational details with an awareness of progress towards outcomes that benefit national interests. This broader view of success will have a beneficial impact on our ability to more effectively prepare for and deliver emergency response with positive, meaningful results.

The U.S. National Response System (NRS)

The U.S. National Response System was established in the late 1960's. It was created in answer to a number of large-scale pollution incidents that highlighted the nation's need to provide a mechanism to foster support, cooperation and collaboration among all response entities, both industry and government (federal, state, local) in order to provide the best possible response. Figure 1 is a summary view of the National Response System. The foundation of the system is the components, or players — industry and government; the business of the system is "Best Response"; and the goal of the system is the protection of those elements of the National Interests summarized here as People, the Environment, Property and the Economy.



Figu

The Goal of the NRS

"*Minimize the Consequences of Pollution Incidents*" – 1999 U.S. Coast Guard Performance Plan

This is the primary goal of the NRS when responding to oil and hazmat incidents. This simple statement focuses on the actual outcome that the NRS is chartered to deliver to the nation. It has been accepted by the U.S. Coast Guard as its goal in the area of pollution response.

The four categories representing the National Interests are designed to be broad enough to include everything the response organization is trying to protect. These categories include:

(1) People - people, their welfare and their interests (social, cultural, archeological and recreational);

(2) Environment - the natural environment;

(3) Property - the property people own; and

(4) Economy - those economic systems that sustain local, regional or national interests.

The Players of the NRS

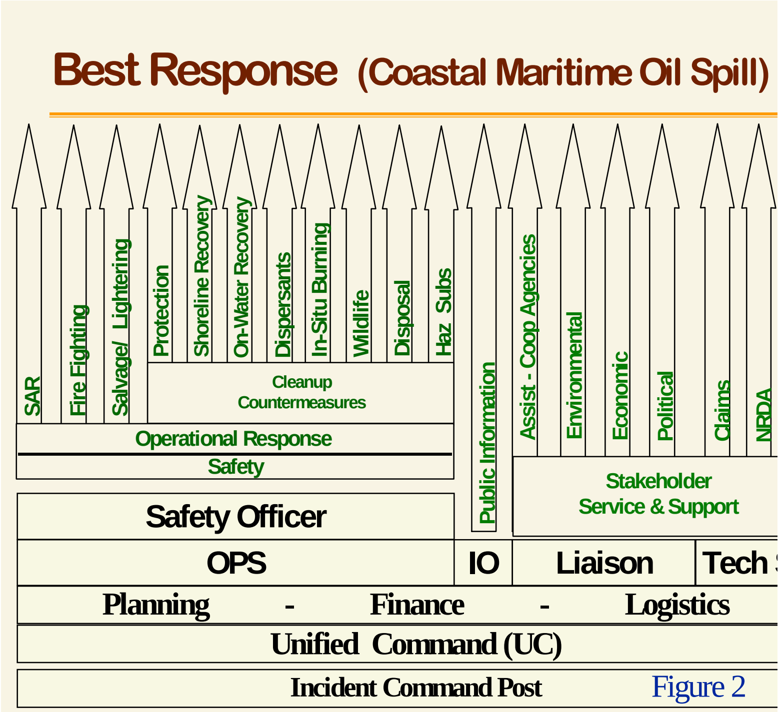
Figure 1 shows that the response system includes both private and public sector representatives. In the U.S., the responsible party (supported by representatives or contractors) and designated government agencies (federal, state and local) each have jurisdiction and on-scene functional responsibilities. Therefore, management responsibilities are normally carried out using a Unified Command (UC) structure and an Incident Command System organization.

The Business of the NRS — "Best Response"

"Response to a major pollution emergency is like standing up, overnight, a multi-million dollar corporation with three (or more) partners (Unified Command) that don't particularly want to be in business together."

This statement captures and characterizes the essence of the challenge of responding to a major pollution emergency in the United States. The tremendous variety of entities (agencies, companies, organizations, individuals, etc.) that are partners, customers, suppliers and stakeholders in the business of emergency response has always posed huge challenges to emergency responders. Over the years, balancing their needs has spawned considerable debate and conflict as response managers wrestled with satisfying all legitimate interests in the midst of emergency response.

In an effort to establish a holistic view — a mental model — of this very complex business, and provide a single common view of what a response is and what it looks like, the Coast Guard measurement development team created a graphic to depict the business of response. Figure 2, "Best Response (Coastal Maritime Oil Spill)" is that model. The model does not pretend to settle the historical conflict and debate over competing priorities; it simply presents them so as to encourage discussion. It does however, attempt to capture the essence of the response, providing a common focus for all segments of the response and stakeholder communities. If the model is accurate, then every major player and



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stakeholder should see his/her primary interest prominently represented in the row of arrows along the upper portion of the diagram. The model has the potential to enable all players and stakeholders to agree on the major functional activities with explicit acknowledgement that all interests are valued and important. As a result, the model can facilitate a more effective discussion focused on how to achieve the Best Response.

The diagram can also serve as a "shared mental model" for the entire response community. A shared model serves as a very practical alignment tool. It helps clarify the scope, complexity and interrelationships of the many important functions carried out in a crisis response. The upper portion of the graphic (the arrows) represents the major functions that must be performed effectively and efficiently to achieve Best Response. The arrows represent those major functions that directly impact the desired outcomes of the response. The use of arrows in the diagram to represent the primary functional areas was a deliberate, symbolic choice representing the fact that an effective response to a complex pollution emergency is a multi-functional event, with a wide variety of things that must be accomplished simultaneously. Each arrow is a complex, multi-organizational function that, by itself, will present significant challenges. It is incumbent on the response manager to ensure that all functions go forward simultaneously.

The lower portion, the foundation of the model, represents the response management system that must ensure that the response is carried out effectively and efficiently. That foundation is based on the National Interagency Incident Management System's (NIIMS) Incident Command System (ICS).

Operational Response

The upper left section of arrows in Figure 2 represents the Operational Response. Typically, a major maritime pollution emergency response begins with a distress call initiating a Search and Rescue (SAR) case. That is followed quickly by mounting operational responses, as needed, in the areas of firefighting, salvage and lightering, and pollution cleanup countermeasures.

Countermeasures may include containment and protection; on water recovery; shoreline recovery and clean up; wildlife protection, recovery and rehabilitation; advanced countermeasures such as dispersant application or in-situ burning; disposal, and hazardous substance response. The arrows indicate parallel, simultaneous execution of these functions.

A block labeled safety is included supporting the entire "operational" complex. Each of the operational response measures, in and of themselves, is potentially extremely dangerous. Safety must be integral to all aspects of each operation.

Public Information and Stakeholder Service & Support

Taken together, the functions of Public Information and Stakeholder Service and Support are the primary "Customer Service" functions provided by the emergency manager. In the past, the primary customer in emergency response had been the "common good" or perhaps the "American people." Certainly these generic customers benefit from the efforts of emergency responders; however, there are far more specific customer groups with more precise needs to be served and their needs merit direct attention.

"*In a Crisis, Always Be the First and Best Source of Information*"–Communications Council of America.

Public Information speaks to the responsibility for keeping the public informed. It is incumbent upon the emergency manager to keep the public fully advised so they feel confident that the response is being carried out correctly. Public confidence is important for the perceived success of the crisis response effort. It is noteworthy that a prime mover for the U.S. Government Performance and Results Act (GPRA) was the seriously eroded public confidence in government. Large crises are situations the public absolutely wants to feel confident that their government (and everyone else) is handling properly. The Public Information function carries the responsibility of ensuring that the public is fully aware of progress and has every opportunity to conclude that the incident is being handled properly. The explicit intent is that the public will have full access to the good and the bad. There is no implied intent that the emergency responders will report anything but the truth.

Stakeholder Service & Support represents the responsibility to keep all stakeholders fully advised about the status of the response. This is important because stakeholders have been impacted by the spill or have a vested interest in the outcome of the response. In an ICS organization, the Liaison Officer routinely deals with assisting and cooperating agencies, organizations or companies. In addition, there are six other categories of stakeholders that must be addressed:

General	Specific
(1) Environmental	(4) Claimants
(2) Economic	(5) Natural Resource Damage Assessment Representatives
(3) Political	(6) Investigators

Appropriate Stakeholder Service & Support includes the idea that the response leadership actively seeks out the stakeholders, keeps them informed, and actively receives input from them. This ensures that, where possible, the management of the crisis will take into account their interests.

Public Information and Stakeholder Service and Support, taken together represent the "Customer Service" side of emergency response and are critical to the overall final judgment of the quality and the success of the response.

The Response Management System – National Interagency Incident Management System Incident Command System

The next section of the model, the bottom half of the diagram, represents the Response Management System. This diagram is arranged to provide a functional representation of how NIIMS ICS interacts and aligns with the major functions - the arrows. The Safety Officer and Operations Section work primarily in support of the Operational Response; the Information Officer (IO) is responsible for Public Information; and the Liaison Officer (LO), supported by Technical Specialists (TS), is responsible for Stakeholder Service and Support.

The supporting layer of organization is shown in the diagram as the Planning, Finance, and Logistics Sections. Their responsibilities spread throughout all areas of the functional response. Similarly, Unified Command carries responsibility for and, therefore, supports all aspects of the response.

The Incident Command Post

The bottom layer of the model—the Incident Command Post—has been placed in the diagram underpinning the entire system. This emphasizes that, in a complex pollution response, the leadership and management of the response will be facilitated by a properly equipped and configured Command Post. Integration of response resources and co-location of the principals will help improve the efficiency and the effectiveness of the response.

"Best Response" Summary

Best Response is the highly complex and challenging business of the U.S. National Response System and emergency response in general. It is very important to understand and to be able to accomplish if we are to reach our national goal to minimize the consequences of pollution incidents to people, the environment, property and the economy.

The Best Response model clarifies and helps us focus our efforts in several ways:

– It depicts the multi-faceted activities occurring in a crisis response.

– It establishes a whole system, graphical view of what emergency response leaders need to provide.

– It adds clarity and common perspective, enabling every participant to better grasp, appreciate, and agree on the length and breadth of all that the response system is required to deliver.

– It serves as a very practical alignment tool, enabling the response community to have a "shared mental model" of the scope, complexity and interrelationships of the many important functions carried out in a crisis response.

– It is useful as a checklist for reviewing readiness.

– It is useful as a checklist for setting objectives during a response.

– It provides the ability to quickly and visually represent to the uninformed the magnitude of the challenge presented by a major pollution response and may serve as a good communication tool.

The Best Response model serves as the basic framework for the measurement scheme proposed in

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the remainder of this paper.

Measuring the Success of a Crisis Response

Why Important?

The next challenge is to identify and to measure the actual outcomes of the response effort. The historical focus has typically been on measuring activities such as: speed in responding; feet of boom deployed; and gallons spilled and recovered rather than the actual impact of those activities. While traditional metrics are important matters in the response, they are largely reflective of processes and activities being carried out in the response and do not always directly relate to the overall outcomes. The intent is to measure outcomes that directly relate to minimizing consequences to people, the environment, property and the economy. Ideally, we want specific information that will relate to the value provided by our response efforts (i.e., through reduced consequences).

Leading vs. Lagging Indicators

There are two general categories of measurements: leading indicators and lagging indicators. Both are valuable to the manager in evaluating progress. The literature suggests that, whenever possible, a measurement plan should include both.

The Leading Indicator for emergency response must center on the response organization's capability to minimize consequences. The indicator should measure the degree of preparedness, i.e. the apparent ability to minimize the consequences. The Coast Guard's leading indicator will involve: 1) a detailed assessment of required response plans and 2) an assessment of apparent capability to respond successfully in a variety of functional areas.

The capability assessment will look at such things as: resources available, systems support, policies, procedures, training levels and exercise participation. The assessments will be principally self-evaluative, but must be useful at the local, regional and national level. The leading indicator will be validated by the lagging indicator proposed below.

The Lagging Indicator will measure the actual outcomes based on the national goal. This means measuring how effective the response organization was at minimizing the consequences of a pollution incident. The primary emphasis during the past year has been on developing a plan to measure the Lagging Indicator - the actual measure of what a response accomplishes relative to minimizing consequences. This is the focus of the rest of this paper.

The Measurement Framework

The process used to develop measures of outcomes is depicted in Figure 3.

Step 1: Identify the goal: "Minimize the consequences of a pollution incident".

Step 2: Identify the key business drivers (KBD) that must be accomplished in order to reach the goal: KBD's should link to those national interests (people, environment, property, economy) we are trying to benefit by minimizing the consequences of a pollution incident. The assumption is that there are several KBDs that must each be addressed to realize success. The final judgment of success will be an aggregate score based on the relative success in each of the KBDs.

Step 3: Identify the critical success factors (CSF) for each KBD: Each CSF is something that must go well or be done right in

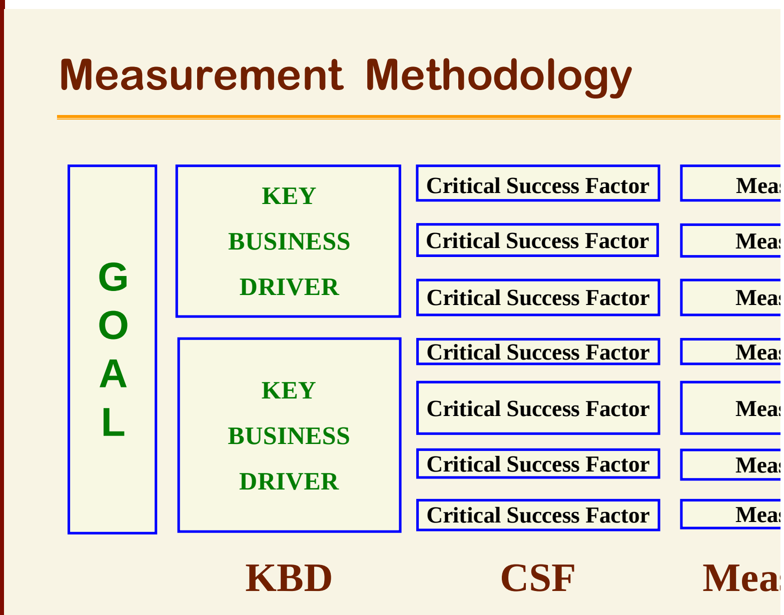


Figure 3

order for the KBD to be protected or receive some benefit (Rockhard, 1981). Again, the entering assumption is that there will be several CSFs that must be accomplished in order to ensure success in each KBD. The final ability to judge success in a KBD will be based on an aggregate of the success in each of the relevant CSFs.

Step 4: Identify measures for the CSFs.

Identifying Key Business Drivers

Identifying the Key Business Drivers (see figure 4), began with a review of the research done over the past twenty years as well as extensive use of a variety of case studies and reviews by a group of experienced responders. As a result, six key business drivers were identified as critical to goal accomplishment. From the outcome measurement perspective, five of the six meet the "outcome" test in that they deal directly with the consequences of the event that we are attempting to address.

The sixth KBD, "Response Organization," is a process outcome that is essential to achieving our desired goal. Because organization figures so prominently in a successful response, it was included as a key business driver. Ideally, the response organization will become so automatic to the responders that eventually it would not even be an issue during a response. Currently, however, our Incident Command System model (or any other crisis management organizational model) is a very challenging and critical aspect of successful response.

The Key Business Drivers (see figure 4) are:

Operational Outcomes:

1. Human Health and Safety: Injury, illness and death to responders and the general public are minimized.

2. Natural Environment: Damage to the natural environment is minimized.

3. Economic Impact: Damage to property and the economy is minimized.

Customer Service Outcomes:

4. Public Communication: The public and the media perceive the response as successful.

5. Stakeholder Service and Support: All stakeholders perceive the response as successful.

Organizational Outcome:

6. The Response Organization: The response organization effectively and efficiently responds to the incident.

Figure 5 depicts the relationship between the major response management functions (shown as arrows) and the key business drivers.

Identifying Critical Success Factors (CSFs)

CSFs for pollution response were identified by Harrald (1994) and consolidated by Walker, et al. (1994). The Coast Guard measurement work group struggled with how those factors might be measured. They were particularly concerned that the methodology chosen would clearly show whether or not desired outcomes had been reached. The intent was to create an evaluation tool that would challenge the response organization to meet high standards. If those standards were met, we felt that we could confidently predict success – success being defined as accomplishing our goal to minimize the consequences of an incident to people, environment, property and the economy.

Given the intent to build a measurement/evaluation tool, and the clear necessity for the CSFs to focus on outcomes and align with the Key Business

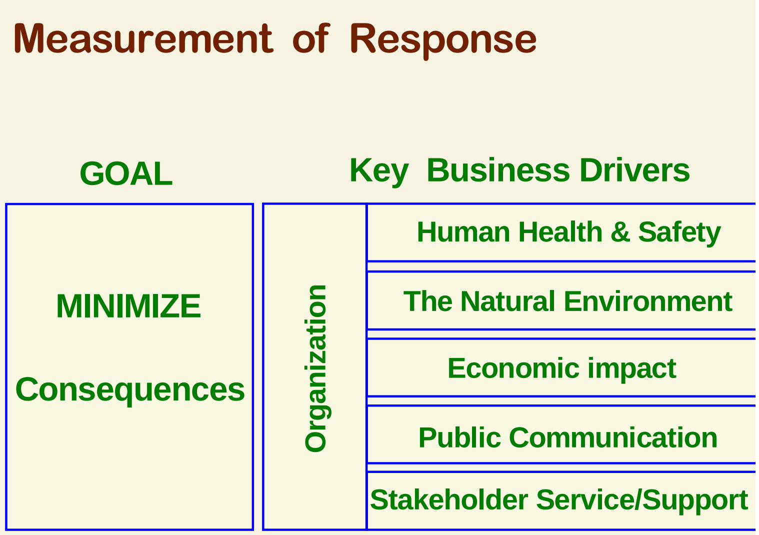
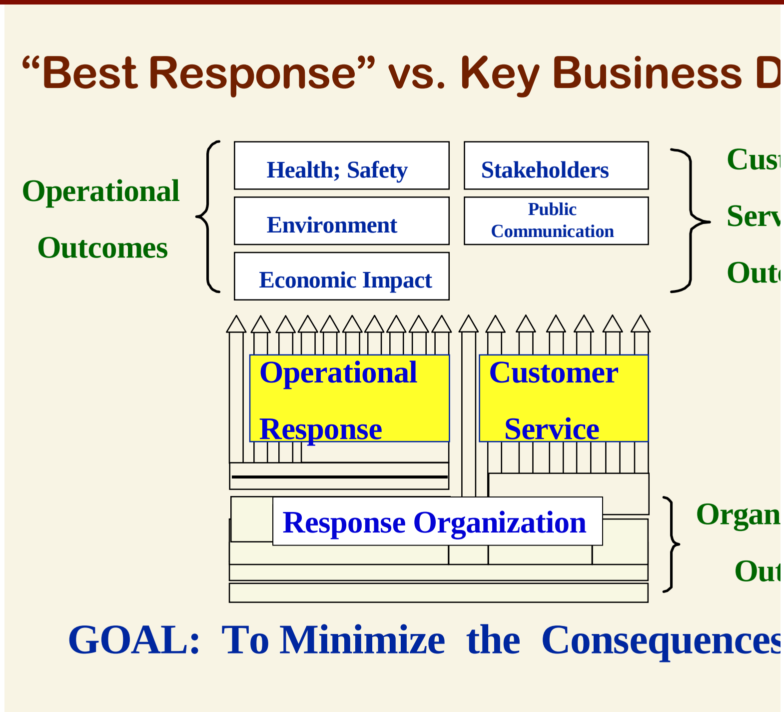


Figure 4

Drivers (KBDs), the CSF's identified in the earlier works mentioned above were extensively reviewed, revised and reworked based upon the following factors:

- Participant's experience
- ICS implementation experience
- Incident Specific Pollution Reports (ISPRs)
- Lessons learned database
- Job task analysis
- Response management job aids



As the list of CSFs was completed and the work began to center on building measures for each CSF, the group concluded that a survey instrument to measure CSF accomplishment was the most practical first step. It was felt that a survey could be used to establish expectations for response and to capture the qualitative assessments of those directly involved in the incident, either as responders or stakeholders.

The Survey

In building the survey instrument, each CSF was transformed into the form of a statement describing in positive terms the accomplishment of the aspect of the response addressed by the CSF. Because the questions are based on CSF's, the expectation is that doing a good job on the CSF will directly impact accomplishment of the KBD and, in turn, success in accomplishing the goal of minimizing consequences. The survey questions created were grouped according to the six KBDs.

Survey Details

The survey is designed to use the judgment of those closest to the event to measure success and judge how well the response organization has done in each KBD. Therefore, only those individuals with good knowledge of or involvement with the response will be asked to fill out KBD surveys. A minimum number of responders and those affected by the incident will be targeted. Each person completing the survey will be asked to fill out a demographics page and then one or more of the appropriate KBD surveys depending on their involvement in the incident. Each Key Business Driver survey is on average one page or less. The methodology of the survey is that the person completing the survey is asked to read each "CSF" statement, and then conclude his/her level of agreement or disagreement that the statement reflects performance in the response being evaluated. A scale from 1 to 7 affords the respondent choices ranging from "strongly disagree" to "strongly agree."

The target population of spills to be measured is tentatively set at 10,000 gallons and over (about 35 per year in the U.S.). A detailed survey protocol—who should complete it, how many, who decides, etc.—is under development. The survey data will be collected by the U.S. Coast Guard National Strike Force Coordination Center (NSFCC), Elizabeth City, NC using standard survey practices. The data will be used in two ways:

(1) NRS Feedback: The survey data will be analyzed, looking for potential areas to provide feedback to the response community for improvements, either regionally or nationally.

(2) Government Performance and Results Act: GPRA requires outcome-based measures of effectiveness to substantiate the value (and thus, continued funding) of a program. The survey data will show that response organizations throughout

the U.S. are meeting consensus-based national success measures, i.e. the CSFs in the survey.

The survey is not presented here due to space limitations but is available to interested parties from the NSFCC. (See example at the end of this article.)

As survey results are obtained, they will be reviewed and analyzed for qualitative and quantitative relationships. Such findings are expected to evolve and change with the growing body of survey data. It is anticipated that the response community will be able to develop norms and factors for assessment of a response's success. We may see such norms differentiated by geographical locale, type or volume of spill or other parameters assisting us in better coming to terms with the concept of "Best Response."

Survey Benefits

The assessment of regional and national performance trends based on post-incident surveys will evolve as surveys are conducted. This may take several years. Nevertheless, the survey, with its embedded KBD framework and specific CSF's will immediately serve three very important needs:

(1) As an alignment tool before the response.

The survey serves as an alignment tool before the response. Such a tool develops a "shared mental model" clarifying expectations for all players. Such a common understanding of goals, methods, roles and procedures can substantially contribute to improving the effectiveness and efficiency of operations. People that understand and buy into the desired outcomes are more likely to work creatively to achieve them with less direction from management.

(2) As a guide—i.e. as part of a "Balanced Response Scorecard"—during the response.

Using the survey parameters as a guide or "Scorecard" during the response may also be very helpful. The "Balanced Response Scorecard" terminology used here is drawn from the literature that suggests that managers need to track a limited array of the "right" measures in order to stay abreast of their organization's progress toward meeting its goals. That limited array of measures for an enterprise is generically referred to as a "Balanced Scorecard". In this context, then, the "Balanced Response Scorecard" phrase suggests that the response manager use a standard set of measures to monitor an organization's progress toward the goal of minimizing consequences.

We believe that the prudent manager, especially in the complex realm of emergency response, should make it their business to identify that limited array of measures and to establish a means to use those measures to guide them in the response. Our suggestion is that the "Balanced Response Scorecard" should include details about progress in the key business driver areas, in addition to the traditional operational details, as noted below:

Balanced Response Scorecard:

I. Operational Details:

Incident Status – "What's the problem?" and "What are we doing about it?"

Situation status – describes incident and area of impact

Resource status – describes people and equipment assignments

Financial status – describes sources and uses of funds

II. Key Business Driver Details:

Key Business Driver Survey – "Will we reach our desired outcomes?"

Operational Outcomes:

Human Health & Safety Impact

Natural Environmental Impact

Economic Impact

Customer Service Outcomes:

Public & Media Communication

Stakeholder Service and Support

Organizational Outcome:

Response Organization Status

(3) Finally, as a consistent, post response, self-evaluation tool.

The KBD survey, with its CSFs provides a consistent, simplified method for evaluating the hundreds of smaller

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incidents that will not be formally surveyed. The response manager can be assured that all key success areas are being reviewed and may use the format to determine lessons learned or best practices from the response.

Summary:

We began with a simplified, whole system view of the National Response System, identifying the players, the business and the goal. We described the NRS as a partnership of the public and private sectors. Each entity works to deliver Best Response in order to meet our goal of minimizing consequences.

We then discussed a measurement plan designed around our goal to minimize consequences and identified six key business drivers. Each business driver had a series of critical success factors proposed as details in a survey. This format enabled the measurement of a complex pollution response through qualitative assessments by responders or stakeholders.

Provided we can obtain consensus – in itself not a simple task - and validate the tools used, this measurement model will be a key performance improvement element for crisis response. It takes a major step towards setting performance expectations by describing what a successful response looks like. It will also provide for more consistent evaluations that will be useful at the local, regional and national levels.

Beyond the benefits of the formal measurement model, we suggested that the survey, with its embedded KBD framework and specific CSFs could serve three other very important needs:

(1) As an alignment tool before the response;

(2) As a guide or as part of a Balanced Response Scorecard during the response; and

(3) As a consistent, post response, self-evaluation tool for those hundreds of incidents that will not be formally surveyed.

The proposed Balanced Response Scorecard blends the traditional operational detail focus with an awareness of progress towards desired outcomes (by reference to the KBD survey). The authors encourage this broader crisis management perspective. Establishing it as our expectation holds great potential to help our entire response system get a better focus on what the country really wants and needs from a crisis response.

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Biography

Captain Joe Kuchin currently serves as the Chief, Marine Safety Division for the Commander, USCG Atlantic Area in Portsmouth, VA. His 27 years of service have included 19 years in the Marine Safety program. His experience in emergency preparedness and response has included assignments as Executive Officer of the Atlantic Strike Team, Chief of the Marine Environmental Response Branch on the Eighth Coast Guard District Marine Safety staff, Executive Officer of Marine Safety Office Guam, Commanding Officer of Marine Safety Offices in Huntington, WV and Mobile, AL and Commanding Officer of the National Strike Force Coordination Center. He is a graduate of the USCG Academy, has an MA in Management, and is a graduate of the U.S. Air Force Air War College Seminar.

Captain Larry Hereth has served in the Coast Guard for 25 years at units on all three coasts. After sea duty and command of a station in Turkey, he specialized in marine safety and pollution response. This included tours as Chief, Port Operations in New Orleans, Alternate Captain of the Port in New York and as Commanding Officer, Gulf Strike Team. He also guided Coast Guard training activities during his assignment as Chief, Marine Environmental Response School in Yorktown, VA. This included supervising all Coast Guard courses related to pollution response and directing the national exercise program, now known as the PREP Program. Captain Hereth assumed the duties of Chief, Office of Response (G-MOR) at Coast Guard Headquarters in July 1997. In this position, he serves as program manager for all Coast Guard activities related to pollution response. In addition to a Bachelor of Science degree from the Coast Guard Academy in 1973, he has an MBA in Management.

Identifying Key Business Drivers

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The Key Business Drivers are:

Organizational Outcome:

1. **The Response Organization**: The response organization effectively and efficiently responds to the incident.

Operational Outcomes:

2. **Human Health and Safety**: Injury, illness and death to responders and the general public are minimized.
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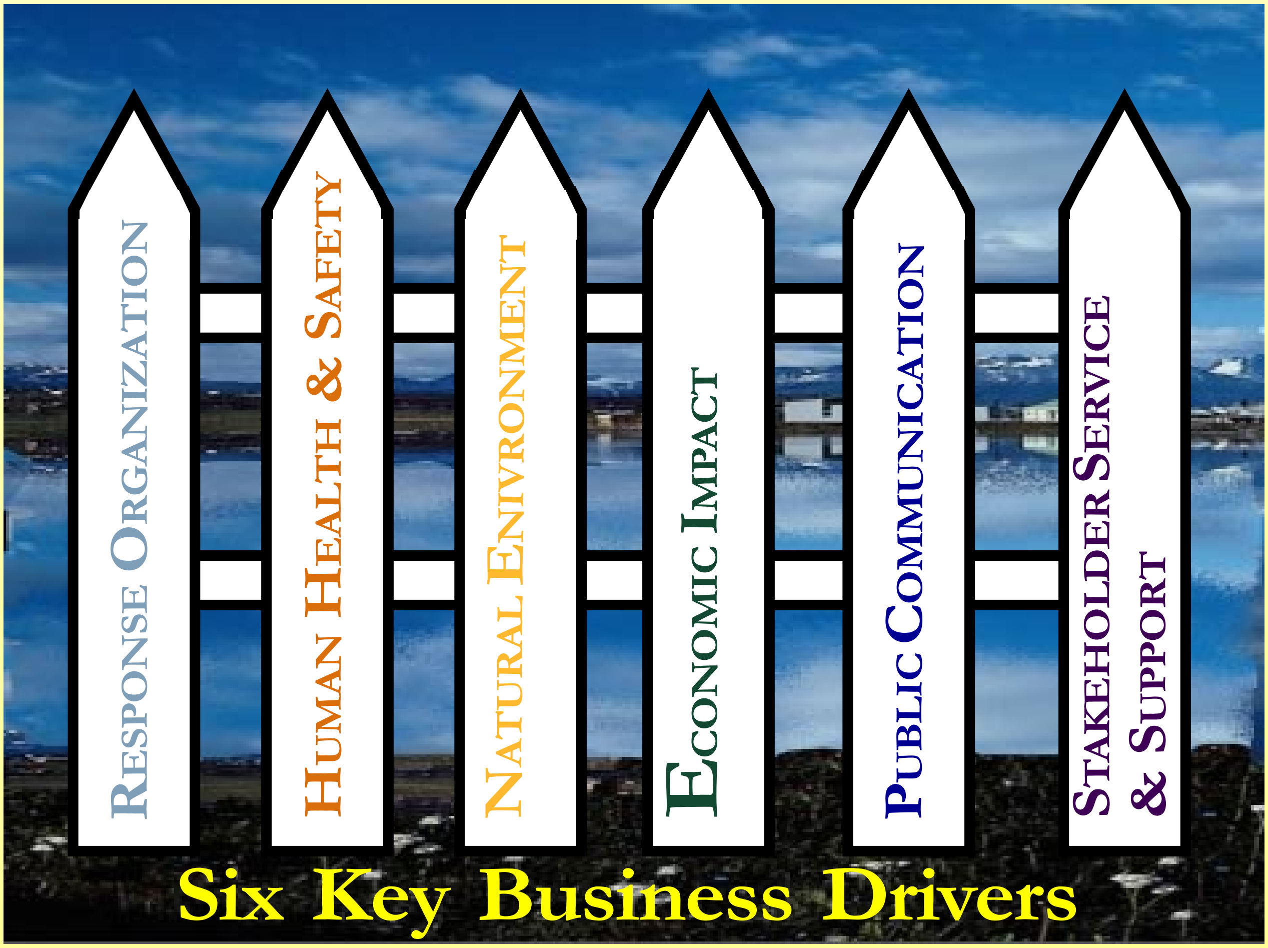
4. **Economic Impact**: Damage to property and the economy is minimized.

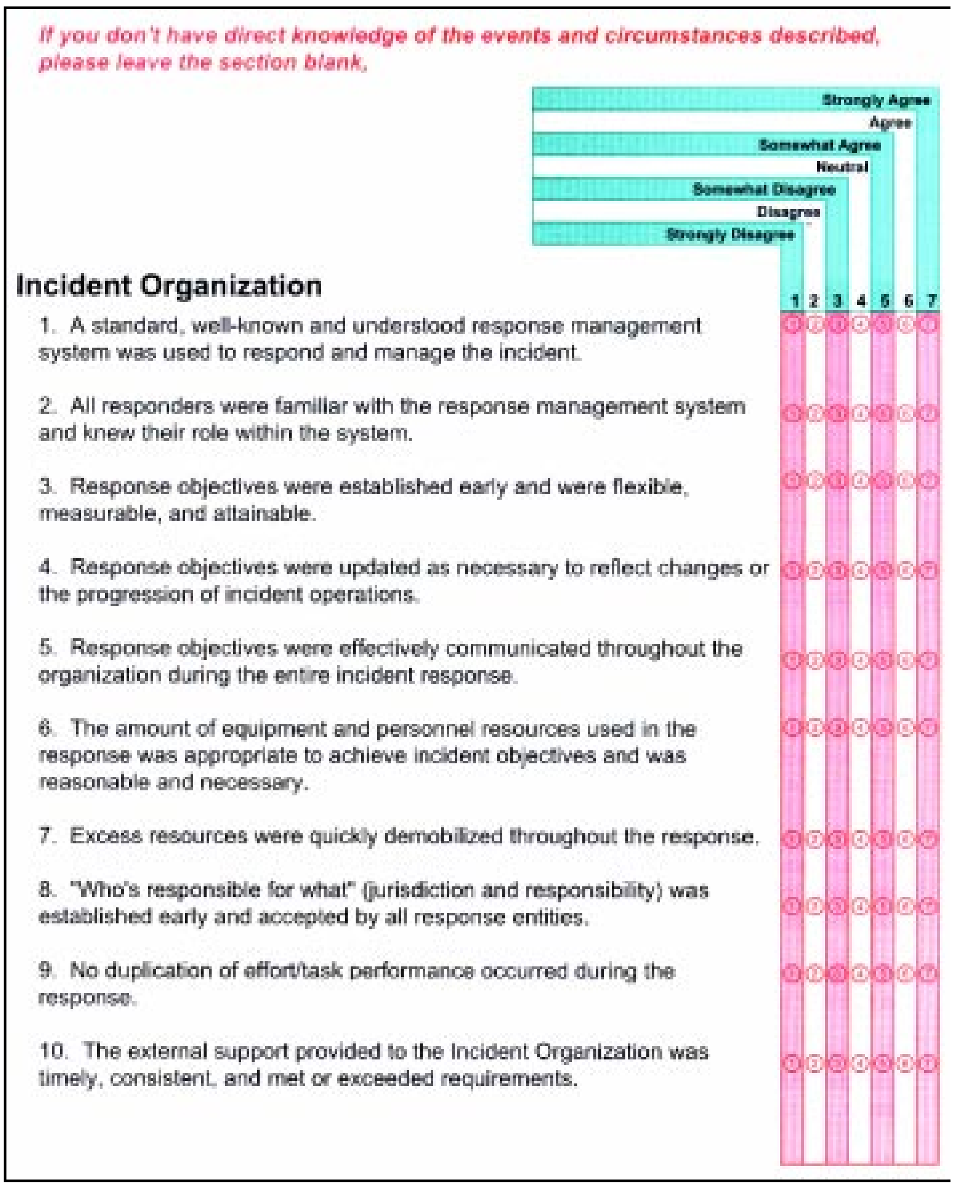
Customer Service Outcomes:

5. **Public Communication**: The public and the media perceive the response as successful.
6. **Stakeholder Service and Support**: All stakeholders perceive the response as successful.



Key Business Driver Survey

The Marine Environmental Response – Key Business Driver Survey was distributed to responders, local stakeholders, and agency representatives involved in the response to the M/V New Carissa. Some of those contacted included local government representatives, local media, environmentalists, business owners, and pollution contractors. Their anonymous responses will be analyzed by the FOSC and others to find out what they and other members of the response community think about the effectiveness and success of this response. Honest feedback gives the Coast Guard and the response community a clearer picture of where our response efforts are succeeding and where we still face challenges. Ultimately, it is envisioned that this information will help improve pollution response goals, policy, training, and the effectiveness of any response. Below is an extract of one page of the eight-page survey form.



If you don't have direct knowledge of the events and circumstances described, please leave the section blank.

Strongly Agree
Agree
Somewhat Agree
Neutral
Somewhat Disagree
Disagree
Strongly Disagree

Incident Organization

1 2 3 4 5 6 7

1. A standard, well-known and understood response management system was used to respond and manage the incident.

2. All responders were familiar with the response management system and knew their role within the system.

3. Response objectives were established early and were flexible, measurable, and attainable.

4. Response objectives were updated as necessary to reflect changes or the progression of incident operations.

5. Response objectives were effectively communicated throughout the organization during the entire incident response.

6. The amount of equipment and personnel resources used in the response was appropriate to achieve incident objectives and was reasonable and necessary.

7. Excess resources were quickly demobilized throughout the response.

8. "Who's responsible for what" (jurisdiction and responsibility) was established early and accepted by all response entities.

9. No duplication of effort/task performance occurred during the response.

10. The external support provided to the Incident Organization was timely, consistent, and met or exceeded requirements.

This section includes articles on the use of the Incident Command System and emerging technologies in support of that system. Within the articles you will find elements of our response organization and an update on where the Coast Guard stands today in implementing that system. Together these elements assist to ensure the response organization effectively and efficiently responds to the incident.

Implementing the Incident Command System By the U. S. Coast Guard: Update 1999

By Captain Harlan Henderson,Commanding Officer, USCG, Marine Safety Office, Alameda, CA

Introduction

The United Stated Coast Guard (USCG) in February 1996 formally adopted the National Interagency Incident Management System (NIIMS) Incident Command System (ICS) as doctrine for response management to oil and hazardous substance incidents. This single decision to adopt ICS completely changed response management in the United States, and it is arguably the most significant initiative to improve our nation's ability to manage effectively and efficiently, all response operations.

Whenever a spill occurs, the common goal is to mount a timely, effective, and efficient response in order to protect human life and safety, and to minimize impact to the environment and the economy. Common sense dictates that all stakeholders, which includes the USCG, other Federal agencies, the affected state and local governments, and the responsible party, can best achieve this by working together cooperatively. The U.S. National Oil and Hazardous Substance Pollution Contingency Plan (NCP) recognized this need to work together, and mandated that "the basic framework for the response management structure is a system (e.g. a unified command system) that brings together the functions of the federal government, the state government, and the responsible party to achieve an effective and efficient response, where the Federal On Scene Coordinator (FOSC) maintains authority." However, the NCP did not identify a specific system to accomplish this goal, and this cooperation did not always occur.

Before 1996, there was no national standard for response management that integrated all stakeholders into a single unified organization. While there were efforts to adopt ICS hybrids at the local field level, it was not the norm. Every oil company and every USCG Marine Safety Office (MSO) developed their own unique organization. This lack of standardization resulted in variations in command and control, terminology, tactical organizations, and communications - all key elements in any response. Though all components existed, inherent confusion of non-standard organizations became particularly burdensome and impeding when personnel from the National Strike Force (NSF), public affairs or salvage personnel from outside the local area were brought into the response. Before they could effectively respond, they first had to learn the nuances of the organization. Figures 1a and 1b reflect a typical reference organization before and after adoption of ICS.

The first formal attempt by the USCG to establish a standard ICS response management system, which later served as a catalyst for the USCG adoption of ICS for spill response, occurred in the USCG Eleventh District in California in 1994. The Standard Oil Spill Response Management System (STORMS) task force was chartered to develop a single, ICS based, response organization for the USCG Marine Safety Offices in San Francisco, Los Angeles/Long Beach and San Diego, in conjunction with State and local agencies, as well as industry. Members included representatives from the USCG, the California Department of Fish and Game's Office of Spill Prevention and Response, the petroleum industry, oil spill response organizations and local governments. The STORMS task force developed several documents including the Field Operations Guide (FOG), a forms catalogue and a training program tailored towards oil spill response. Once ICS was adopted, USCG Headquarters in Washington, DC established the ICS Implementation Team (IIT) which will be discussed later and the STORMS task force was disbanded.

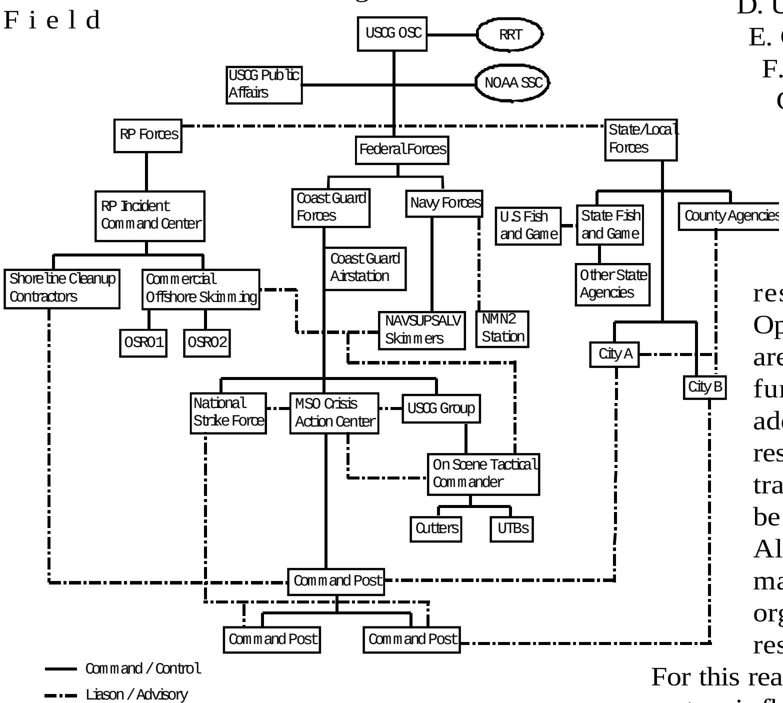


Figure 1a. Basic Response diagram (PRE ICS)

Why NIIMS ICS?

NIIMS ICS is the predominant public domain Incident Command System in the United States today. Yet, ICS is only the response sub-system in the NIIMS "all risk, all hazard" model. Other sub-systems include: training, qualification and certification, publications and supporting technologies. Combined, these five subsystems create the foundation for consistency on all levels: terminology is consistent region to region, publications are standard nationally, and certification is reliable. These have replaced confusion and insecurity with clarity and assurance.

ICS incorporates the sound principles of modern business management into a universally accepted and proven response management system. The basic components include:

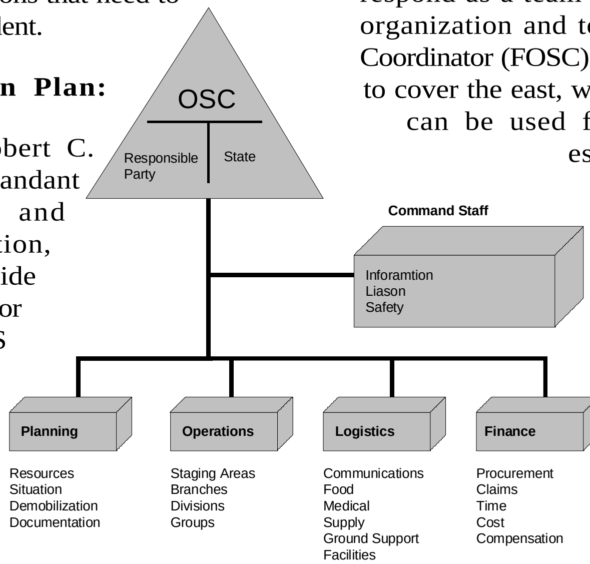
A. Common terminology
B. Modular organization
C. Integrated communications
D. Unified Command structure
E. Consolidated action plans
F. Manageable span of control
G. Pre-designated incident facilities
H. Comprehensive resource management

To implement these components, the ICS structure has five functional areas of responsibility: Command, Planning, Operations, Logistics, and Finance, which are depicted in Figure 1b. Each of these functional areas may sub-divide into additional organizational elements as the response dictates. These functional areas transcend boundaries and, therefore, can be implemented for all types of incidents. Although ICS works very well when managing an incident wholly within an organization, it is especially useful when responding with different organizations. For this reason, the key underlying principle of the system is flexibility. The "all risk, all hazard" model can be used to respond to any contingency including natural disasters (earthquakes, hurricanes), accidents (airplane crashes, train derailments, search and rescues), and planned events (major athletic events, parades).

The public domain aspect of ICS is important in that all the training and qualification materials are readily available at a low cost. This increases accessibility and encourages implementation by the many different organizations that need to respond to the same incident.

The Implementation Plan:

Rear Admiral Robert C. North, Assistant Commandant for Marine Safety and Environmental Protection, promulgated a USCG-wide instruction in May 1997 for the implementation of ICS which included a training and qualification strategy. For the USCG, this was a major program change that would not be achieved overnight. Calling ICS "the future of non-military incident management," Rear Admiral North developed an aggressive three-year, two-dimensional plan.



The two dimensional aspect of the implementation plan includes, first, a solid training program for USCG personnel to build proficiency and a firm knowledge base of ICS. Second, it establishes a systematic training and qualification program with the goal of institutionalizing the program within the USCG training infrastructure such as correspondence courses and resident training at training commands. An ICS Implementation Team, comprised of a cross section of experienced Coast Guard officers from various commands, coordinated the implementation plan.

Two key concepts were developed to determine the level of training required to implement the plan. First, incidents were "typed" by size and complexity. A type 1 incident is the largest and most complex, and a type 4 is the smallest which represents the majority of responses.

Local USCG Marine Safety Offices (MSOs) are expected to respond to the type 3 and 4 incidents with existing personnel. However, MSOs may need outside assistance for the larger type 1 and 2 incidents, which led to the concept of the Incident Management Assist Team (IMAT).

This paradigm acknowledges that it is not realistic or cost effective to train all responders to the highest levels. The IMAT is composed of highly trained and experienced USCG personnel who respond as a team to augment the local response organization and to assist the Federal On Scene Coordinator (FOSC). The plan calls for three IMATs to cover the east, west and gulf coasts. The IMAT can be used for any size spill but would especially be beneficial to the larger type 1 and 2 spills due to the limited resources of local MSOs and the complexity of the response.

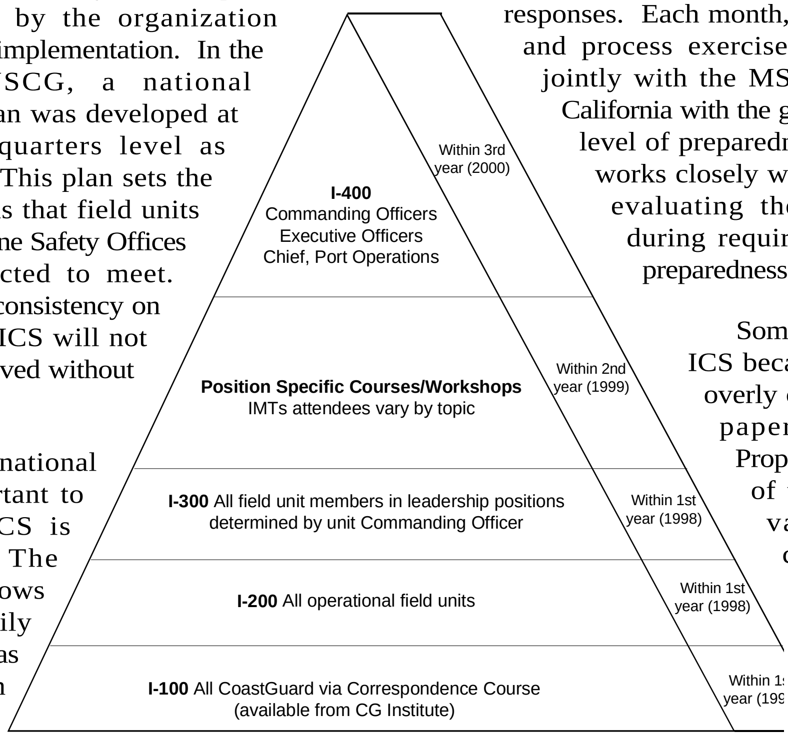
After characterizing the incidents and organizations, the workgroup next identified specific training opportunities. These included general ICS courses (e.g. I-100 through I-400); position specific courses and workshops; and team training opportunities. A matrix was then developed illustrating the training opportunities at different levels of experience. Since this was a new training opportunity, a timeline was developed to frame the training requirements. Specifically, the matrix depicts the relationship between the course, who takes the course, and when the course is required.

Finally, a qualification system was established. A "performance based" system was chosen focusing on individual performance as observed by an evaluator using approved standards. Superior results are expected in using this method over a "training based" system which is based on merely passing a course. Additional work is in progress in the areas of identifying performance standards, evaluation criteria, and qualification training.

Keys to Success

The following 10 keys to success were developed based on review of lessons learned and personal experience with implementing ICS. While many of the items seem basic, they continue to be overlooked and continue to occur.

1. Nationalize / Institutionalize ICS. A national response management system requires national doctrine by the organization responsible for the implementation. In the case of the USCG, a national implementation plan was developed at the USCG Headquarters level as discussed earlier. This plan sets the minimum standards that field units such as USCG Marine Safety Offices (MSOs) are expected to meet. However, national consistency on the application of ICS will not and cannot be achieved without national policy.



Even with a national policy, it is important to remember that ICS is FLEXIBLE. The modular design allows the system to easily expand or contract as the situation warrants. For example, as operations shift from on-water skimming to shoreline cleanup, the organization can easily shift to meet the changing need. Only those positions which are needed to create an effective organization are staffed. Also, the expansion can occur rapidly such as to integrate a large influx of personnel. The system is flexible in that changes can be accommodated as long as the basic tenants of ICS remain intact. However, beware of hybrid systems. Many organizations and consultants have tweaked the system to the point where some of the basic elements of the system are lost. Recently someone asked which NIIMS ICS was being used. To achieve an effective national response management system it must be standardized.

Finally, ICS needs to be institutionalized within an organization and be a part of the organization's culture.

2. Focus on the process. Too often, people look just at the ICS organizational chart and think they understand the whole system. The beauty of the system is in the details which are the processes (e.g., the planning cycle, information flow to the situation and resource units, or the communication process among section chiefs). At USCG MSO San Francisco Bay we have developed mini process exercises in partnerships with the state based on lessons learned from exercises and actual responses. Each month, alternating training and process exercise sessions are held jointly with the MSO and the state of California with the goal of increasing our level of preparedness. The MSO also works closely with local industry in evaluating their ICS processes during required annual tabletop preparedness exercises.

Some people resist using ICS because they view it as overly complicated and too paperwork intensive. Proper training in the use of the system and the various forms is critical. The system and the associated forms are designed to help improve the effectiveness and efficiency of the response. In no way should the paperwork impede the response, only the forms that assist in achieving this goal are used and completed. During an actual event, the forms are critical in developing the Incident Action Plan, which clearly articulates the response plan to the entire response organization.

3. Exercise/train jointly. Spill response is almost always a multi-agency, multi-jurisdictional event. If a single organizational structure is established that integrates all stakeholders, it is essential for these stakeholders to train and exercise together. An old adage is that your best tool in any emergency is a familiar face and that you should meet your friends before you need your friends. By all response personnel (USCG, state, industry and response organizations) practicing together they become more familiar with one another so that the level of trust and respect is solid when an actual event occurs. Also, there has been a move towards larger, more complex exercises. I am a proponent of small, short duration exercises that focus on processes with an occasional large scale exercise to tie all the pieces together. Small exercises offer the opportunity for teambuilding by small groups of participants that would normally work together during an actual spill. An example might be training

personnel staffing the Joint Information Center (JIC), the Planning Section or the Situation Unit.

4. Train using lessons learned. Most agencies and organizations do a terrific job in critiquing exercises and actual responses to capture lessons learned. Few organizations ever truly learn the lessons or fix problems they so diligently identified. As previously mentioned, small, focused exercises based on a single lesson is an ideal way to attack this issue.

5. Establish a trackable qualification program with qualified instructors. ICS includes a comprehensive qualification process. That process or a similar process should be adopted. The process should also include documentation on the level of qualification of each individual that should be maintained in a national database. A Federal On-Scene Coordinator can then request personnel with specific qualifications. For example, the FOSC can order a Logistic Section Chief, an Information Officer, and a Procurement Unit Leader and be assured they will receive someone with the qualifications to do the job. For consistency, it is also important to ensure instructors are qualified. Ideally instructors should be trained to at least one level above what they are teaching, have real world experience, and have some teaching credentials.

Locally, I have appointed an ICS unit coordinator to train personnel and track their qualifications. We have taken the qualification process a step further by publishing an ICS organization chart to identify where unit personnel, our state counterparts, and the USCG Strike Team personnel would likely serve. This allows each person to know her/his job for all exercises and actual responses and includes substitutes should someone not be available. As a result of these efforts, the command now has the capability to "push the button and go." Finally, it is important that the Incident Commanders assign the most qualified person to a positions and not make

Incident Complexity	**Incident and Organization Cha**
Type 4 **Initial Response**	• Small Incident (approx.80% of spills**)** • Typically one operational period. Verbal action • Single or a few resources. • Command, General Staff positions normally not
Type 3 **Extended Response**	• Larger incident (approx. 15% of spills), e.g. vsl (response efforts, of serious potential, resolved fa • **May require multiple operational periods – if** • **Several single resources to several strike team** • Some Command and General Staff activated; usı
Type 2	• Regionally significant incident (<5% of spills). • Multiple operational periods. Written action plaı • Many resources, combined as task forces/strike t the front line, up to 500 overall. • Most/all Command & General Staff, and many f • Examples: T/B NORTH CAPE (Rhode Island), (Texas).
Type 1	• Nationally significant incident (<1% of spills). • Multiple operational periods. Written action plaı • Numerous resources, extensive field ops. Hundr on front line, many more in support roles. • Command & General Staff, and functional unit p • Examples: San Jacinto River flood (Texas), T/B T/V EXXON VALDEZ (Alaska), T/V MEGA B

FIGURE 2. INCIDENT TYPE AND CHARACTERISTICS

RESPONSE ORGANIZATION

personnel decisions based on rank or what organization they represent. Conversely, the Incident Commanders must be willing to make personnel changes when the performance of a unit or individual dictates it in order to improve the response, again regardless of rank or affiliation.

6. Establish a Joint Information Center (JIC). Sophisticated media coverage of incidents combined with high public expectations puts pressure on the Incident Commanders to showcase an effective and efficient response. Early joint press releases and press conferences are a must. It is crucial to show unified decision making and to get ahead of the media, if at all possible. Any inconsistency the media uncovers will undermine the perception of a well organized and effective response. For example, if the USCG reports recovering 1,000 barrels of oil, the Responsible Party reports 1,500 barrels, and the state reports 800 barrels, the perception is clearly that the unified command is not unified; therefore, they must not be working well together and the response must be in chaos. This impression is often impossible to change. By creating a JIC, not only will the response have consistent messages, but each agency's specific concern or issue may be addressed. During questioning at a press conference or when calls come into the JIC, deference is made to the agency or party with expertise in that subject area (e.g., USCG on skimming, state on wildlife issues, local agency on emergency services). As much as a JIC disseminates information, it also provides reconnaissance as information from outside sources comes in (e.g., surfers reporting oil in a previously unknown location).

7. Use ICS routinely. Again, the more the system is practiced the better it will be used. Vince Lombardi, a famous American football coach, was quoted as saying "you play the way you practice." If you do not practice spill response frequently, you can almost guarantee you will not perform well when the real event happens. USCG Marine Safety Office San Francisco Bay uses ICS for all responses from the smallest of spills to the largest. Many of the forms are used daily by the Command Duty Officer to track non-pollution incidents such as a vessel grounding. ICS has been used for non-emergencies such as the relocation of a major USCG command from the Los Angeles area to San Francisco, change of commands and mass casualty exercises. To maximize training and response effectiveness, the MSO has created nine separate ICS "go packs" which contain all the necessary supplies and equipment to initiate a response. One go-pack is created for each ICS section plus one for the situation and resource units. These go-packs serve to greatly expedite the start-up of a response by having all the necessary tools and equipment at the incident location. Most importantly, check-in and resource tracking can begin immediately and the situation documented from the start.

8. The Incident Commanders set the tone of the response. The FOSC, state incident commander, and responsible party Incident Commander must project a positive attitude and a commitment to work together. They must be out and about together and visible to the response organization. When the top leadership is seen working together towards a common goal, it filters through the rest of the organization. Whenever possible they must agree to disagree amicably.

9. Use technology but be cautious. Significant technological progress has been made in the field of response management. Technology is an area within spill management with tremendous potential. New systems should be analyzed, carefully tested and aggressively implemented when determined to add value to the response. However, several systems have been too big and too complex to effectively use. Other systems have not been properly tested before being accepted. A great deal of time and money can be wasted without first completing up front analysis. Also, if the care and feeding of the system is too great, it will take away from the main objective of the response organization, which is to minimize the impact of the spill.

10. Emphasize planning. Planning drives the response; therefore, highly experienced response personnel must be assigned to the Planning Section. Too often, inexperienced personnel or individuals lacking familiarity with local resources are assigned to planning, which results in developing unrealistic plans. The advantage of an integrated Planning Section is that each agency or organization brings with them a certain expertise that can be shared with the entire organization. The result will be a more realistic, comprehensive plan. A common theme in post spill response analysis is that the Planning Section was never fully staffed or utilized and too much effort was put into the Operations Section, which focused on daily tactical issues. One of the goals of ICS is to shift from an emergency operation into a well-organized, controlled management project. The only way to achieve this goal is to establish the planning function early in the response and allow the planners to drive the response.

Case Studies

The purpose of this section is to analyze three cases, two in which ICS was not used and one in which ICS was used. The intent is not to find fault with the responses, but rather to discuss the possible benefits if an ICS organization had been utilized.

MORRIS J. BERMAN Oil Spill: 7 January 1994

The tank barge, loaded with approximately 36,000 barrels of number 6 fuel oil, grounded just 200 yards from the heart of Puerto Rico's tourist district at the height of the season. The barge was holed and began discharging its cargo onto the environmentally and economically sensitive beaches. While the response to this incident was deemed a success, especially from the public perception and response effectiveness aspect, it does not mean that the response was trouble free. In the FOSC report on this incident, it emphatically states that major improvements are needed in certain aspects of response preparedness and most especially in response management. The FOSC strongly recommended that the USCG adopt ICS nationally with the training, tools and information management systems to ensure its success.

The following problems were encountered in which ICS could have helped to improve the response:

Organizational Structure: A unified command was never fully established nor was there a clear chain of command. The responsible party did not integrate well into the overall response organization. Several command posts were established by different agencies and groups and that directly contributed to the lack of command and control. Even the Responsible Party's senior decision-makers were not co-located with the FOSC. An organizational chart was not published until well into the response. The organization in place for days 2 through 7 was not drawn until well after the fact as part of the effort to decipher what really happened.

ICS requires that the organizational chart be posted and included in the Incident Action Plan (IAP). Only one command post should be established and it must be staffed jointly by all parties in order to realize the maximum benefits of using ICS.

Operations Oriented: Emphasis was placed on ongoing operations. A dedicated Planning Section was never fully realized. While numerous staff meetings were held during the response, none were clearly identified as a strategic planning meeting. The strategic objectives and response strategies were developed by key members of the FOSC's staff in a series of short discussions, but they were not documented or published in the IAP. As a result, the entire response organization was not always aware of the response plans and objectives.

Planning is essential to get organized and to be in control of the response. A dedicated Planning Section must be established early on in the response with the goal of developing an Incident Action Plan for the next operational period and beyond. Also, the IAP must be widely distributed to the entire response organization so that everyone knows the plan.

Other Agency Support: Approximately 15 federal and Puerto Rico agencies were involved in the BERMAN response. The roles for some of the agencies had been pre-identified prior to the spill, but some of the roles were not defined until the spill.

Through drills, exercises and pre-spill planning efforts, all agencies that may be involved in a spill response should be identified and included in the training and included in the local contingency plans. Those agencies that are not pre-identified can be integrated into an ICS organization where they add the most value. Because within the ICS, the duties and responsibilities of each position are defined, it is a fairly easy decision based on a person's skills where they can be plugged into the organization.

TWA Flight 800 Disaster: 17 July 1996

At approximately 2230, TWA flight 800 with 230 passengers and crew onboard burst into flames and crashed into the ocean 10 nautical miles from Long Island, New York. The USCG portion of the response included over 70 units and 1400 personnel. Additionally, more than 20 agencies including local, state and federal agencies responded. An ICS organization was eventually established and the overall operation was very successful. However, the early establishment of an ICS organization could have greatly improved this response. Even the USCG Admiral in charge of the accident scene stated that ICS should be employed for multi-agency responses such as this. Some of the areas where ICS may have helped include:

R E S P O N S E O R G A N I Z A T I O N

Quickly establish an ICS Structure. It took time to determine who was in charge of what and how everyone fit into the overall response. Because of the number of agencies involved, it was necessary (and difficult at times) to determine how each agency fit in. The USCG did provide the Command Post and took the lead in bringing together a unified command.

ICS requires that lead agencies, in this case the USCG, the National Transportation Safety Board, and the Federal Bureau of Investigations, quickly come together to build an organization using the best qualified personnel to fill each of the roles.

Communications: Radio communications quickly became overloaded because of the tremendous volume of radio traffic and multi-agency involvement. Also the demand for information was overwhelming.

Using ICS, the Incident Commanders could have set one of the first objectives to develop a Communications Plan and have it quickly delivered to all participants. By establishing a protocol for not only what frequency to use, but for what information needed to be passed, the situation unit have could more quickly provided the organization an accurate on-scene picture.

Training/Qualification Program: Many USCG personnel responded, including reserves and auxiliarists. However, not all were qualified and some had to be sent home.

ICS includes a qualification program. These qualifications must be tracked and readily available so that the Incident Commander can request personnel for certain positions and be sure he/she will receive a qualified person.

Demobilization Plan: After the initial surge of personnel and equipment, and when the operation becomes more routine, a demobilization plan must be developed to send those people and equipment home. After the operation became routine, large numbers of people remained on-scene without specific tasking.

ICS recognizes the need to send non-essential assets home. The Demobilization Plan should be developed early in a response in order to ensure timely and orderly demobilization. Huge cost-savings can be realized with the early development and implementation of a Demobilization Plan.

M/V KURE Oil Spill: 5 November 1997

At 0455 the M/V KURE while repositioning at the Louisiana Pacific Dock punctured a fuel tank, spilling 4500 gallons of Intermediate Fuel Oil.

Over 400 people and 10 government agencies responded to this spill in the isolated and extremely sensitive Humboldt Bay.

By all accounts, the response management aspect of this response was highly successful. An ICS organization was quickly established with USCG, state and local agencies filling all positions until day two of the response when the RP arrived on scene. Using ICS contributed to the success of this response in the following areas:

Unified Command: The FOSC, State Incident Commander, and the RP Incident Commander met the first evening of the response and developed detailed response objectives, assigned personnel into the ICS organization and approved the written Incident Action Plan for the next day's operation. Throughout the response the Incident Commanders set a positive tone and let the organization work without micro management.

Media: Press coverage was extremely positive. A Joint Information Center was established the first day with joint press releases and joint press conferences held throughout the response. The Unified Command always spoke with one voice and always had a common message to deliver. Also, time was made to give the media tours of the command post and field operations to explain and answer any questions the media had.

Planning: Planning did drive the operations. Detailed IAPs were signed early enough to ensure distribution to those responsible to implement the plan the next day. This early distribution allowed time for proper staging of equipment and personnel so time wasn't wasted the next day.

Exercise/Team jointly: Only two months prior to the spill, a large scale industry led exercise was held in Humboldt Bay which concentrated on developing a strong ICS organization. When the spill did occur, the majority of the players already knew each other, which allowed them to quickly function as a team.

Qualified personnel: Because a data base of ICS qualified Coast Guard personnel was maintained, replacements were able to be ordered for specific positions that had the necessary qualification to perform the assigned task.

Where is the USCG going from here?

In June of 1998, the Joint Operations and Marine Safety Coordinating Council (JOMSCC) agreed that the Coast Guard would recognize tremendous benefits by adopting ICS for all Coast Guard response operations. In August of 1998, the Coast Guard formally adopted ICS for use Coast Guard wide. In order to ensure the effective and efficient implementation of ICS, the JOMSCC established a charter tasked to act as the ICS implementation program manager. The charter laid the framework of goals for the Response Management Coordination Council (RMCC). The RMCC is composed of senior management from: the Office of Response (G-MOR), the Headquarters Command Center (G-OPF), the Office of Defense Operations (G-OPD), the Office of Search and Rescue (G-OPR), the Office of Training and Performance Consulting (G-WTT), RTC Yorktown, the National Strike Force Coordination Center, Atlantic and Pacific Area Commands and Maintenance and Logistics Commands. The RMCC further broke down their efforts into four work teams. These teams are: the Policy and Doctrine Team, the Training and Certification Team, the Ad Hoc Lessons Learned Team, and the Ad Hoc Instruction Development Team. The teams are working to develop an implementation strategy for the Coast Guard. There are still many training and policy issues that must be vetted.

Conclusion

In only a few short years the U.S. Coast Guard, by adopting ICS, has implemented a major change in its approach to response operations. The case studies illustrate how the response system has improved in the last few years. The NIIMS ICS meets the Coast Guard's need and it works well because of the types of incidents to which we regularly respond. While ICS may not be the panacea for response management, it is the best system available for the following reasons. First, it is designed to address multi-agency, multi-jurisdictional incidents; second, it is an "all risk-all hazards" system; third, the system is flexible and may be expanded or contracted depending on the incident; and finally, most of the material is in the public domain.

ICS allows tremendous efficiencies to be gained by all organizations working together in partnership with a shared commitment to effecting the best response possible. There is clearly a need for response organizations to work cohesively and toward a common goal. Although the jurisdiction, as well as area of responsibility, of each organization is different, the overall goal of the response is to mitigate the situation effectively and efficiently. In the United States the shift is clearly towards more and more agencies realizing the benefits of ICS and adopting the system. Even at the highest level within the federal government, multiple response management systems are seen as less effective and inefficient. Because the training material is easily available to all organizations, the NIIMS ICS provides a vehicle to train and exercise any number of organizations together.

By working together, using the same language, training jointly with people from different organizations, and focusing on continuous improvement, overall response capability has improved. The future is bright for responders to continue making improvements in response if we continue to talk the same language and work together.

Achieving the Best Response through the Application of Technology

By LCDR Lorne Thomas, and LT Steve Wischmann, G-MOR, USCGHQ, Washington, DC

RESPONSE ORGANIZATION

In spite of our improvements and advances in pollution response and preparedness, significant challenges still lie between the response organization and a successful response. There exist the expected difficulties in marshaling adequate response resources and personnel, and the need to recover the spilled material and mitigate its impact on the environment. Overlaid on these demands is the critical challenge of effectively managing the massive amount of information that is generated, transmitted, and considered within the Incident Command System structure for such events. It is this information management responsibility and optimal use of technology that has too often been overlooked, or given only passing consideration in preparing for, the best possible response.

Recently, the Coast Guard's Office of Response (G-MOR) has sought to leverage a series of existing and developing technological innovations to enhance its ability to coordinate and manage complex, multi-agency response operations. This initiative includes a blend of Coast Guard, government and commercial-off-the-shelf technologies that will form the foundation of the Command, Control, Communications, Computers and Information (C4I) capability for the Marine Safety and Environmental Protection program (G-M).

This article presents a broad overview of these technologies. For discussion purposes, they are grouped with the four elements of the most commonly applied definition of Command and Control, *Sense, Assess, Decide and Act*, as represented in the model included below.

Sensor products, Global Positioning System (GPS)-based vessel tracking systems, a geographic information system (GIS), digital imagery, trajectory models, and decision support systems (DSS) comprise the inputs (*Sense, Assess, Decide*) to the model. These inputs are assimilated and integrated, consummating in the outputs (*Act*) of a tactical, near real-time situation display, an Incident Action Plan (IAP) and a system for tracking and managing response equipment and personnel resources. At the hub of the model, fusing all of this information together, is the Coast Guard's On-Scene Command and Control System (OSC2).

On-Scene Command & Control System

In February of 1996, G-M joined a growing number of federal, state, local, and private organizations and adopted the National Interagency Incident Management System (NIIMS) Incident Command System (ICS) for structuring its response to oil discharges and hazardous substance releases and other multi-organizational incidents. The entire Coast Guard adopted the NIIMS ICS for "all hazard-all-risk" responses in August of 1998.

The NIIMS ICS organization and process relies heavily on a standardized set of forms to process information and develop a comprehensive Incident

Figure 1
G-M Command and Control Model

Action Plan (IAP) for managing response operations. To date these 30-plus forms are prepared, delivered, displayed, and stored manually. This manual, paper-based approach to crisis response, although effective, is very time-consuming and labor-intensive. Additionally, the existing version of a situational display is primarily a paper-based process. A combination of ICS forms, maps, charts, and white "grease boards" are used for command and control and to convey a tactical picture of operations. Maintaining a display by this method is, likewise, time-consuming, inefficient and usually fails to meet the Unified Command's need for a near real-time tactical display of current response operations.

With the advent of the new PC-based, Standard Workstations, it became apparent that a computer-assisted tool should be developed to automate and optimize the use of NIIMS ICS for pollution and other ICS-based responses. In 1996, the Office of Response and the USCG Research and Development Center initiated development of a prototype "proof of concept" system called On-Scene Command and Control. In addition to personnel from these two offices, the development team drew representatives from prospective stakeholders at the Coast Guard's National Strike Force Coordination Center, the Atlantic Strike Team, and the Marine Safety School. Although designed for oil and hazardous substance responses, the OSC2 system will be capable of being utilized for any multi-agency, ICS-based response to a natural or man-made disaster.

ICS FORM 203: ORGANIZATION ASSIGNMENT LIST

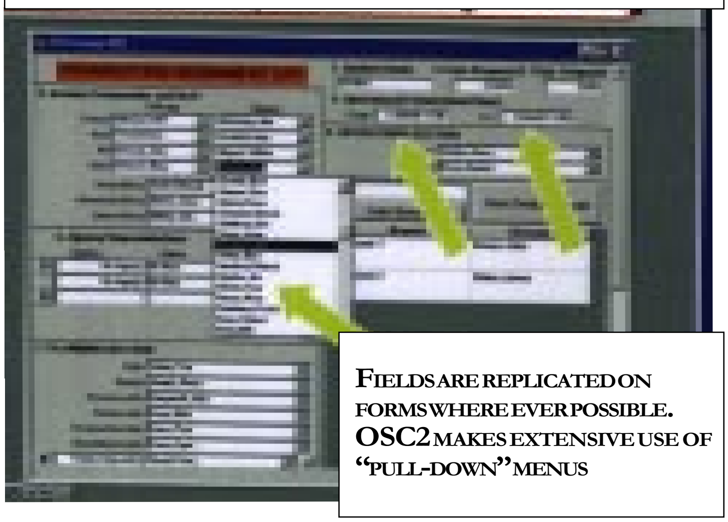


Figure 2. Example of OSC2 ICS form

The OSC2 system is intended to streamline the information management processes of incident command and control. The prototype system is a portable, networked system that will be utilized to support the information management needs of the Planning and Operation sections of an ICS-based response. The scaleable system consists of electronic ICS forms, with an underlying Microsoft Access relational database, that automatically replicates common fields among the forms, links fields and records between the forms, and aggregates data, with the desired result of streamlining the completion of the ICS forms and the IAP.

The OSC2 system includes a graphic-based, situational display that will be utilized for command and control and tracking ICS-managed response resources, ICS divisions and groups, environmentally sensitive areas and other geo-referenced objects and contingency plan data. The display will include an imbedded oil spill trajectory model and anyone in the Incident Command Post will be able to quickly ascertain the status of the current response operations by viewing the situational display. The display has fundamental GIS functionality including:

- vector and raster-based maps and nautical charts;
- the ability to manage multiple layers of data; point object, polygon and polyline capability;
- import/export commercial-off-the-shelf GIS data, and;
- the ability to link icons to files and databases.

Although access to the preparation of forms and the situational display manipulation will be controlled, the data in the networked system will be available for display from any of the system's terminals. Additionally, a web-based Intranet will be linked to the network in order to disseminate completed ICS forms and display information to all members of the Incident Command. This Intranet will have the capability to be accessed from outside the ICP, either through controlled access for other Coast Guard units, Districts or Headquarters or, if desired, via the Internet.

OSC2 is being designed for use by people with varying computer backgrounds throughout the Coast Guard's marine safety mission area, such as at Marine Safety Offices. Invariably there will be those with a great deal of experience, while there will be others with very little. The system's functionality must mimic the natural processes found in the ICS structure, while not presenting technical or work process hurdles that prohibit a reasonably trained user from easily performing the functions. In an effort to avoid the negative effects of a software package laboring under its own weight of "capabilities," the OSC2 design team focused on building a powerful software package that successfully automated the ICS process but did not exceed the minimum number of critical functions. In spite of its simple architecture, an operator will need basic PC workstation skills, have a solid understanding of NIIMS ICS and receive training on the use of the system; primarily focused on the operation of the GIS-based situation display.

The Coast Guard's National Strike Force is field testing the system at several Coast Guard-led Preparedness for Response Exercise Program (PREP) drills in FY1999. The Office of Response has initiated the procurement process to obtain a production version of the software for distribution to field units late FY00 or early FY01. The application will be available on the CG Standard Workstations. Field units will be able to use OSC2 to respond to a pollution incident or to support any ICS-based response or planned event. The Strike Teams will establish and operate independent OSC2 networks, on laptops, at remote command posts when supporting response operations.

Sense

The AIREYE sensor suite, found on Air Station Corpus Christi's HU-25B Falcon jets, will remain the Coast Guard's primary wide-area surveillance platform for pollution discharges. These sensors include a Side-Looking Airborne Radar (SLAR) supplemented by an infrared and ultraviolet line scanner. The C-130s based in Elizabeth City, NC have SLAR capability as well.

The current AIREYE configuration produces an analog output consisting of separate videotape and an unwieldy piece of film. The aircraft must land and process the imagery before the output can be used by responders. This year, the Coast Guard will begin to upgrade AIREYE's obsolete processing equipment. The sensor output(s) will be digitized which will allow it to be fused into a single picture and transmitted in "real-time" to the ground for exploitation. The geo-referenced imagery will be capable of being imported into the situation display of OSC2 as an overlay or GIS layer.

The Integrated Deepwater System acquisition will provide the next generation of wide-area, surveillance platforms. G-M is seeking to impart a basic capability, such as infrared, to detect the presence of a pollutant, and its boundaries, in the standard sensor suite of all the Deepwater fixed-wing aircraft. This will greatly extend our pollution

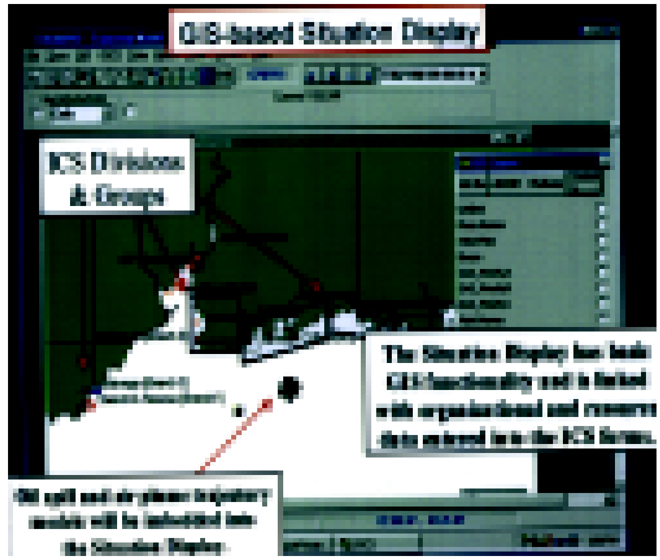


Figure 3. Example of OSC2 situation display

enforcement and response capability.

Another wide-area surveillance tool available for exploitation is satellite imagery. G-MOR and the Intelligence Coordination Center have established a process to access national assets to surveil large coastal discharges. Infrared, optical and synthetic aperture radar sensors can cover a wide area of ocean or a remote coastline. National assets can provide a classified image or an unclassified derived product (a drawing) which can be electronically transmitted as a fax or a GIS layer capable of being imported into OSC2 or any GIS-based situational display.

The real-time positions of response resources or other merchant vessels can be tracked and broadcasted using portable global positioning system (GPS) transponders. These positions, or the output from an existing vessel traffic management system, can be imported and displayed in the situation display of OSC2.

Assess

Instrumental to the functionality of the G-M C4I architecture is a commercial-off-the-shelf (COTS) geographic information system or GIS. A COTS GIS would greatly increase our ability to create interactive, graphics-based, contingency plans for a wide variety of pollution, natural disaster and readiness scenarios. Moreover, it would also allow the Coast Guard to take advantage of the wealth of GIS data that has been generated by other state and federal agencies such as NOAA and FEMA.

A GIS database could be populated with spatial data on environmentally and culturally sensitive areas, underground pipelines, staging areas, transportation routes, hazardous material facilities, aids to navigation and other nautical chart information. All of this data could be imported into OSC2's situation display for a response or other operational mission.

Furthermore, a GIS could extensively utilize existing geographic data in our Marine Safety Information System (MSIS) and new data entered into the forthcoming Marine Safety Network. This software would give us the ability to conduct a wide variety of spatial analyses towards identifying trends and managing the risks within a port or along a coastline.

Timely pictures of response or salvage operations or impacted areas can be invaluable to the response organization. In addition to its tactical use, imagery can be used for press releases, public information, and as briefing material for the agencies' chain of command. Digital pictures of sensitive areas or other key locations can be inserted into GIS-based contingency plans. Instead of a map or chart, a geo-referenced aerial photograph can be used as a base map for additional overlays of spatial data.

The use of digital imagery can expedite the transfer of the imagery inside and outside the Coast Guard. Real-time transmission via satellite, radio, cellular or wire phone lines is possible and the digital format permits immediate posting on a web page.

Decide

The Spill Planning Exercise and Response System, or SPEARS, has been G-M's decision support system for the past four years. This Macintosh-based system is a composite of existing NOAA Spill Tools and EPA Computer-Aided Management of Emergency Operations (CAMEO) applications. The Office of Response is in the process of obtaining certification for the Windows versions of NOAA's Spill Tools and CAMEO for installation on the CG Standard Workstations. Some of the functionality included in SPEARS, that is not provided by the Windows versions of these products, will be provided by the Marine Safety Network applications including the Incident Response and Planning module.

In addition to the oil weathering and plume trajectory models imbedded in CAMEO and the Spill Tools, the Coast Guard will have the ability to operate an oil spill trajectory model on the Standard Workstation. NOAA Hazmat has developed a simple desktop oil trajectory model called the General NOAA Oil Modeling Environment or GNOME. The model is based on their well-established On-Scene Spill Model (OSSM). Region-specific location files will be developed for each On-Scene Coordinator's area of responsibility. Location files for the coastal areas will be developed first followed by the inland rivers and Great Lakes. The GNOME model will be capable of operating independently or within the situation display of the OSC2 system.

Conclusion

A computer-based, graphic-oriented system, such as OSC2, can foster the rapid development of a common, shared understanding of the current and planned tactical situation, as well as provide a scaleable management tool that can be used to better assign and track response resources. The integrated use of sensing technologies, GIS-based plans, digital imagery, models and decision support systems have a positive synergistic impact on the response organization's efforts to minimize the consequences on human health, the affected economy and the natural environment. Additionally, technologically enhanced, information management and dissemination capabilities significantly increase the level of communication between the Unified Command and the public and other stakeholders.

Historically, the Coast Guard has been slow to adopt and embrace the measured application of technology in order to improve its level of preparedness or performance. Hardware and software compatibility, funding constraints, and training limitations have all contributed to the lack of automation and "value-added" technological advances. Funding and training concerns are perpetual; however, the arrival of the new Standard Workstations, the rapidly increasing level of Coast Guard computer literacy, and the Coast Guard-wide implementation of the Incident Command System will eliminate some of the barriers to the use of technology towards improving the Coast Guard's preparedness and achieving the best response possible.

Achieving the Best Response: Improved Financial and Resource Management

By LT Steve Wischmann, USCGHQ, Washington, DC

Recent History

The accurate tracking of oil spill response resources and their costs is part of the Coast Guard's responsibilities under the OPA 90. The proper billing of responsible parties by the National Pollution Funds Center (NPFC) is dependent upon accurate tracking of response resource use and the collection of reliable cost information by the Federal On-Scene Coordinator's (FOSCs) staff. Indeed, sound response-related business management practices underlie successful response operations, both for the private sector and for the Coast Guard.

Notable initiatives have been undertaken over the last five years to bolster the Coast Guard's ability to manage the financial dimensions of spill response operations.

In 1996 the FOSC Business Practices Quality Action Team (QAT) released its Final Report. The report recommended that several steps be taken to improve the FOSCs ability to more effectively manage the finance and resource dimensions during spill response operations. Many of the recommendations made by the QAT, such as improving the handling of Basic Ordering Agreements (BOAs), were achieved through internal process improvements and better computer automation. However, some of the QAT's recommendations required further study or development.

The FOSC Finance and Resource Management Work Group

The Federal On-Scene Coordinators Finance and Resource Management (FFARM) Work Group was formed in January 1998 to examine the challenges that Coast Guard FOSCs face in managing the financial aspects of spill response. The group is comprised of representatives from the Office of Response, the National Pollution Funds Center, the Office of Financial Systems, the Office of Procurement Management, the National Strike Force Coordination Center, the National Strike Teams, and the Atlantic and Pacific Maintenance and Logistics Commands. This group's efforts build on the work performed by the FOSC Business Practices QAT, which recommended, among other things, that a group be formed to "review the effectiveness of spill contracting and accounting processes and to conduct any other review" as necessary.

The FFARM group has determined that, among other things, the Coast Guard needs to address three issues:

1) the development of a uniform, scalable, and automated resource and cost documentation system that can be used at the field level during spill response operations;

2) the development of a field guide that serves as a concise summary of the relevant financial and contracting procedures by which the Coast Guard manages spill response and the related pollution response funds, and;

3) the development of a FFARM-related training scheme to bolster the Coast Guard's field-level, response-related business management skills.

Automated Cost Documentation System

The FFARM group evaluated how the Coast Guard has historically tracked and documented spill-related costs. The group recognized that the bulk of cost documentation to date has been performed manually, using hand written materials and reports.

The group deliberately focused on existing automated cost documentation systems in an effort to identify critical functionality useful to the Coast Guard. The FFARM group discussed the strengths and weaknesses of each system in an effort to identify their role for a standardized and automated spill response cost/resource tracking system for use

Coast Guard-wide.

The information gathered from this effort aided in the development of recommendations for a system to meet Coast Guard requirements.

The primary weaknesses in the Coast Guard's spill response cost documentation processes were determined to be:

- a lack of computerized processes and outputs, and;
- a lack of uniformity in the automated systems that did exist.

To better understand the "state of the art" of cost documentation systems, the FFARM group examined several emerging or existing software packages. The Logistics Support System (LOGSS) was formally evaluated to determine its potential viability for tracking spill response resources and costs and to discern the useful functionality comprised in the system.

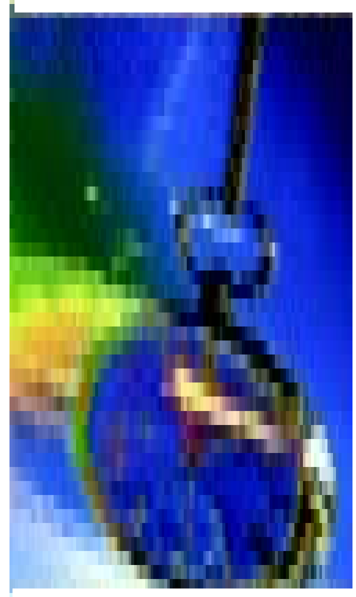
The LOGSS project, begun in 1994 by the National Strike Force Coordination Center (NSFCC), proposed the use of laptop computers and bar coding technology. The NSFCC worked with staff from the Navy Supervisor of Salvage to develop LOGSS. After early development progress, the NSFCC and Navy ended their joint development efforts. The NSFCC continued to develop and refine LOGSS independently.

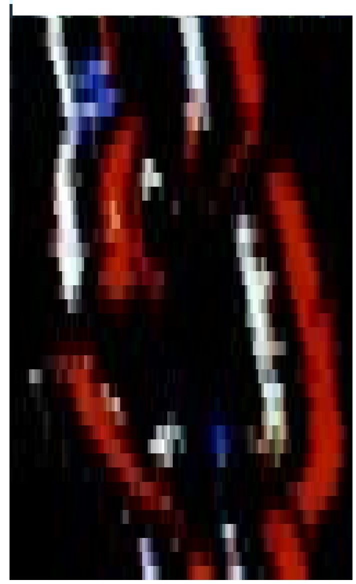
Hardware was purchased and software developed to beta test the system, but no formal testing of the system was conducted. LOGSS was demonstrated on several occasions, but not systematically evaluated. Funding limitations, coupled with other priorities, limited the scope of the project. The LOGSS project was subsequently shelved for future consideration.

The FFARM group determined that the LOGSS possessed useful functionality that could be included in its recommendations for a cost tracking system, even if LOGSS itself would not be fully embraced.

The group looked at several commercial software applications as well, but found that in most cases the software was too complex and feature-laden, or demanded extraordinary management and maintenance, to maximize its usefulness.

In the end, the FFARM group determined that the Coast Guard's deployed cost documentation software needed to possess the following characteristics:





- easy to setup and operate;
- portable (laptop- or palmtop-based);
- possess only the most needed functionality; yet expandable to address large-scale responses;
- compatible with the Coast Guard's Standard Workstation III system, and;
- capable of producing relevant cost documentation reports.

Following much discussion, it was agreed to field test a software package developed by the NPFC called the 5136 Series. This Microsoft Excel-based software automates the 5136 daily cost documentation forms by using a "look-up table" feature for Coast Guard Standard Rates. The three Coast Guard Strike Teams have been evaluating the Series and have offered very favorable comments.

The first version of the 5136 Series is expected to be refined and made ready for use Coast Guard-wide by the summer of 1999. The system is expected to possess all of the desired characteristics, plus offer the benefit of being available on the NPFC Internet site for easy download. The FFARM group will be providing guidance and additional information on the 5136 Series over the next few months.

Over time, the 5136 Series will be linked with the emerging On-Scene Command and Control (OSC2) System that is being developed by the Coast Guard's Office of Response and the Research and Development Center. OSC2 is designed as a portable, tactical support tool for use in support of the Incident Command System at remote command posts. There are logical resource tracking functions in OSC2 that could inform the 5136 Series when used together during a spill response operation.

The FFARM Field Guide

The FFARM group also responded to the FOSC Business Practices QAT's recommendation that FOSCs, and their staffs, be provided an accessible and reliable finance and resource management guide. Notably, the group independently concluded the need for a "field guide" that would address the fundamental responsibilities that an FOSC must meet in the financial management of a spill response. To that end, the FFARM group began outlining the topics that must be included in such a guide.

The group agreed that the NPFC's User Reference Guide and the Technical Operating Procedures are excellent references; however, a condensed version of this guidance for use "on the beach" was determined to be important in getting the information in the hands of FOSC Representatives and responders.

It was determined that a spill-related business practices field guide must be able to serve as a concise summary of the relevant financial and contracting procedures by which the Coast Guard manages spill response and the related pollution response funds.

The group prepared a draft guide that was reviewed by the Strike Teams and several Marine Safety Offices in order to determine how well the guide met its objectives.

The review and revision process, conducted over the last six months, has resulted in a completed guide that covers the principal policies, procedural requirements, and terms and definitions that are comprised within the Coast Guard's numerous existing publications regarding contracting and financial management of oil spill and chemical release response activities. The group expects to deliver the guide to the field by the summer of 1999.

The FFARM Field Guide will provide the Coast Guard's marine safety and environmental protection community with a portable reference to get quick, accurate answers to the most common financial and contracting questions posed during spill response.

FFARM Skills

The final topic addressed in the FFARM group's first year of meetings regarded skill levels and training. The group agreed that the Coast Guard's response-related business management skill set needed to be improved upon at the field level, despite a strong record of spill response performance overall. Again, picking up on issues identified by the Business Practices QAT, the group examined how to improve in this area.

It was determined that weakness in this skill area could be attributed to many possible factors, including:

- frequent rotation of people in and out of the M-program, Storekeepers in particular;
- inadequate response-related financial management training of M-personnel in general;
- relatively infrequent opportunities to use

these skills in many MSO AORs ("hats off" to the Coast Guard and industry for this; however, we still must find a way to maintain spill response skills);

• exercises rarely, if ever, challenge the Finance Section or focus on cost documentation and ceiling management issues, and;

• a need exists for more accessible user guides or reference tools for M-field personnel, hence the development of the FFARM Field Guide.

The FFARM group will continue its examination of this issue. The FFARM Field Guide will bolster the reference materials available to field personnel. In addition, the group will work with the Office of Training and Performance Consulting, as well as the Marine Safety School, to determine the best method to design and deliver FFARM-related training.

Conclusion

Each of the participating offices or units involved in the FFARM work group plays a crucial role in the successful financial management of a spill. The FFARM Work Group is committed to producing ongoing benefits to the Coast Guard's business and procedural practices during spill response operations. The FFARM group intends to develop tools and solutions to the challenges of better business management of spill response in order to contribute to the Coast Guard's best possible response to environmental incidents.

Human Health and Safety

An essential element of Best Response is the key business driver, Human Health and Safety. By this we are referring to the ways the risks of injury, illness and death to responders and the general public are minimized. Under this section we will cover Scientific Monitoring of Advanced Response Technologies and Getting in Focus With Multiple Hazards. In addition, we continue to seek the advice of the scientific and public health advisors through our Scientific Support Coordinators at each USCG District Office and headquarters who work for the National Oceanic and Atmospheric Administration.

SMART: Scientific Monitoring of Advanced Response Technologies

By LCDR Roger Laferriere, USCG HQ, Washington, DC
Nir Barnea, NOAA Hazmat, Seattle, Washington

Overview

SMART (Scientific Monitoring of Advanced Response Technologies) is a new monitoring program designed to provide the Unified Command with real-time field data when in situ burning and dispersants are used during oil spill response.

For dispersant monitoring, SMART recommends a three-tier approach. Tier I recommends visual observation by trained observers, from vessels or from aerial platforms. Tier II combines visual observations with water column sampling at a single depth, using a fluorometer. Tier III expands the fluorometry monitoring to several water depths, and uses a water quality lab. Water samples for later analysis and correlation of fluorometry readings are taken both in Tier II and Tier III.

For in-situ burning, SMART recommends deploying three or more monitoring teams, each equipped with a real-time particulate monitor with data logging capability. The teams deploy downwind of the burn at sensitive locations, and report particulate concentration trends to the Unified Command.

Background

The need for protocols to monitor oil spill response technologies has been recognized since the early 1980s. Technological advances in dispersant and in situ burning (referred to as advanced response technologies), their acceptance in several regions in the US, and in some cases a conditional approval of in situ burning only if monitoring is done, reaffirmed the need for protocols to standardize monitoring of these methods when used at oil spills for which the Federal Government assumes full responsibilities for the response under the National Oil and Hazardous Substances Contingency Plan. Protocols have also been needed to serve as guidelines for assisting or overseeing industry's response to spills.

In November of 1997, a workgroup consisting of federal oil spill scientists and responders from the U.S. Coast Guard, the National Oceanic and Atmospheric Administration, the Environmental Protection Agency and the Center for Disease Control and Prevention, convened in Mobile, Alabama to provide the guidelines needed for generating the protocol. The workgroup built upon programs and procedures currently available, mainly the Special Response Operations Monitoring Program (NOAA, 1994), and lesson learned during spill response and drills. The result of this collaboration is the Scientific Monitoring of Advanced Response Technologies (SMART) program.

SMART is not a regulatory requirement. Rather, it is an option available to the Unified Command when it needs real-time, yet scientifically based information, to assist with decision making when in situ burning or dispersants are used. Furthermore, users may choose to tailor the SMART guidelines to specific regional needs.

The SMART program is divided into two modules: one for in-situ burning operations, the other for dispersant application.

Monitoring Dispersant Efficacy

Dispersant operations and the need to monitor them vary greatly. Therefore, SMART recommends three levels (or tiers) of monitoring.

Tier I: Visual observations

Tier I recommends visual observation by a trained observer who can provide, using visual aids, a qualitative assessment of dispersant efficacy. Observations should be documented, photographed, and videotaped to assist in communicating them to the Unified Command.

When available, visual monitoring may be enhanced by advanced sensing instruments such as infrared thermal imaging. These and other devices may provide a higher degree of sensitivity in determining dispersant effectiveness.

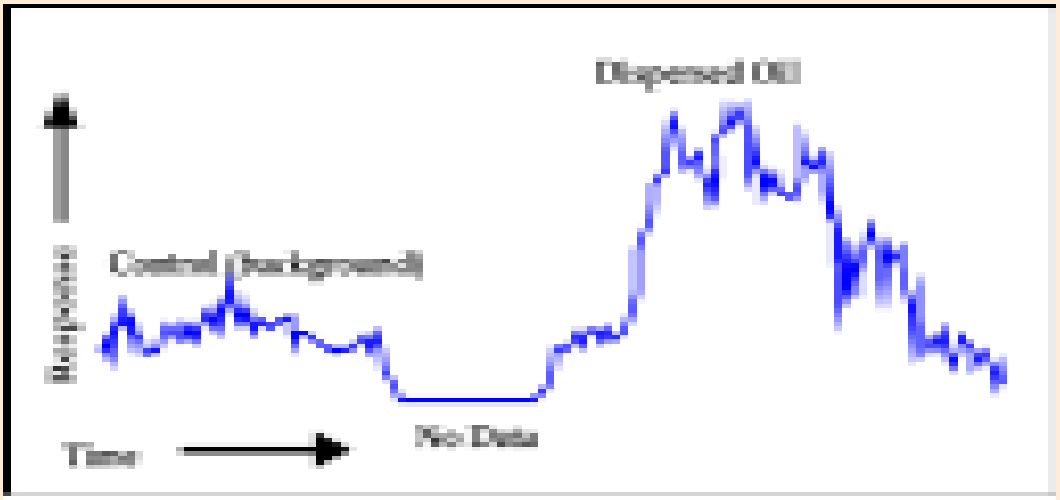


Figure 1. Graphical presentation of fluorometer data.

Visual monitoring is relatively simple and readily done. However, visual observations do not provide ground-truth that the oil is dispersed. Such validation is provided by Tier II.

Tier II: Fluorometry for efficacy

To confirm the visual observations, teams deploy to the dispersant application area to conduct on-site real-time monitoring. While some differences of opinion exist on the methodology, we have held meetings with stakeholders to formulate an accepted methodology. We expect to eventually publish this together with that for Tier III.

Water column monitoring should be accomplished at various locations. The purpose is to collect data on three primary target locations: background water (no oil); oiled surface slick prior to dipersant application; post-dispersant application. Data should then be collected in a real-time mode. This data is used to show the efficacy of the dispersant application. Critical are the exact locations and times for the samples collected. The number of these samples is a function of the scope of the monitoring effort.

Tier III: Transport

When information on the fate and transport of the dispersed oil is needed, the Unified Command may request expanded monitoring. In this case, Tier III replaces Tier II to include monitoring of the transport of dispersed oil. Similar to Tier II development efforts, we have held meetings to formulate an accepted methodology for Tier III.

Transport monitoring should include different depths and sampling at static stations. Other ambient water data may be needed. Plume profile and maximum dispersed oil depth at centerline may also hold some value.

All aspects of Tier II monitoring documentation are valid for Tier III, including the use of a check standard to verify instrument response. It is important to keep in mind, however, that Tier II and Tier III are different plans. When deploying to the field, the sampling team should be prepared to conduct either Tier II or Tier III monitoring, because it would be difficult to shift from Tier II to Tier III in the middle of the operation.

Measure of efficacy

Providing the Unified Command with objective information on dispersant efficacy is the goal of dispersant monitoring. Visual observation by a trained observer may provide the evidence that dispersants are working, or may suggest that no dispersion has been observed. When using fluorometry, a clear indication of dispersant efficacy is a five-fold increase in fluorometer readings over background. When visual observations and on-site monitoring confirm that dispersants are not effective, the Unified Command may consider evaluating further use. If, on the other hand, visual observations and/or fluorometry monitoring suggest that dispersants are effective, dispersant use may be continued.

Monitoring In Situ Burning Operations

During in situ burning operations, monitoring may be conducted when there is a concern that the general public may be exposed excessively to smoke from the burning oil, and the Unified Command, for decision making purposes, needs real-time data on the concentration trends of particulates, in addition to visual observation and to modeling. Monitoring is not required, however, when public exposure to smoke is not predicted to occur.

Sampling and reporting

SMART recommends that three or more monitoring teams be deployed. Each team uses a real-time particulate monitor (such as the DataRAM) capable of detecting the small particulates emitted by the burn (10 microns in diameter or smaller), a global positioning system, and other equipment needed for collecting and documenting the data. Each monitoring instrument provides an instantaneous particulate concentration as well as the time-weighted average over the duration of the burn. The readings are displayed on the instrument's screen and stored in its data logger. In addition, particulate concentrations are logged manually every five minutes.

The monitoring teams are deployed at designated areas of concern to determine ambient concentrations of particulates before the burn starts. During the burn sampling and recording continues. After the burn has ended and the smoke plume dissipated, the teams remain in place for some time (15-30 minutes) and again sample for and record ambient particulate concentrations.

During the course of the sampling, it is expected that the instantaneous readings will vary widely. However, the calculated time-weighted average readings are less variable (since they represent the average of the readings collected to this point) and hence are a better indicator of the concentration trends. When the time-weighted average readings approach or exceed the LOC, the team leader conveys this information to the Burn Coordinator and the Scientific Support Team, which reviews and interpret the data and makes recommendations to the Unified Command.

Monitoring locations should be flexible and determined on a case-by-case basis. In general, one team is deployed at the upwind edge of a sensitive location (e.g., a town). A second team is deployed at the downwind end of this location. Both teams remain at their designated location, moving only to improve sampling capabilities. A third team is more mobile, and is deployed at the discretion of the burn coordinator.

Level of concern

The level of concern for in situ burning monitoring operations follows the National Response Team (NRT) guidelines (NRT, 1995). NRT recommends a conservative upper limit of 150 micrograms of PM-10 per cubic meter of air, averaged over one hour, a level that should be used as a general guideline. If it is exceeded substantially, human exposure to particulates may be elevated to a degree that justifies terminating the burn. However, if particulate levels remain generally below the recommended limit with few or no transitory excursions above it, there is no reason to believe that the population is being exposed to particulate concentrations above the EPA's National Ambient Air Quality Standard.

When addressing particulate monitoring for in situ burning, NRT emphasizes that concentration trends rather than individual readings should be used to determine whether to continue or terminate the burn. For SMART operations, the time-weighted average (TWA) generated by the particulate monitors should be used to ascertain the trend.

SMART in the ICS organization

SMART activities are directed by the Operations Section in the Incident Command System (ICS), of which the in situ burning and dispersant monitoring teams form a Group (Figure 2). At a minimum, each monitoring team in the Group consists of two members: Monitor and assistant monitor. The monitor serves as the team leader. The teams report to a Monitoring Group Supervisor who directs and coordinates team operations, and who reports to the Operation Section.

The Operations Section maintains operational control of the unit. Information from the

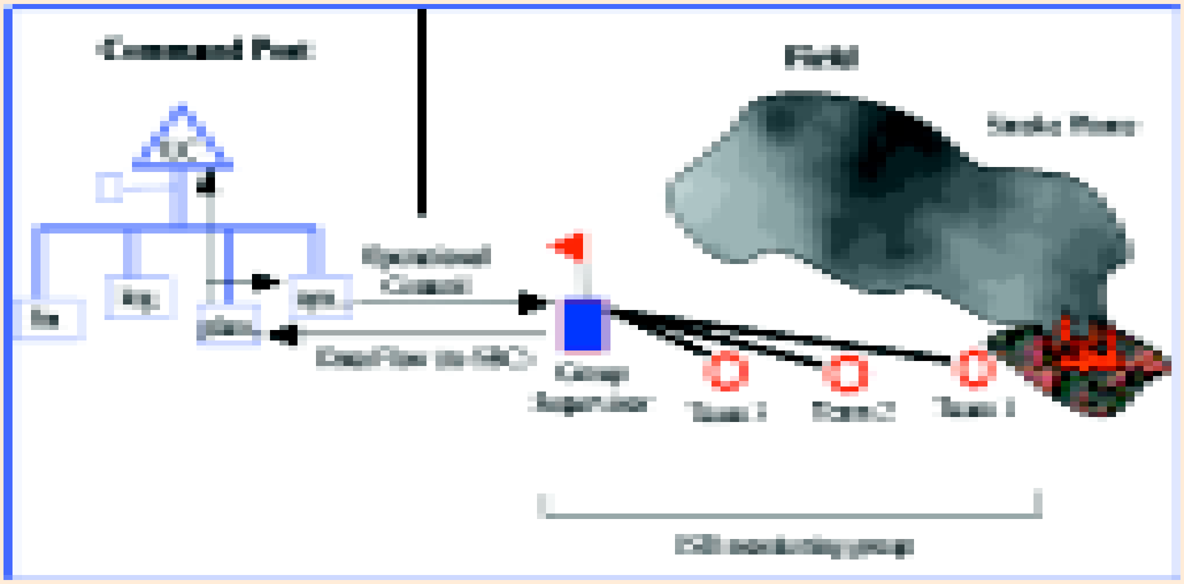


Figure 2. Command Control and Data Flow During SMART In Situ Burning Monitoring

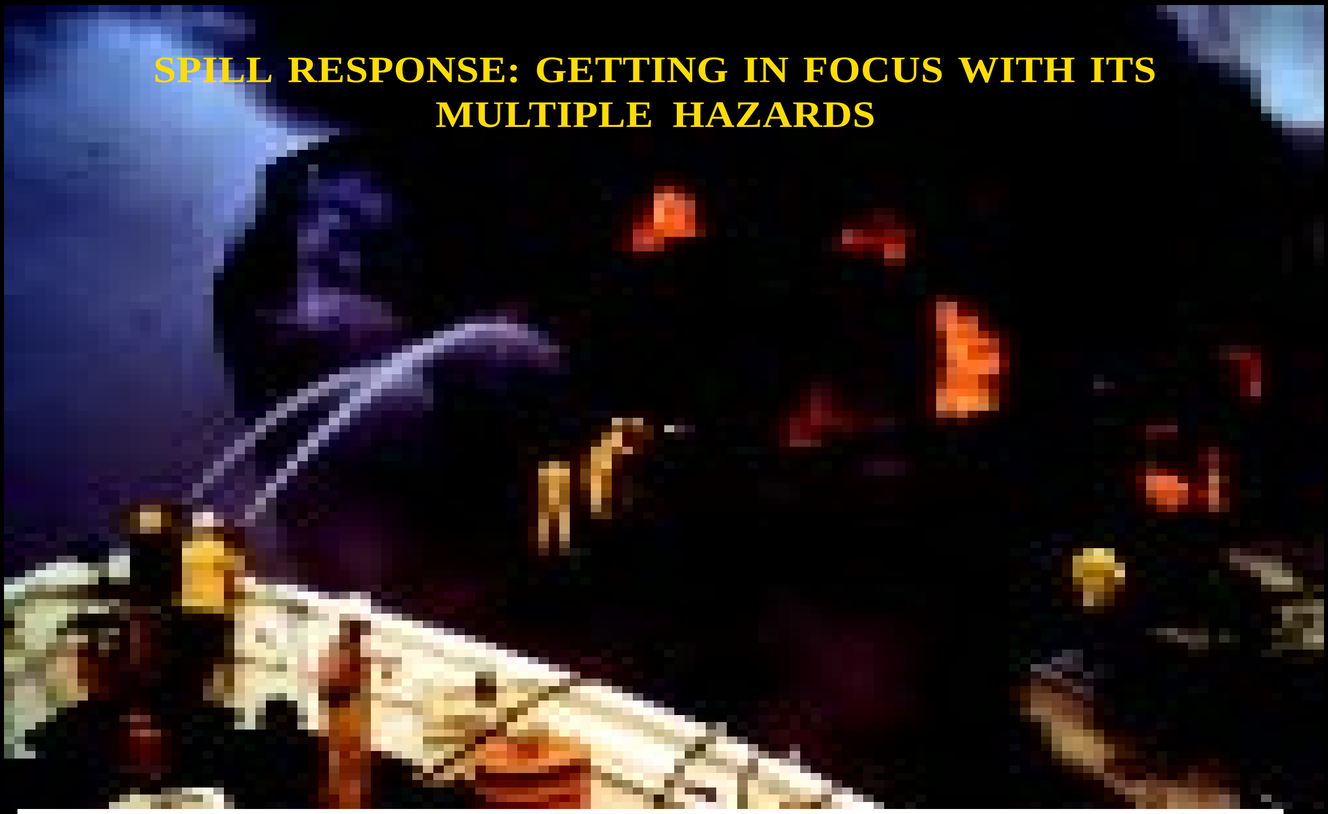
H U M A N   H E A L T H   &   S A F E T Y

field to the Unified Command flows to the SSC in the Planning Section. The SSC and his/her team review and assess the data in the context of other available information, and, most importantly, formulate recommendations on whether to continue or discontinue the burning or dispersant operations. The SSC forwards these recommendations to the FOSC. Quality assurance and control are applied to the data both in the field and at the ICS.

Conclusions

SMART provides the Unified Command with an option to carry out a simple and field oriented monitoring plan for dispersant and in situ burning operations. To monitor dispersant efficacy, SMART recommends three tiers of monitoring, ranging from observation to fluorometry at several water depth. For in situ burning SMART recommends monitoring downwind of the burn, at sensitive locations, using field portable particulates monitors. Monitoring for in situ burning and dispersants were recently tested in training and real spills, and proved operational. SMART is designed to be a flexible and adaptable, changing as more experience and expertise are gained over time.

SPILL RESPONSE: GETTING IN FOCUS WITH ITS MULTIPLE HAZARDS



By LCDR Roger Laferriere, USCG HQ, Washington, DC

Query a commuter about traveling to and from work and how to do it safely and a typical response is “watch out for the other guy and you’ll be alright.” A simple safety formula, but not very effective. On a given day thousands of accidents occur across the United States amongst commuters heading into and leaving work.

What’s this have to do with emergency response? The similarity between driving and emergency response, is that people tend to focus on a few hazards, leaving many other potentially serious hazards in the background.

The driving analogy is used here only to demonstrate human nature in an attempt to simplify problems (parsimony). The same single-mindedness on driving safety is often applied to emergency response. It’s this tunnel vision that can cause persons to be injured, by not taking the right precautions to protect from all hazards. In the driving analogy, there can be multiple reasons for why an accident occurred: it’s not only the other guy, but also road conditions, weather, fatigue, driving experience, distractions and many other contributory pieces to the puzzle.

The emergency responder has the mission to contain and control a pollutant to protect the community, the environment and often most overlooked, the responder. Using the car analogy, there is often an Indianapolis 500 mentality in completing emergency response within the response community. There is a common misconception that an esprit de corps emergency response team is one that could get the job done in the quickest time possible. In reality a good response team is one that completes the response in the safest manner. The emphasis should be on safety of the responder, community and environment and not quickness in response. There are some instances where risk is taken and rapid response is performed in order to protect the community, but it’s important to fully categorize community risk before subjecting responders to excessive risk. During a state wide study of hazmat teams in 1997 for the State of Massachusetts, the teams consistently did a great job determining the risks to the responder, community and environment, but a poor job of comparing the risks to each other. Why is comparison necessary? If the risk to the community and environment are low and the responders high, response managers should take the time to ensure that responders are properly protected instead of rushing into a response. If only the environment is at stake, why compromise the safety of our responders through speed and cutting corners? Emergency response teams need not only determine the risk to the community, responder and environment, but they must compare these risks to identify the urgency of the response and ensure responders are protected to the maximum extent possible.

So what about the other hazards of emergency response? Are they not covered in the general site safety plans? During the study mentioned earlier, several major hazardous materials exercises and responses were physically observed and numerous past histories analyzed. The results indicated that other hazards are not brought into focus alongside the chemical ones, so there is a potential for injuries to occur from other than chemical exposures. It's not the everyday emergency response that involves spills of tri-methyl-ethyl death. On the contrary, the releases are for the most part, less severe in degree of toxicity and quantity. This is one of the reasons we must also be concerned with the other hazards of response. They can often be more severe than the chemical ones.

The study revealed that hazards can be categorized into 4 areas: industrial hygiene, ergonomic, safety and psychosocial factors. These categories can be further broken down into the following:

During the study a sophisticated qualitative sampling procedure by health and safety observers was used to observe activities during the major exercises and incidents.

The results indicated that hazmat responses (and other spill emergency responses as well) could be broken down into 5 phases:

1. Initial Assessment and Staging (arrival, assessment, vehicle staging)

2. Equipment Setup (breakout equipment, setup decontamination corridor)

3. Entry Operations (entry into the contamination zone, cleanup, control, containment)

4. Decontamination

5. Equipment breakdown (stowage)

The observations revealed that all 4 types of hazards were evident, but predominantly ergonomics presenting the greatest hazard risk. This was largely due to the fact that ergonomics were the least controlled hazard. The other hazard often overlooked is fatigue. Fatigue is the root cause of many accidents in emergency response and yet mostly unappreciated during planning and the initial part of a response.

Ergonomics, a relative new field of health and safety is also very under appreciated. Ergonomics are basically hazards caused by human interaction with tools and equipment resulting from awkward postures, contact stresses, forceful exertions and repetition, that can result in

Industrial Hygiene	Ergonomic	Safe
Chemical	Awkward Postures	Slips an
Thermal Stress	Contact Stress	Fal
Noise	Forceful Exertions	Electr
Radiation	Illumination	Blunt/Shar
Biological	Repetitive Motion	Struck by
	Vibration	Caught Betwe
		Explosi

cumulative or acute trauma to joints, muscle, bones, ligaments, tendons, nerves that can cause permanent disorders (tennis elbow, bursitis, trick knees). Some examples from the hazmat team observations included:

- using finger pinch grips to carry heavy equipment weighing greater than 50 pounds
- lifting with the back and/or while twisting the torso excessively
- improperly carrying unconscious victims
- Lowering heavy gear into equipment packs
- Carrying stack packs and other heavy gear on shoulders
- removing teammates' boots with back bent and exerting excessive force

These are just a few examples. On the surface, these look like normal work activities. However, many heavy materials when handled, combined with the sense of having to complete the job quickly, can result in stresses to body parts that could accumulate or acutely develop into a permanent injury. Ergonomic hazards occur during entry operations as a result of interacting with the source of the chemical release (boom deployments, using tools, containment, shutting valves, etc.). Lower back pain was the number one cause of injury during the T/V EXXON VALDEZ spill. Decontamination hazards occur in removing and handling equipment to be decontaminated. Phase 5, stowing equipment, has many obvious ergonomic hazards.

The irony is that ergonomic hazards are always present during an emergency response, but for the most part are ignored, even though the chemical hazard may be minimal to non-existent (exercises). Additionally, ergonomic hazards are highly preventable. Proper training and oversight for lifting operations, use of waist high tables for placing equipment on and off of, reducing size and weight of storage packs, and movement at deliberate speeds rather than excessive ones are a few control examples.

For the industrial hygiene hazards, the observed hazmat teams did a good job of addressing the level of protective clothing needed. However, more care could have been taken to fully understand the limitations of the air monitoring equipment used and interpreting results.

Most emergency response teams use a standard array of air monitoring equipment including a combustible gas meter, oxygen meter, some chemical sensors for a few chemicals (carbon monoxide, hydrogen sulfide), radiation meters and

RANK	SCBA ONLY	
1	SCBA Fogged Vision	
2	SCBA Vocalization	
3	Heat Stress	SC
4	Poor peripheral vision	
5	In-mask sweating	
6	Helmet discomfort	
7	SCBA weight	
8	SCBA Shoulder Straps	
9	Decreased center of balance	
10	SCBA communications	

possibly some total hydrocarbon monitors. It is important to not only know what your instruments can do, but what they can't do. Too often, hazmat teams report readings as being definitively below toxic concentrations or if no readings are observed that nothing hazardous is there. The standard air monitoring suite above does not detect all inorganic carcinogens or highly toxic heavy metals. Additionally, these instruments have a listed error percentage in accuracy some times as high as 25% at standard temperatures (room temperature) and pressures. Emergency response incidents rarely occur at standard temperatures and pressures. These instruments will experience an increase in error the further they are from their optimal environmental parameters. Read the manufacturers' manual and call them to discuss instrument limitations. Search the internet and find out about any studies that have been done on the instrument. The health of the responder depends on it.

Heat stress is always a concern during emergency response. Your body is a working machine that burns fuel, much like your car engine. The more work you do, the hotter you get. The body does a good job of removing heat from your body core by transporting heat away from your skin (through blood transport). Your skin acts as a radiator by removing heat by dilating blood vessels and through sweating. Personal protective clothing, Level A, B turnout gear, splash protection, do a great job of keeping your body from dissipating heat. Imagine wrapping your car engine and radiator in a lead blanket. How could you minimize your car from overheating if you couldn't remove the blanket? Well, you wouldn't start the car if you didn't have to. But, if you had to, you would be moving very slow. Additionally, if you had your choice of using a car that was still hot from just running or that had not been ridden yet, you would choose the latter.

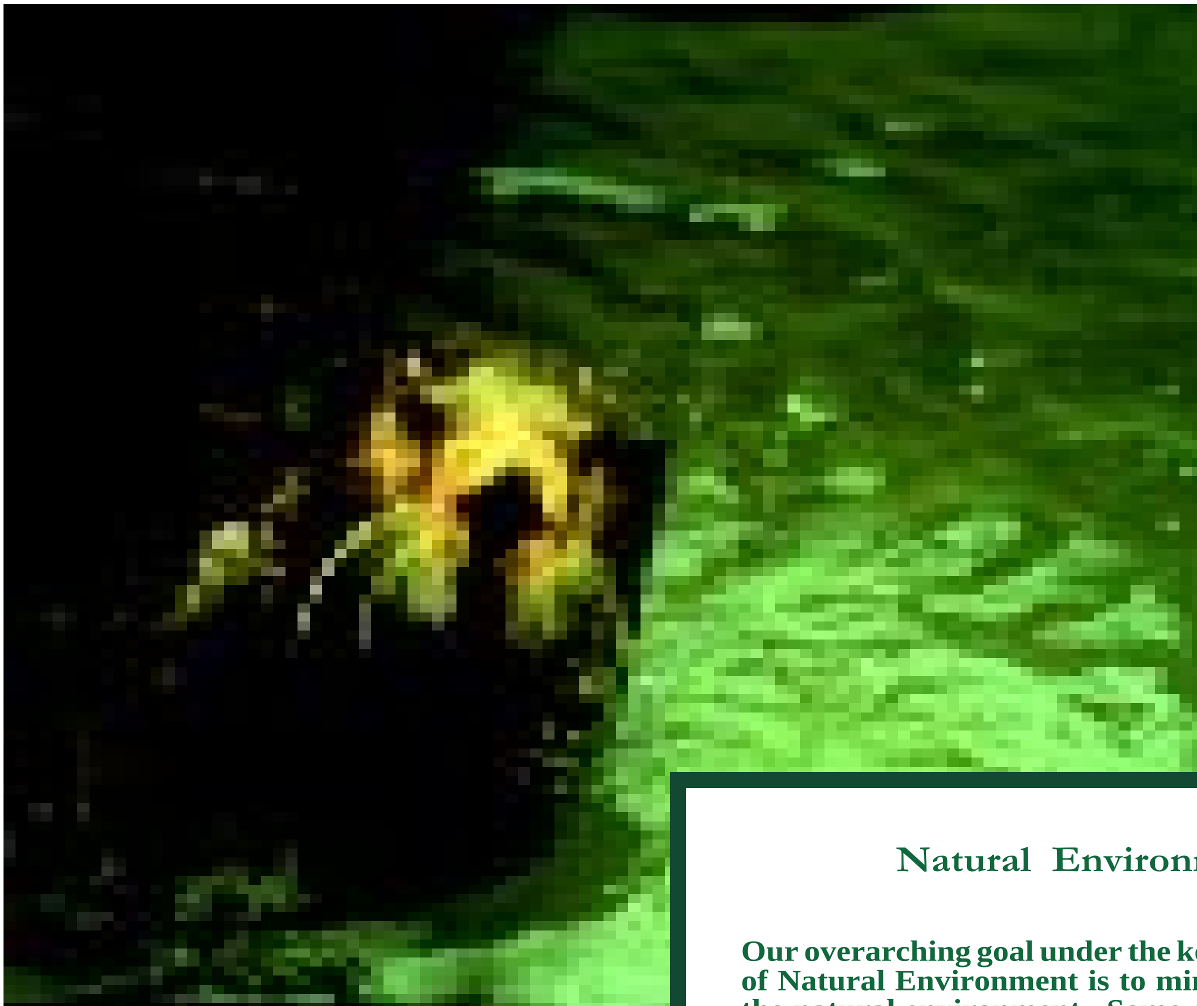
Therefore, like choosing the rested car, personnel designated for wearing protective clothing should also be rested. They should be fit and not overweight. They should not be wearing their SCBAs (generating heat) or dressed to the waist in their clothing before making an entry. Why do we continually see this heat stress-contributing behavior during emergency response? Why aren't the responders filling up on coolants (water is best)? Why do we take care of our cars better than ourselves when it comes to preventing heat overload?

Concerning psychosocial factors, over 240 hazmat responders were given a survey to identify what features while wearing an SCBA and an SCBA with an encapsulated suit were most interfering in accomplishing work tasks. The figure below shows the top 10 most interfering factors identified.

The important conclusion from this information is that emergency response managers must be aware of the decreased capability of a responder in these dress out ensembles. This decreased capability can result in a greater probability of a safety injury. These ensembles limit vision, balance, grasping capability and other functions which responders rely on to prevent injury from occurring.

What can be done to improve an emergency response team in addressing these concerns? First, evaluate your team to determine if they are properly addressing health and safety hazards. You may want to consider bringing in outside evaluators. Train on the deficiencies identified in your evaluation. Update your plans and standard operating procedures. Last but not least, consider developing a pocket field guide with reminder type checklists (with no extraneous narrative text). Airline pilots use safety checklists all the time. The airline industry has an excellent safety record for pilot performance.

The big picture on safety, it's acceptable to keep chemicals in the center of the photo, but be sure to bring those background hazards into focus and on par with the chemical ones. It makes for a better picture of all the potential hazards, one that *you* may treasure for the rest of your life.



Natural Environment

Our overarching goal under the key business driver of Natural Environment is to minimize damage to the natural environment. Some of the tools at our disposal have been explained under the article on Scientific Monitoring of Advanced Response Technologies under the previous section. In this section we discuss The Environmental Tradeoffs of Spill Response Alternatives, In-Situ burning of Oil Spills and Are You Making the Most of Every Opportunity. Two of the three articles are from the perspectives of our partners in response. The first article explains a concept sometimes referred to as Net Environmental Benefits Analysis and the challenges of finding a middle path; this includes planning with the end "restoration" in view, the perspective of one of the National Oceanic and Atmospheric Administration's Seattle based staff. The second article is from the head of Canada's prominent research laboratory for environmental response. Our third article discusses rethinking the use of all response methods and technologies in light of appropriate risk analysis. In addition, we have included some short text boxes on related areas of interest.

NATURAL ENVIRONMENT

The Environmental Trade-offs of Spill Response Alternatives: Finding the Optimum Path to Recovery

By Robert Pavia, PhD, NOAA

The Exxon Valdez launched a massive cleanup effort, a massive damage assessment effort, and a titanic battle among conflicting public and private interests over restoration priorities, ultimately affecting recovery efforts that continue to this day. These events taught many lessons about how spills and response operations can affect the environment, some of which became embodied in the U.S. Oil Pollution Act of 1990. The Act identifies key goals in spill planning, response, and mitigation. The traditional decoupling of response, natural resource damage assessment, and restoration undermines the success of response efforts. The goal of a spill response should be to reduce to a practical minimum the overall magnitude of resource injury and the time necessary for environmental recovery. These points suggest the need for finding the optimum path to recovery.

What has happened to U.S. spill preparedness and response efforts since 1989? Spills occur less frequently and preparedness activities are increasing tremendously. All the while, the cost of response and the number of people involved in conducting a response have grown. By one estimate, the average cost to cleanup a gallon of oil in the U.S. is now $250, the highest in the world by far. Spill response has become a very formalized process without quantitative means for measuring success in the context of environmental consequences. Spill research has become more compartmentalized, focusing on ever finer details of problems that have been investigated for decades. One positive change has come in the approach for assessing damages, moving from claims based on the monetary value of injured resources to a restoration-based process. Yet today, as in 1989, the end of a response still can precipitate fractious debate about how clean is clean enough.

In the United States, the goal of response actions is often stated as protecting public safety and the environment. During a spill response there are at least four groups working to control the outcome of the event: the On-Scene Coordinator, the responsible party, natural resource trustees, and potential third party claimants. Each group is working to optimize different aspects of the response to achieve their response goals. Some business drivers of a response are measurable and the U.S.

Coast Guard is building tools for evaluating these. Other business drivers, particularly environmental ones, are more difficult to quantify.

Critically, various players can have divergent definitions of optimum solutions, often leading to response actions that many participants will view as contrary to their best interests.

A spill response usually moves in parallel with damage assessment and restoration activities. The response concentrates on how-clean-is-clean, while the damage assessment focuses on how to improve the environment once the response has ended. The arbitrary separation that exists between response cleanup activities and damage assessment-based restoration activities can deflect actions necessary for environmental protection. As stated above, the chief environmental goal of a spill response should be to reduce to a practical minimum the overall magnitude of resource injury and the time necessary for resources to recover from that injury. These can be minimized through the combination of response and restoration actions.

Restoration can serve as the bridge between response and recovery. Efforts to meet environmental goals take place in the context of all the operational, economic, and policy constraints facing an On-Scene Coordinator. For the purposes of the discussion that follows however, those aspects will be conveniently ignored.

Identifying the optimum path to recovery is simple conceptually, but very difficult in real life due to large gaps in understanding long term ecological processes. Taking an abstract view of the issue can help focus on actions responders can take now towards this optimum path. The accompanying figure provides a conceptual illustration of how response alternatives can positively or negatively affect environmental recovery.

To begin there are several things to notice about the design of this figure. The horizontal axis is a simple linear plot of elapsed time from when a spill occurs. The vertical axis is an arbitrary measure of environmental quality, movement down the axis is a negative impact, movement up the axis represents recovery from this impact. The impacts include negative effects from both the spill and the response. The area between the "conditions in absence of a spill" line and the line representing a particular "cleanup" is the cumulative impact from a spill and the associated response.

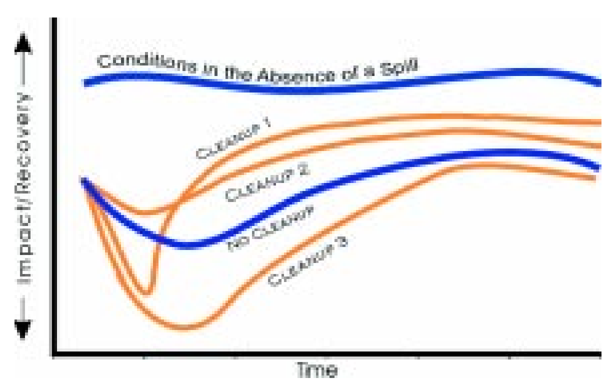
In trying to estimate the cumulative impact from a response, the first consideration is that habitats are in a constant state of change due to a broad range of natural and human influence distinct from any spill event. Because the time axis starts at the spill event, we have no clear picture of how the environment behaved prior to the spill, just like in real life.

This significantly complications any discussion of recovery as a measure of response performance because defining a reference for comparison is so difficult. The second reference for defining response success is the "no cleanup" line. This line defines how the environment would recover following a spill in which there is no human intervention. The environmental goal of a response can be simply to reduce the area between "conditions in absence of a spill" and "no cleanup." If a response does not improve on this, then it should not be undertaken.

The cumulative response impact is clearly greater for the case that "cleanup 3" defines, here the response does more harm than good. In the "cleanup 1" case, the cumulative response impact is clearly less than the "no cleanup" alternative, here the response has an environmental benefit.

The case for "cleanup 2" is not as clear cut. One way to interpret this line is that the initial response increases the level of environmental impact but accelerates the recovery rate. The figure is constructed so that "cleanup 2" has the smallest cumulative impact of any alternative.

A final thought, you will notice that none of the cleanup curves ever intersect the "conditions in absence of a spill" line. A first this might seem incorrect, recovery would be complete when conditions return to what they would have been



without the spill. Unfortunately, it is usually not possible to define this endpoint, when the recovery line begins moving in parallel to the reference area recovery is likely to have occurred. This parallel path indicates that changes along the impact/recovery axis are attributable to environmental and human factors and not the spill.

How does restoration fit into this equation? Restoration actions, for example developing new habitat to support an endangered bird, can help accelerate the rate of recovery. This reduces the cumulative impact of the event, conceptually no different from what is traditionally called response. In some cases cleanup is characterized as reducing contamination levels and restoration as creating or improving habitat. In reality, no clear lines exist, restoration activities sometimes require reducing contamination and response actions can include restoring habitat the cleanup disrupts.

In the ideal world we could stand at the confluence of response options shown in the figure and look out into the future, selecting the combination of actions that produce the optimum result for the environment. In the real world, we can not do this, not only because we do not yet have quantitative, scientifically based measures of success, but also because of the political and economic forces that compete with the environment during a response.

There are actions taken today that can help move toward this optimum approach. Most important is building on lessons learned during events and extracting practices that can be broadly applied during future events. This along with longer term research efforts will help develop measures of success based on reducing the time to recovery and the magnitude of natural resource impairment pending recovery. Even as the necessary scientific investigations evolve, response today can begin focusing on recovery as a response objective, in part by better integrating injury investigations with efforts to develop response strategies.

When spill response actions target the optimum path to recovery, responsible parties, the Federal On-Scene Coordinator, and trustees can strive for common objectives during a response. Orienting response actions to this path will require both assessing the economic and policy forces at work in spills and developing quantitative, scientifically based measures of success.

Environmental Sensitivity Index Maps

To reduce the environmental consequences of both spills and cleanup efforts it is necessary to identify vulnerable coastal locations before a spill happens. The most widely used approach to sensitive environment mapping in the United States is NOAA's Environmental Sensitivity Index (ESI). These maps serve as quick references for oil and chemical spill responders.

ESI maps contain three kinds of information. Shorelines are color-coded to indicate their sensitivity to oiling. Sensitive biological resources, such as seabird colonies and marine mammal hauling grounds, are depicted by special symbols on the maps. ESI maps also show important human-use resources, such as water intakes, marinas, and swimming beaches.

Sensitivity maps are not an end in themselve, rather they are a starting point for prevention, planning, and response actions. This objective is best achieved when ESI maps are used to identify the locations of sensitive resources before a spill occurs, so that protection priorities can be established and cleanup strategies designed in advance.

To find out more about ESIs and check their availability for your area visit this site on the Internet: **http://response.restoration.noaa.gov/esi/esiintro.html**

IN-SITU BURNING OF OIL SPILLS: A HISTORICAL PERSPECTIVE

By M. F. Fingas, PhD., Emergencies Science Division, River Road Environmental Technology Centre
Environment Canada, Ottawa, Ontario

Introduction

In-situ burning of oil spills has been tried over the past thirty years but has only recently been accepted as an oil-spill cleanup option in some countries. The lack of acceptance of burning as a cleanup option is largely because of the lack of understanding of the combustion products and the principles governing the combustibility of oil-on-water. There remain several barriers to the full acceptance of burning, especially concern over emissions, but also the ability to retain oil slicks that are thick enough to burn.

This paper reviews the history and the state-of-the-art in burning to shed light on what is known and what remains to be researched. The history of burning is full of reversals, re-directions and re-inventions. Often a concept for ignition or containment reappears on the market or on a research list. Unfortunately, the progress has not been linear over the years and often efforts have been wasted on concepts or theories that yielded no benefit to the practical application of burning. The main cause of this is the interdisciplinary nature of oil spills. Researchers and engineers are often unaware of findings and concepts in each others fields. The practical approaches usually win out for funding, often at the detriment of advancement in the field. This paper will focus on the advancements and the progress made through the years and not the difficulties encountered on the way. Table 1 highlights some of the in-situ burns and experiments over the past 30 thirty years.

Outside of Arctic regions, deliberate burning has not been used to a large extent. Several reviews contain histories of deliberate and accidental burns.[1,2] Often accidental burns were viewed as being detrimental to the situation and efforts to put out the burn were paramount to mounting other measures. Needless to say, a large release of oil from a stricken tanker would be motivation to stop a fire, however such a threat was not always imminent. The current instinct is to put out the fire irrespective of the situation. Underlying this action, appears to be the view that burning is bad and results in negative effects on the situation and on the environment.

The acceptance and use of burning in a given country often depended on the success (or failure) of initial attempts to use the technique. The first recorded burn was in Northern Canada in 1958, where a log boom was used to successfully contain oil for in-situ burning on the Mackenzie River. After this, many burns were conducted in Canada, most often without any form of documentation. Similarly, several successful burns in Sweden and Finland resulted in the use of burning on many occasions in those and surrounding countries. In Britain, extensive efforts to ignite the TORREY CANYON spill and the vessel itself resulted in mixed results. Consequently, burning has not been tried again in Britain until recently.

In recent years, the understanding of in-situ burning has matured to the point where it will be accepted in several jurisdictions. 3-5 Burning is now an "approved" technique requiring authorities permission in most western countries. Despite, the newly-gained acceptance, there a no to few actual uses of in-situ burning on open waters. It should be noted that in-situ burning still has wide application on spills on land and on small waterbodies. In-situ burning is used extensively in the petroleum-producing regions of Canada and the United States to deal with oil spills.

What Will Burn?

In earlier years, theories varied as to the burnability of oils. 6,7 Some of the early papers suggested that some oils would not burn in-situ. In fact, most if not all oils will burn on water or land if in sufficiently thick slicks. The "prime rule" of in-situ burning is that oils will ignite if they are at least 2 to 3 mm. thick. They will continue to burn down to slicks about 1 to 2 mm. thick. The reason that these thicknesses are required is heat transfer. Sufficient heat is required to vaporize material for continued combustion. For very thin slicks, most of the heat is lost to the water and combustion is not sustained.

The effect of weathering on oil combustion is to increase the difficulty with which the material is ignited. Weathered oil requires a longer ignition time and somewhat higher ignition temperature. This is not a problem for most ignition devices because they generate sufficient temperature and have sufficient burning time to ignite most oils.

The effect of water content on oil ignition is similar to that of weathering. It is known that oil that is completely emulsified with water cannot be ignited. Oil containing some emulsion can be ignited and burned. The successful test burn of the EXXON VALDEZ oil had some emulsion present (probably less than 20%) and this did not affect either the ignitibility or the efficiency.[8] It is suspected that fire breaks down the water-in-oil emulsion, thus water content may not be a problem given that the fire can actually be started. At what point an emulsion can be ignited is not known. One test suggested that a heavier crude would not burn with about 10% water, another burned with as much as 50% and still another burned with about 70% water. Extensive studies on emulsions have shown that there are different categories and the results above may only relate to the stability of the emulsion.[9] There still remains extensive work to solve this problem.

Only limited work has been done on burning oil on shorelines. Because sub-strata are generally wet, minimum thicknesses are thought to be similar to those for on water — 2 to 3 mm. Oil is sometimes deposited in layers much thinner than this. Burning may cause the part of the oil to penetrate further into the sediments. Where shorelines are close to human settlements and other amenities, burning would not be considered.

Emissions From Oil Spill Burning

The concern over atmospheric emissions remains the biggest barrier to the widespread use of burning. Unfortunately, burning of all kinds, is in today's times, a questionable process because of concern over combustion by-products. Analysis is still difficult, although technology does permit analysis of key compounds and comparison to ambient levels of pollution.

Early papers on the topic did not report on extensive experiments, but focussed either on simple measurements or predictions of the types of emissions that could be encountered. Some papers focussed only on Sulphur Dioxide, others on PAHs. Only recent studies have explored hundreds of compounds to delineate the concerns with emissions. The following paragraphs summarize the current state-of-knowledge in the field. [10-12]

All burns, especially those of diesel fuel produced an abundance of particulate matter. The concentrations of particulates from diesel at the same distances were approximately 4 times that for similar-sized crude oil burns. Concentrations of particulate matter with diameters of 10 µm or less (PM-10) were sometimes about 0.7 of the total particulate concentration (TSP), as would be expected, but sometimes were the same as the TSP. The same is true of the PM-2.5 concentrations.

Crude oil burns result in Polycyclic Aromatic Hydrocarbons (PAH) downwind of the fire, but the concentration on the particulate matter is often an order-of-magnitude less the concentration in the starting oil. Diesel fuel contains low levels of PAHs with smaller molecular size, but results in more PAHs of larger molecular sizes. Larger PAHs are either created or concentrated by the fire. Larger PAHs, some of which are not even detectable in the Diesel fuel, are found both in the soot and in the residue. The concentrations of these larger PAHs are however low and often just above detection limits. Overall, more PAHs are destroyed by the fires than are created.

One-hundred and forty-eight volatile organic compounds (VOC) were measured from samples taken in recent studies. The concentrations of VOCs are about the same in a crude or diesel burn. Concentrations appear to be under human health limits even at the closest monitoring station (about 30 m). VOC concentrations are about three times higher when the oil is not burning and is just evaporating. Unfortunately, this is difficult to measure at all burns.

Particulates precipitated downwind and oil residue were analyzed for dioxins and dibenzofurans, very toxic substances often produced by the burning of organic chlorine-containing compounds. The levels of these toxic compounds were at background levels indicating no production by either crude or diesel fires.

Oil burns produce low amounts of the small aldehydes (formaldehyde, acetaldehyde, etc.) and ketones (acetone, etc.). These would not be a health concern even close to the source fire. Carbonyls from crude oil fires are at very low concentrations.

Carbon dioxide is the end result of combustion and is found in increased concentrations around a burn. Normal atmospheric levels are about 300 ppm and levels near a burn can be around 500 ppm. There is no human danger in this level. The three-dimensional distributions of carbon dioxide around a burn have been measured. Concentrations of carbon dioxide are highest at the 1 m level and fall to background levels at the 4 m level. Concentrations at ground level are as high as 10 times that of the plume. Distribution along the ground is broader than for particulates.

Carbon monoxide levels are usually at or below the lowest detection levels of the instruments and thus do not pose any hazard to humans. The gas has only been measured when the burn appears to be inefficient, such as when water is sprayed into the fire. Carbon monoxide appears to be distributed in the same way as carbon dioxide. Sulphur dioxide, per se, is usually not detected at significant levels or sometimes not even at measurable levels. Sulphuric acid, or sulphur dioxide that has reacted with water, is detected at fires and levels, although not of concern, appear to correspond to the sulphur contents of the oil. Attempts were made to measure oxides of nitrogen and other fixed gases. None were measured in about 10 experiments.

A concern about burning crude oil lies with any "hidden" compounds that might be produced. One study was conducted several years ago in which soot and residue samples were extracted and "totally" analyzed in various ways. The study was not conclusive, however, no compounds of the several hundred identified were of serious environmental concern. The soot analysis revealed that the bulk of the material was carbon and that all other detectable compounds were present on this carbon matrix in abundances of parts-per-million or less. The most frequent compounds identified were aldehydes, ketones, esters, acetates and acids. These are formed by incomplete oxygenation of the oil. Similar analysis of the residue shows that the same minority compounds are present at about the same levels. The bulk of the residue is unburned oil.

The quantity of soot produced by in-situ oil fires is unknown. No measurement techniques exist because the emissions from fires cover a large area. Estimates of soot production vary from 0.2 to 3% of the starting oil volume, however some older techniques reported numbers as high as 16%. These estimates are complicated by the fact that particulates precipitate from the smoke plume. This appears to occur at an exponential rate from the fire outwards. Some researchers have tried to estimate soot production by performing a carbon balance. They measure the soot quantity and the carbon dioxide concentration at the same point in the smoke plume. The soot production is estimated by taking the percentage of soot versus the total amount of carbon in both the soot and carbon dioxide. This technique results in high estimates of soot production and is flawed because the soot is largely confined to the smoke plume but the carbon dioxide is emitted over a very wide sector. Further work on quantity of soot production is required.

Ignition

Much of the earlier work focussed on the ignition of slicks.[13,14] The thinking was that proper ignition was the key to successful burning of oil on water. Studies conducted in the last ten years have shown that ignition is relatively unimportant. Research has shown that slick thickness is the major factor and ignition is only important under certain circumstances. Heavy oils require longer heating times and a hotter flame to ignite compared to lighter oils. Many ignition sources can supply sufficient heat for sufficient length of time.

Several igniters have been developed. A simple device consisting of juice cans and propellant was developed by Dome petroleum and was known as the “Dome” igniter. Environment Canada and the Canadian military developed a device with a sophisticated time fuse. This device was commercialized under the name “Pyroid” but did not continue in production. Some of these devices are used from time to time for experimental spills. Work was also conducted on developing a laser ignition device, although a working unit was not completed. The state-of-the-art in ignition technology is a device called the “Helitorch”. It is a helicopter-slung device which distributes packets of burning, gelled fuel.

Actual burns at some incidents and experiments have been ignited using much less sophisticated means. The EDGAR JORDAIN spill was lit using a roll of diesel-soaked toilet paper. The east coast oil burns were lit using oil-soaked sorbent. The test burn at the EXXON VALDEZ spill was ignited using a lunch “baggie” filled with gelled gasoline. This illustrates the ease and lack of sophistication that is required to ignite oil slicks.

Efficiency and Burning Rates

In early years, it was presumed that burn efficiency was somehow related to oil type. It is now known that burning efficiency is simply a matter of initial thickness and of encounter. Efficiency is largely a function of oil thickness. Oil thicker than about 2 to 3 mm. can be ignited and this will burn down to about 1 to 2 mm. If we ignite a slick at, lets say, 2 mm. and this burns down to 1 mm., our efficiency can be at most, 50%. However if we ignite a pool of oil 20 mm. thick and this burns down to 1 mm., our efficiency of removal is about 95%. Current research has shown that other factors such as oil type and water content only marginally affect these values.

The residue from oil spill burning is largely unburned oil with some lighter or more volatile products removed. It is adhesive and because of this, somewhat easy to recover with manual techniques. Recent concern has been raised over the fact that these may sink, but this is only speculation and has only occurred on two spills.

Most oil pools burn at a rate of about 3 to 4 mm. per minute. This means that the depth of oil is reduced by 3 to 4 mm. per minute. Several tests have shown that this does not vary significantly with oil type, weathering and water content. As a rule of thumb, one can burn about 5000 Litres per-square-metre per-day (or about 100 gallons-per-square-foot per-day).

Burning Techniques

Containment is usually required to concentrate oil slicks so that they are of sufficient thickness to ignite and burn efficiently. Lightweight and fire-resistant booms now exist which make burning very feasible. The trial burn conducted at the EXXON VALDEZ site illustrates how oil spills can be burned without threatening the spill source. Two fishing vessels towed a fire-resistant boom using long tow lines. The boom was towed slowly through the slick until the boom-holding capacity was reached. The oil-filled boom was then towed away from the main slick and the oil ignited. Fire could not spread to the main slick because of the distance.

Burning in-situ without the benefit of containment boom can be done only if sufficient thickness (2 - 3 mm.) exists to ignite the oil. For most crude oils this only occurs for a few hours after the spill event. Oil on the open sea rapidly spreads to equilibrium thicknesses. For light crude oils this is about 0.01 to 0.1 mm., for heavy crudes and heavy oils this is about 0.05 to about 0.5 mm. These are far too thin to ignite.

Log booms were first used to contain oil for burning and this was successful. In the early 1970s Environment Canada initiated several projects to develop fire-resistant containment techniques. Water spray and air jet were examined but abandoned because of the impracticality of this approach. Several series of stainless steel booms were built and also different versions of ceramic booms. Alaskan workers and 3M pioneered the development of a flexible fire-resistant boom and this product continues until today. Dome petroleum pursued one of the stainless steel booms and this product has been recently been re-engineered into a smaller product.

Lately much work has been conducted on fire-resistant booms. This has been highlighted by two series of tests of these at Mobile, Alabama to test the fire resistance and further testing of the same booms at OHMSETT for the usual containment parameters. These tests have highlighted several insights about fire-resistant booms. First, a simple fire-resistant blanket over the top of a standard boom will not function well for the purpose. Second, heavy metal booms may be impractical in operational situations, despite their outstanding ability to withstand fire. Third, water-cooled booms, although functional in test situations, may not be practical in open burn situations. Obviously, more development is still needed.

Concluding Remarks

Progress has been immense in the ability to apply in-situ burning. Better information transfer is still needed. It has been noted that literature in the field and general scientific literature is often not used. On the positive side, more spill workers are accepting burning as a technique and are receptive to information on the technique.

HISTORICAL BURNS AND SPILL STUDIES

Year	Country	Description	Events	Lessons
1958	Canada	Mackenzie River, NWT	First recorded use of in-situ burning, on river using log booms	In-situ burning possible with use of containment
1967	Britain	TORREY CANYON	Cargo tanks difficult to ignite with military devices	There maybe limitations to burning
1969	Holland	series of experiments	Igniter KONTAX tested, many slicks burned	Burning at sea is possible
1970	Canada	ARROW	Limited success burning in confined pools	Confinement may be necessary for burning
1970	Sweden	OTHELLO/KATELYSIA	Oil burned among ice and in pools	Can burn oil contained by ice
1970	Canada	Deception Bay	Oil burned among ice and in pools	Can burn in ice and in pools
1973	Canada	Rimouski - experiment	Several burns of various oils on mud flats	Demonstrated high removal rates possible, >75%
1975	Canada	Balaena Bay - experiment	Multiple slicks from underice oil ignited	Demonstrated ease of burning oil on ice
1976	U.S.A.	ARGO MERCHANT	Tried to ignite thin slicks at sea	Not able to burn thin slicks on open water
1976	Canada	Yellowknife - experiment	Parameters controlling burning not oil type alone	Parameters controlling burning not oil type alone
1978-82	Canada	Series of experiments	Studied many parameters of burning	Found limitations to burning was thickness
1979	Mid-Atlantic	ATLANTIC EMPRESS/AEGEAN CAPTAIN	Uncontained oil burned at sea after accident	Uncontained slicks will burn at sea directly after spill
1979	Canada	IMPERIAL ST. CLAIR	Can readily burn fuels with ice	Can readily burn fuels amongst ice
1980	Canada	Mckinley Bay - experiment	Several tests involving igniters, different thicknesses	Test of igniters, measured burn rates
1981	Canada	McKinley Bay - experiment	Tried to ignite emulsions	Noted difficulty in burning emulsions
1983	Canada	EDGAR JORDAIN	Vessel containing fuels and nearby fuel ignited	Practical effectiveness of burning amongst ice
1983	U.S.A.	Beaufort Sea - experiment	Oil burned in broken ice	Ability to burn in broken ice
1984	Canada	series of experiments	Tested the burning of uncontained slicks	Uncontained burning only possible in few conditions
1984-5	U.S.A.	Beaufort Sea - experiment	Burning with various ice coverages tested	Burning with various ice coverages possible
1984-6	U.S.A.	OHMSETT - experiments	Oil burned among ice but not with high water content	Ice concentration not important, Emulsions don't burn
1985	Canada	Offshore Atlantic - experiment	Oil among ice burned after physical experiment	Ease of burning amongst ice
1985	Canada	Esso - Calgary - experiments	Several slicks in ice leads burned	Ease of burning in leads
1986	Canada	Ottawa - experiments/analysis	Analyzed residue and soot from several burns	Analysis shows PAHs about same in oil and residue
1986	U.S.A.	Seattle and Deadhorse - experiments	Test of the Helitorch and other igniters	First demonstrations of Helitorch as practical
1986-91	U.S.A.	NIST - experiments	Many lab-scale experiments	Science of burning, rates, soot, heat transfer
1986-91	Canada	Ottawa - analysis on above	Analyzed residue and soot from several burns	Found PAHs and others—not major problem
1989	U.S.A.	EXXON VALDEZ	A test burn performed using a fire-proof boom	One burn demonstrated practicality and ease
1991	U.S.A.	First set of mobile experiments	Several test burns in newly-constructed pan	Several physical findings and first emission results
1992	U.S.A.	Second set of mobile burns	Several test burns in pan	Several physical findings and emission results
1992	Canada	Several test burns in Calgary	Emissions measured and Ferrocene tested	Showed smokeless burn possible
1993	Canada	Newfoundland Offshore burn	Successful burn on full scale off shore	Hundreds of measurements, practicality demonstrated
1994	U.S.A.	Third set of Mobile burns	Large scale diesel burns to test sampler	Many measurements taken
1994	U.S.A.	North Slope burns	Large scale burn to measure smoke	Trajectory and deposition determined
1994	Norway	Series of Spitzbergen burns	Large scale burns of crude and emulsions	Large area of ignition results in burn of emulsions
1994	Norway	Series of Spitzbergen burns	Attempt at uncontained burn	Uncontained burn largely burned
1996	Britain	Burn test	First containment burn test in Britain	Demonstrated practicality of technique
1996	U.S.A.	Test burns in Alaska	Igniters and boom tested	Some measurements taken
1997	U.S.A.	Fourth set of mobile burns	Small scale diesel burns to test booms	Emissions measured and booms tested
1997	U.S.A.	North Slope tank tests	Conducted several tests on waves/burning	Waves not strongly constraining on burning
1998	U.S.A.	Fifth set of mobile burns	Small scale diesel burns to test booms	Emissions measured and booms tested

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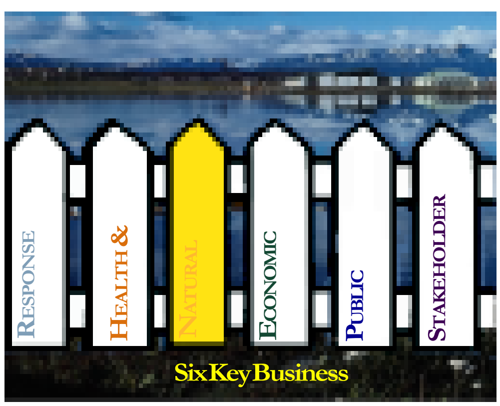


Are You Prepared to Make the Most of Every Opportunity?

Why you should consider an Ecological Risk Assessment for your Port

By LCDR John Caplis, Plans and Preparedness Division, USCG, G-MOR-2, Washington, DC

The in situ burn on the NEW CARISSA is a recent example of a new opportunity provided by an emerging technology. In the case of the NEW CARISSA, in situ burning was used when it became apparent that more traditional removal methods would fail. But must we wait until traditional methods fail before we can use these emerging tools? Do we fully understand the role of these tools, or the opportunities for environmental protection that they offer us?

Today's "response toolbox" contains multiple technologies. Dispersants and in situ burning are now available to complement the mechanical recovery systems that have been the traditional focus for planning and response efforts in the United States. As these technologies continue to mature, they present us with new opportunities to combat spills. It is critical that we are prepared to make the most of these opportunities.

The purpose of this paper is threefold: to briefly discuss the role of the "tools" in the toolbox, to examine our readiness to capitalize on the opportunities they present, and to offer a model for improved pre-spill planning and response decision-making with regard to their use.

Roles Within the Toolbox

In summer 1998, the Coast Guard held a series of workshops to gather public comment on potential changes to the OPA 90 response plan requirements. During the workshops, it was proposed that dispersant capable resources be added to the existing requirements for mechanical recovery systems. These workshops, and the 1998 SONS drill in Alaska, generated considerable debate regarding the proper role of emerging technologies (such as dispersants and in-situ burning), and their relationship to mechanical recovery systems.

Many concerned citizens argue that mechanical recovery systems are the only true "primary" response options. In their eyes, all other technologies, such as dispersants, are secondary response options, and should only be used after efforts to use mechanical recovery systems have failed. Many people invoke the Clean Water Act (CWA) to support this posture, stating that the Act requires the "removal" of oil. They cite mechanical recovery as the only "true means of removing" the oil from the environment.

A closer examination of the Act, however, reveals that {section 311(a)(8)} refers to "removal" as: containment and removal of oil from the water and shorelines or the taking of other such actions as may be necessary to minimize or mitigate damage to the public health or welfare of the United States or to the environment.

Clearly, the CWA broadly interpreted the term "removal" to include any and all actions necessary to minimize the impact to the environment, not just the use of mechanical recovery systems. As such, the Act does not specifically indicate a preference for one response method over another. While the Act may view various countermeasures as "removal options", it does not provide detailed guidance on the role of specific tools. Where then can we get further clarification on this issue? One need go no further than the National Oil and Hazardous Substances Contingency Plan (NCP) [40 CFR 300], as amended in 1994.

The NCP, mandated by the Federal Water Pollution Control Act and first promulgated in 1972, establishes national policy for response to oil and hazardous substance incidents occurring in and around U.S. waters. While the EPA has statutory responsibility for the plan, it is written in collaboration with and represents a consensus of participating federal agencies for oil spill response in the U.S. The NCP provides clear guidance regarding the role of countermeasures. Section 300.317 [which outlines the national response priorities] states: "A response must use all necessary containment and removal tactics in a coordinated manner to ensure a timely, effective response that minimizes adverse impact to the environment… all parts of the response strategy should be addressed concurrently…. the OSC should not delay containment and removal decisions unnecessarily and should take actions to minimize adverse impact to the environment that begins as soon as a discharge occurs."

The NCP is quite clear that the stated endpoint of the national response priority is to have the immediate ability to use all parts of a response strategy to minimize adverse impact to the environment.

The NCP {Section 300.310} provides further guidance on the intended state of response readiness: "defensive actions shall begin as soon as possible to prevent, minimize, or mitigate threats to the public health or welfare of the US or the environment. Actions may include…the use of chemicals and other materials in accordance with subpart J of this part to restrain the spread of oil and mitigate its effects.

EPA further stated that: the circumstances surrounding oil spills and the factors influencing the choice of a response method are many, and the NCP does not and should not indicate a preference for one response method over another.

Instead, the NCP states that: actions shall be taken to recover the oil or mitigate its effects…of the numerous chemical or physical methods that may be used, the chosen method shall be the most consistent with protecting the public health and welfare and the environment.

The NCP clearly does not support a hierarchy where mechanical means must be considered before other countermeasures. Instead, the NCP treats all countermeasures as potential primary response options, and instructs us to chose the response methods that afford the most protection to the environment given the circumstances of the incident.

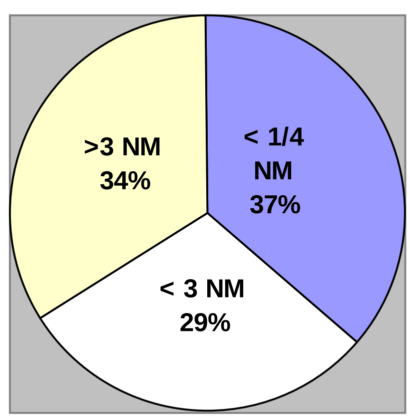
Thus, the role of the tools in the toolbox is clearly stated. According to the NCP, mechanical recovery, dispersants, and in situ burning are all potential primary response options. These countermeasures should all be given immediate consideration, and when appropriate, addressed concurrently in a timely and coordinated fashion.

The Role of Pre-Authorization Plans

If each countermeasure is a potential primary response tool, how do we go about choosing the method(s) that will best minimize the adverse impacts of the spill to the environment?

Again, the NCP, realizing that this selection

Figure 1. Distribution of Spills >1000 Gallons Based on Distance from Shore (1993-1998)



process is a complex problem, made provisions that: RRTs and Area Committees shall address, as part of their planning activities, the desirability of using such products as dispersants.... Regional Contingency Plans (RCPs) and Area Contingency Plans (ACPs) shall, as appropriate, include applicable pre-authorization plans and address the specific contexts in which such products should and should not be used. {Section 300.910}.

Great progress has been made by RRTs and area committees in developing initial pre-authorization plans throughout the US, and the number of pre-authorization plans in force around the US has dramatically increased over the past eight years. These plans have made dispersants and in situ burning a viable option for almost every offshore area in the United States.

Pre-authorization plans continue to be of limited value, however, due to the imposition of very conservative geographic and hydrographic restrictions. Restrictions for burning were adopted to ensure a minimum safe distance for the shoreline from the resultant smoke plume that is generated by the burning oil. Distance and depth criteria were adopted for dispersant use to ensure that adequate mixing and water depth would minimize any threat to benthic or water column resources resulting from exposure to dispersed oil.

Consequently, in situ burning and dispersant operations are effectively limited to offshore waters in most areas, typically three miles from shore and in water depths of at least thirty feet in depth. (Soza 1999) These restrictions are largely independent of oil type or spill size, and are based on informal determinations that the risks of negatively impacting a population center or sensitive resource at this distance from shore were so low that they did not require additional analysis. In essence, these countermeasures were pre-authorized only for areas where a "no resource impairment" exposure threshold was likely to result from either dispersing or burning oil at sea.

"No [resource] impairment" is an interesting concept that until now has not been equally applied to mechanical recovery. Mechanical recovery is typically employed if it appears to reduce the impacts of a spill relative to the alternative of leaving the oil in the environment. Traditionally, planners have not examined the potential harm to the environment that may result from the deployment of mechanical recovery. Further, "no impairment" assumes at best that mechanical recovery, in situ burning and dispersants all offer equal environmental benefits. A central point to this paper is that all of these response options pose some potential harm, but also offer varying degrees of environmental benefits that deserve closer examination. It is in the best interest of the response community to examine the potential harm and benefits of all three of these options relative to each other and to select the option or mix of options which provide the largest net environmental benefit.

The issue of concern is whether the pre-authorization plans, based as they are on the "no impairment" regime, adequately prepare us to make the most of all our opportunities to combat a spill.

Historical / Potential Opportunities

In order to assess the opportunities provided by these tools, the Coast Guard conducted an evaluation of all spills greater than 1000 gallons that occurred in and around U.S. coastal waters from 1993 to 1998. This evaluation, part of a larger overall technology assessment [Response Plan Equipment Caps Review], was completed by SOZA & Company, LTD in May of 1999, and provides a detailed analysis of recent spill opportunities. (Soza, 1999)

The parameters of oil type, weather conditions, water depth, and distance from shoreline were used to estimate the frequency and geographic distribution of spills that would have been amenable to mechanical recovery, dispersants and in situ burning (Table 1). The analysis resulted in 231 oil spills greater than 1,000 gallons occurring in coastal waters over a 69-month period (January 1993 to September 1998). The spills were grouped as either crude or refined oils and tallied by USCG Districts to give a geographic distribution of the potential opportunities (Figures 2 through 7). The majority of the spills involved were refined products, with crude oil spills contributing only a small percentage of the overall total (Figure 2).

Of the 231 spills that occurred in the coastal area, i.e. from the shoreline out to the outermost boundary of the Exclusive Economic Zone (EEZ), only 34% occurred more than three nautical miles from shore (see Figure 1). 29% of spills occurred between ¼ nm and 3nm from shore, that is in areas where pre-authorization does not exist but where current evidence indicates dispersant and or in situ burning may offer significant environmental benefit. How many of these incidents might have been potential candidates for in situ burning or dispersants?

CRITERIA	MECHANICAL RECOVERY	DISPERSANT USE	
		EXISTING	EXPANDED
API° gravity	17 to 45	17 to 45	17 to 45
Pour point	N/A	< 41°F	< 41°F
Wind speed	≤ 16 kts	≥ 7 kts	≥ 0
Water depth	N/A	≥ 65 ft	≥ 10 ft
Distance from shore	N/A	≥ 3 nmiles	≥ ¼ nmiles

Table 1. Criteria Used in This Review to Analyze for Historical Opportunities

Potential Use of Mechanical Recovery

According to the Caps review, mechanical recovery would have been appropriate in 61.9% (143 of 231) of the coastal spills (Figure 3). Conditions were conducive to mechanical recovery in 15 of 16 crude oil spills and 128 of 215 refined oil. There were 87 spills in which mechanical recovery was the only viable option for oil removal. Mechanical recovery was eliminated as a potential oil removal technique in 88 of the 231 oil spills because either the oil type was not recoverable using mechanical methods or the wind speed during the time of the spill exceeded 16 kts.

Potential Use of Dispersants

The Caps review reported that under existing pre-authorization guidelines, dispersant use may have been appropriate in 21.2% (49 of 231) of the oil spills analyzed. Based on the criteria in Table 1, the evaluation shows that 4 of 16 crude oil spills and 45 of 215 refined oil spills were potential candidates for dispersant use as a countermeasure (see Figure 4). There were 12 spills in which dispersant use was the only viable removal option.

Using an expanded criteria, (considering dispersant use for all spills ¼ miles from shore versus 3 miles from shore) potential use may have been appropriate in 45% of the oil spills in the historical analysis. Evaluation shows 8 of the 16 crude oil spills and 95 of 215 refined oil spills demonstrate the potential for dispersability under the expanded criteria (Figure 5).

Potential Use of In-Situ Burning

Under existing pre-authorization guidelines, the Caps review states that in situ burning was a viable removal option in 24.2% (56 of 231) of the oil spills. Evaluation shows 7 of 16 crude oil spills and 49 of 215 refined oil spills having conditions amenable to burning methods. (Figure 6). In situ burning was

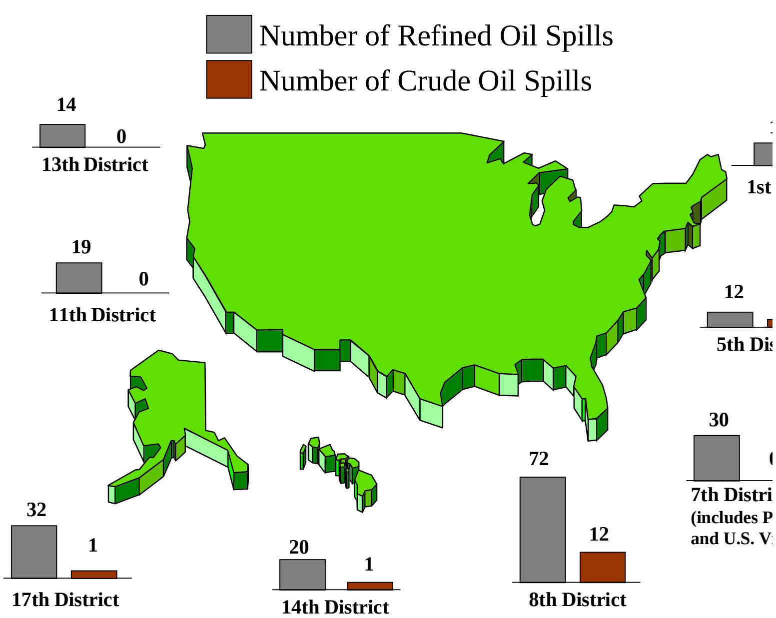


Figure 2. Overall Distribution of Spills (n = 231) by USCG District, 1993-1998.

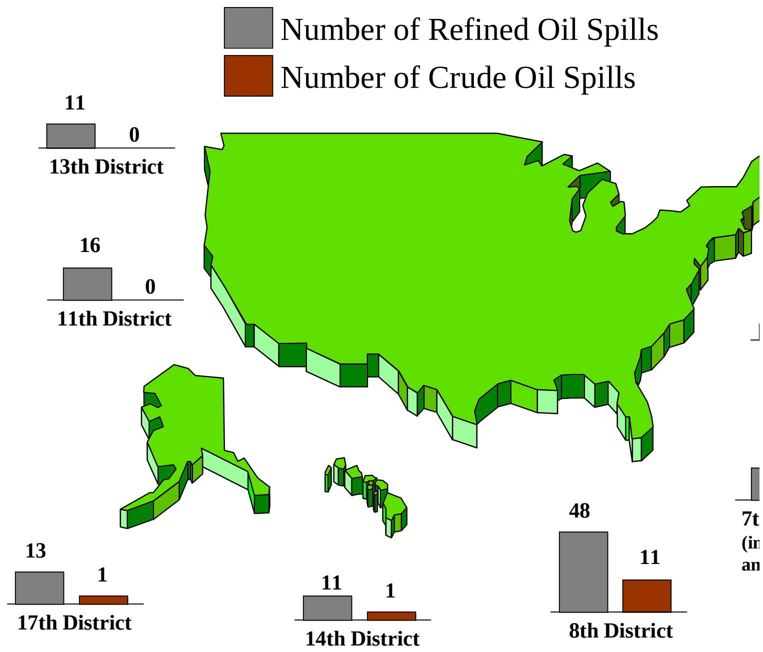


Figure 3. Distribution of Oil Spills (n = 143) by USCG District in Which Mechanical Recovery Could Be Used.

eliminated as a potential oil removal technique in 175 of the 231 oil spills analyzed.

The percentage of candidate spills increased to 40% (90 of 231) for spills under the expanded criteria. Evaluation shows 11 of 16 crude spills and 79 of 215 refined oil spills as potential candidates for in situ burning in combination with mechanical recovery (Figure 7).

Implications for Response Planning

Clearly, the data shows that mechanical recovery has potential for use in the greatest number of spill scenarios. Mechanical recovery will continue to be the backbone of our planning and response efforts. It is interesting to note, however, that nearly 38% of all spills were not well suited for mechanical recovery methods. A quick visual comparison of the data in Figure 2 (overall spills) and the data in Figure 3 (mechanical recovery potential) graphically highlights the potential shortfalls of relying solely on mechanical recovery systems. This data, in combination with the fact that historically "it is unusual for more than 10 to 15 percent of spilled oil to be recovered from a large spill where attempts have been made to use mechanical recovery" [Congressional Office of Technology Assessment, 1990], presents a sobering picture of mechanical recovery capabilities.

It is clear that we can not limit ourselves to a single response technology without placing ourselves in an unnecessarily vulnerable position. The data suggests that we must have a complementary set of primary response options at our disposal that can be selected based on the specific needs of each spill response.

The historical record also shows that dispersant use and in situ burning can have significant impact in a high percentage of spill occurrences, and that one of the biggest constraints on their use is their artificial restriction to areas far offshore.

Many opportunities exist to use these countermeasures throughout the entire offshore area, unfortunately, the current pre-authorization guidelines limit our opportunities to use these tools effectively. Most pre-authorizations are restricted to greater than 3 miles from shore. As Figure 1 clearly indicates, only about one third of all spills occur in those offshore waters. Thus, we are currently missing many potential opportunities in areas that experience spills frequently.

By expanding the pre-authorization use areas for dispersants and in situ burning shoreward, the percentage of candidate spills for these oil removal techniques increases greatly. In fact, the opportunities for dispersant use more than doubled from 49 to 103, so that nearly 45% of the 231 spills analyzed might have benefited from dispersant use. The number of opportunities for in situ burning increased in similar proportions from 56 to 90, or 40% of the 231 spills. A visual comparison of Figures 4 and 5 for dispersants, and Figures 6 and 7 for burning, graphically illustrates the improved opportunities that might be realized by extending the pre-authorization areas shoreward.

Improving Our Opportunities to Combat a Spill

The historical analysis clearly shows that there are many opportunities for response yet to be realized. However, this cannot be accomplished by simply redrawing lines on a pre-authorization chart. If we are to use these countermeasures more effectively, our authorization guidelines must become more flexible and allow planners/responders to make decisions based on evaluation of the environmental tradeoffs involved.

As stated earlier, the NCP established a criteria for selecting response actions in that "the methods chosen shall be the most consistent with protecting...the public health, welfare, and environment" {Section 300.310}. Our guidelines must be based on sound environmental data that ensures the response options selected are the most beneficial for the environment.

The "no impairment" expectation for using in situ burning and dispersant countermeasures is too rigid, and does not allow responders to weigh whether it is in the best interests of the environment to employ a technique. The "no impairment" criteria essentially rules out a countermeasure as soon as there is weight on the "harm" side of the scale, irrespective of how much it is outweighed by the "benefit" side. How often would mechanical recovery be used if it was subjected to the same "no impairment" exposure criteria?

As our understanding of the ecological consequences of any response method improves, mechanical recovery included, we are faced with decisions that require the weighing of environmental tradeoffs. We have learned over time that mechanical methods can often be intrusive and cause long term damage to habitats. Sometimes the level of harm created by the mechanical recovery of the oil is acceptable considering the level of protection it provides to other resources at risk. In other situations, the environmental tradeoffs suggest natural recovery is more appropriate.

We have grown confident in allowing responders to routinely weigh the tradeoffs in selecting shoreline cleanup techniques. Similarly, we must learn to consider the environmental tradeoffs in our selection of primary response countermeasures. This is true, whether the tradeoffs are weighed in advance, as in the case of pre-authorization

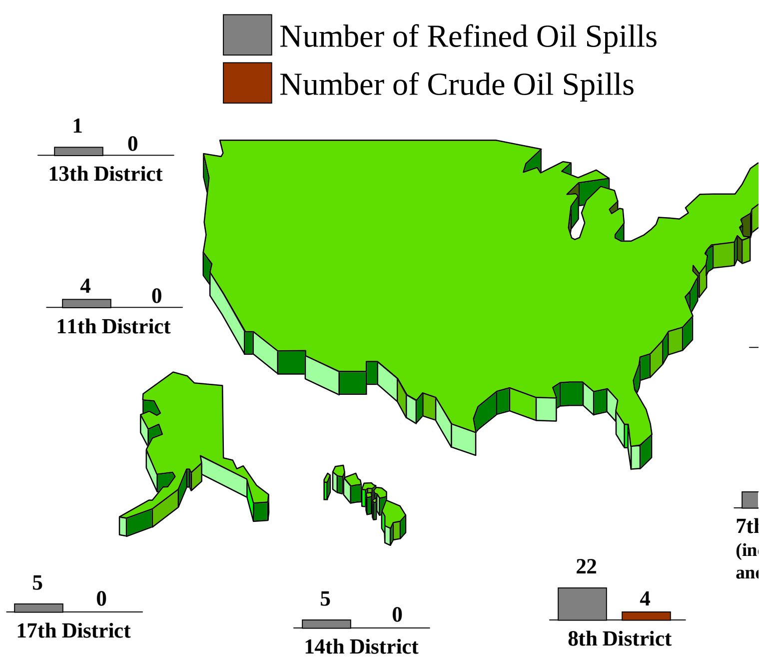


Figure 4. Distribution of Oil Spills (n = 49) by USCG District in Which Dispersants Could be Used Under the Existing Criteria; Greater than 3 Nautical Miles (Nmiles) from Shore.

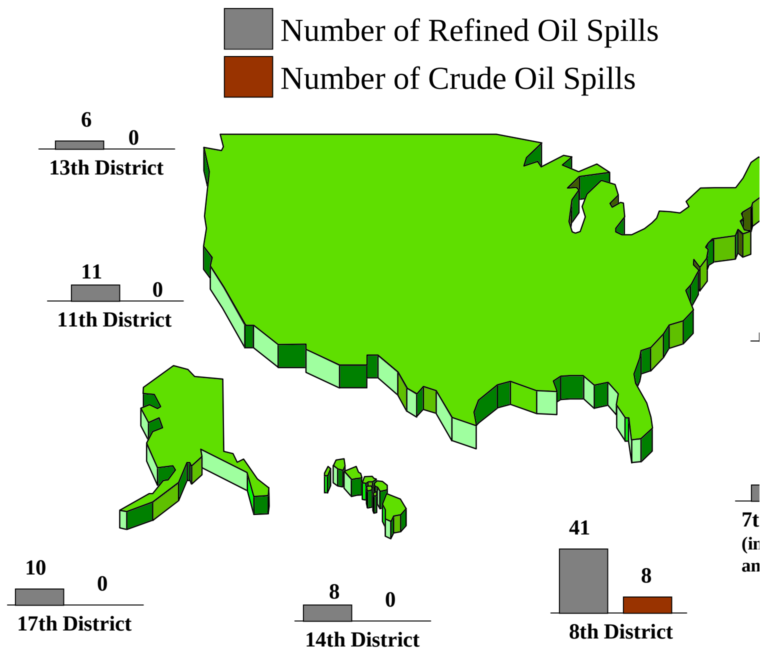


Figure 5. Distribution of Oil Spills (n = 103) by USCG District in Which Dispersants Could Be Used Under the Expanded Criteria;Greater Than ¼ Nautical Mile (Nmile) from Shore.

guidelines, or during the course of a spill, by responders.

The premise (or expectation) that guides our selection process must make a shift from the ultra-conservative "no impairment" paradigm to the more flexible and pragmatic lens of "net environmental benefit analysis" (NEBA) (Baker, 1995).

What is Net Environmental Benefit Analysis?

In almost all spills, there are advantages and disadvantages to using a particular countermeasure. Countermeasures can create both benefits (adverse impacts minimized as a result of using a countermeasure) and costs (adverse impacts created as a result of using a countermeasure). For example, mechanical recovery resources may remove the oil from the surface of the water, however, those same booms and skimmers may create extensive bottom damage to shallow grass beds or mud flats.

Net environmental benefit analysis (NEBA) is the weighing, from an environmental point of view, of the advantages and disadvantages of a particular countermeasure(s) (Baker, 1995). It goes beyond ecological effects and attempts to compare all of the costs and benefits of the potential response, including economic, aesthetic and social issues. NEBA assumes that countermeasures may cause some level of harm that is acceptable in order to gain the level of protection desired. NEBA ultimately will favor the selection of countermeasures that result in the greatest overall benefit for the long-term health of the environment and society.

Applying Net Environmental Benefit

The historical analysis of spills clearly shows that there are many potential opportunities for dispersant and in situ burning which are not covered by current pre-authorization plans. The question at hand is whether it makes good sense to use dispersants or in situ burning in such cases.

Recent evidence from two spills in the United Kingdom and subsequent scientific studies indicate that there may be significant benefits to the use of dispersants while the environmental damage from dispersed oil may be minimal. The 1993, the tankship BRAER released a very large volume of oil which was naturally dispersed into the water column with very little long-term environmental effect (Ritchie and O'Sullivan, 1994). The 1996 SEA EMPRESS spill involved chemical dispersion of a large quantity of oil into the water column. The SEA EMPRESS dispersant response resulted in a significant benefit to the environment due to the prevention of severe oiling of shoreline. Again, the SEA EMPRESS incident resulted in little environmental damage due to dispersed oil droplets in the water column, and was probably much less damaging than if the oil had not been dispersed (Sea Empress Environmental Evaluation Committee, undated).

It should be noted that both of these spills were significantly larger than the EXXON VALDEZ spill. Data from these and other spills have indicated that the peak concentrations of dispersed oil throughout the water column will decline very rapidly as long as dilution can occur. (SOZA, 1999) For smaller dispersant treatments in open water, it has been shown that it takes only hours to return to background levels.

Unfortunately, the picture is not always so optimistic. During the grounding of the barge NORTH CAPE on the shore of Rhode Island in 1996, a large volume of home heating oil was dispersed by severe weather in shallow water very near shore. This oil has a relatively high toxicity to marine organisms and there were significant effects, especially to lobsters. This would not have been a situation in which dispersants would have been likely to be used, and certainly not to the extent associated with the severe weather. Even so, the adverse effects were geographically limited and the oil within the water column returned to normal levels within three days (Research Planning, Inc. 1996).

In general, the information now available appears strongly supportive of the expanded use of dispersants. However, concerns about toxicity have been slow to dissipate. These concerns have been compounded by confusion, conflicting scientific studies, and uncertainties created by gaps in the available data. Because the decision to use dispersants or burning is often so complex, planners and decision-makers have been hesitant to re-evaluate the pre-authorization guidelines, especially with regard to the nearshore environment. These concerns can be addressed with a well-structured process that employs NEBA concepts to evaluate potential opportunities.

What is an Ecological Risk Assessment (ERA)?

The Coast Guard recently began co-sponsoring "Ecological Risk Assessments" (ERAs) in selected coastal areas around the U.S. The ERA process is designed to infuse pre-spill planning and decision-making with NEBA-oriented concepts. The ERAs are based on the "Guidelines for Ecological Risk Assessment" [EPA, 1998], as modified for oil spill response planning by Dr. Don Aurand of Ecosystem Management & Associates Inc. (Aurand, 1995)

The ERA provides response communities with

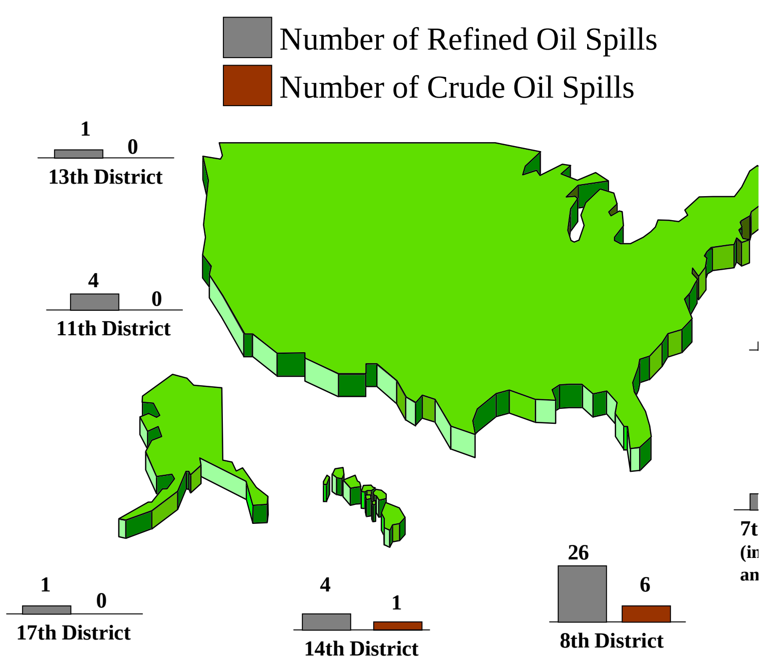


Figure 6. Distribution of Oil Spills (n = 56) by USCG District in Which In Situ Burning Could Be Used Under the Existing Criteria; Greater Than 3 Nautical Miles (Nmiles) from Shore.

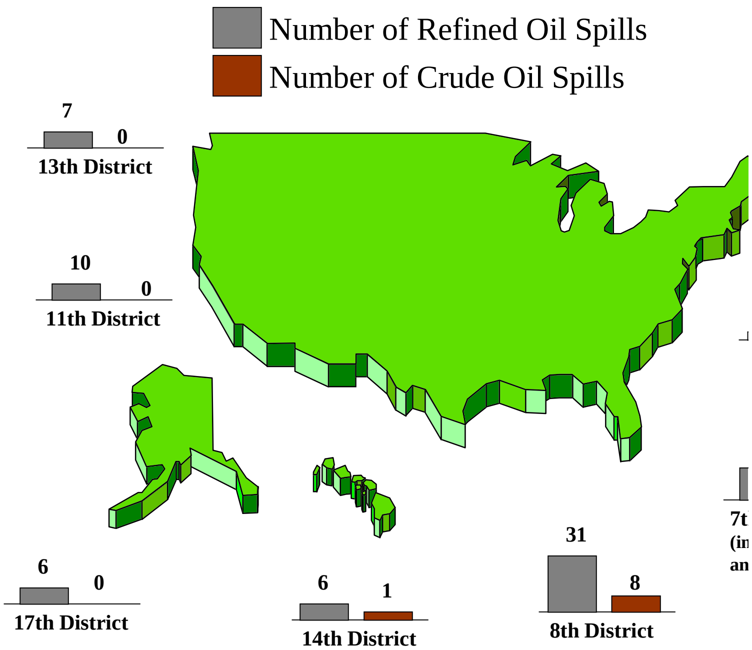


Figure 7. Distribution of Oil Spills (n = 90) by USCG District in Which In Situ Burning Could Be Used Under the Expanded Criteria; Greater Than ¼ Nautical Mile (Nmile) from Shore.

an analytical tool for evaluating how various response options can be used to minimize the adverse ecological impacts of a spill. Using expert opinion and the latest scientific data available, participants compare the ecological tradeoffs that result from using different countermeasures. The ERA provides a defensible methodology for characterizing the risks to sensitive resources posed by various potential countermeasures. This information may then be used in conjunction with information on economic, aesthetic and social issues to complete the NEBA process.

The ERA, for example, can assist stakeholders in examining the ecological consequences that may result from using dispersants, in terms of acute toxicity, population disruptions, or chronic ecosystem effects in a variety of spill situations, including nearshore applications. The ERA can also be used to determine a range of opportunities and specific contexts in which an identified countermeasure offers the most protection.

The ERA Process

The ERA process includes three primary phases - problem formulation, analysis, and risk characterization.

- Problem formulation involves identifying goals and assessment endpoints, preparing a conceptual model and developing an analysis plan. During this early stage, risk managers (response managers) and risk assessors (resource trustees and/ or other technical experts) work together to determine which response issues and scenarios should be tested.

- The analytical phase involves a characterization of the exposure of oil to the resources at risk and the ecological effects that are likely to result. The characterization uses known or extrapolated effects data which is applied to the resources at risk based upon the exposure pathways identified in the conceptual model.

- Finally, the risk characterization estimates the risks in relation to the endpoints that were established earlier in the process. (Aurand, et al , 1998)

Broad stakeholder involvement is essential if the findings of an ERA are to gain wide acceptance and incorporation into local response plans. Federal, state, local, and industry response managers, natural resource managers (trustees), environmental interest groups and academic technical experts all should participate in the ERA process. To encourage this participation, the ERA was framed into a workshop environment. The workshop process enables resident stakeholders to educate themselves regarding the issues at hand, fosters consensus building, and allows those with local expertise to conduct much of the needed analytical work. This is important, since the ERA should be driven by the local area committee and should address the potential opportunities within their specific area of responsibility.

The ERA process currently consists of three multi-day workshops separated by a period of several months for independent research and analysis. During the first workshop, risk managers and assessors work together to define the problem and develop scenarios that will adequately test the issues to be resolved. Also identified are stressors and potential pathways for interaction between stressors and the environment. Risk managers develop the assumptions and parameters for the use of response countermeasures to be employed in the scenarios. Concurrently, risk assessors identify potential resources at risk, and develop the assessment endpoints, conceptual model, and analytical approach for the risk characterization.

Between the first and second workshops, scenario modeling is completed for oil fate and transport, and populations are identified for the resources at risk.

During the second workshop, risk assessors use the oil fate/transport data to assess exposure. The assessors combine effects data with exposure information to estimate the ecological impacts to the resources at risk. The result of this analysis is a draft risk characterization, illustrating the ecological consequences of various response countermeasures.

Each participant takes the results of the draft risk characterization back to their parent agencies for evaluation between the second and third workshops. Participants reconvene for a third and final workshop to resolve any remaining analytical concerns and to finalize the risk characterization. The risk characterization is then used to develop any recommended changes that should be considered for response planning in their area, including the potential changes to their pre-authorization plans if appropriate. (Aurand, et al, 1998)

ERA Efforts to Date

The Coast Guard partnered with industry and state officials in Washington State to conduct an ERA for the Puget Sound area. The participants completed the first two workshops in 1998, and are now working toward completing their risk characterization.

Local stakeholders were particularly interested in evaluating the tradeoffs of nearshore dispersant use on a smaller spill (500 barrels) in the northern end of Puget Sound. This area of Puget Sound is deep and has good water circulation, and the potential for dilution in the test scenario is high. The initial workshop results indicate that using dispersants in the area chosen on a small spill may offer significant benefit in terms of preventing oiled shoreline and surface habitats. (Walker et al., 1998)

The participants for the Washington State workshops continue to work on the risk assessment and are evaluating the results for potential modifications to their pre-authorization guidelines.

The ERA process was also initiated this year for Galveston Bay, Texas and San Francisco Bay, California. Both workshops have had excellent involvement from their respective area committees, and the second sessions for both locations are scheduled for the month of June.

In the Galveston Bay ERA, participants chose to test two spill scenarios near the entrance to Galveston Bay (500 barrel and 4000 barrel spills of Medium Arabian Crude). The stakeholders are very interested in examining both the effectiveness and the ecological consequences of using dispersants, in situ burning, and mechanical recovery systems for the two scenarios.

An important issue in Galveston Bay is the shallow water depths that exist throughout the Lower Bay area. This facet may limit the areas where full on-water mechanical recovery efforts can be used, as well as create higher levels of risk for benthic communities from dispersed oil in the water column. Since spill trajectories indicate extensive wetland habitats will be threatened if a significant portion of floating oil makes landfall in the eastern Bay, the assessment will have the opportunity to consider some significant environmental tradeoffs and should produce interesting findings for planners in the area to consider (Kraly et al., 1999).

In the San Francisco ERA, stakeholders are also interested in testing two scenarios. The first is a 2500 barrel spill of intermediate fuel oil (IFO 180) at the pilot station outside of the main entrance to the bay. The second is a 2500 barrel spill of Alaska North Slope (ANS) crude inside of San Francisco Bay (northern end near the Richmond Bridge).

Both areas have good water depth and circulation systems, and both scenarios appear to threaten sensitive resource areas (the Farallon Islands are of particular interest in the offshore scenario). Another interesting factor in the evaluation of the offshore scenario is the potential use of dispersants on the refined fuel product involved. (Kraly et al., 1999)

Certainly the individuals and organizations participating in the Puget Sound, Galveston Bay, and San Francisco ERAs should be commended for their proactive efforts to explore the potential response opportunities in their area. While the outcome of these ongoing efforts is not yet certain, at a minimum, the response communities involved will gain a much better understanding of the response options available to them. This is very important, since pre-authorization plans are driven by regional and local values for natural resource protection. Pre-authorization plans should balance stakeholder values with good science. ERAs can contribute to good science.

Why Should You Do an ERA?

The NCP states that we should choose the tools that are most beneficial to the protection of the environment. It also suggests that we should consider all countermeasures as potential primary response options.

The historical review of spills suggests that there are many opportunities in the offshore and nearshore environments to use these countermeasures. The current pre-approval guidelines are very conservative, and may unnecessarily limit our ability to take advantage of these opportunities. Moving the pre-authorization areas shoreward could potentially double the number of spills in which in situ burning and dispersants might be used.

Recent spill experiences and scientific studies suggest that the use of these tools in the nearshore environments may be appropriate for many spills dependant upon oil type, spill size, water depth, circulation patterns, ambient conditions, and the threats posed to sensitive resources.

Decision-making models (NEBA) and educational consensus building processes (the ERA workshops) are now available to weigh the environmental tradeoffs. These processes can be used directly to evaluate the response options available in your area and to ensure that your pre-authorization guidelines afford you the maximum opportunity to minimize the adverse impacts of a spill. These processes are already underway in Washington, Galveston, and San Francisco, and there has already been discussion about starting workshops in Long Island Sound, New York and Prince William Sound, Alaska.

Are you prepared to make the most of every opportunity? Isn't it time to start thinking about doing an ERA in your port? For more information about the ERA process, please contact Captain Larry Hereth of the Office of Response (G-MOR), at (202) 267-0516, or Lieutenant Commander John Caplis of the Plans and Preparedness Division (G-MOR-2), at (202) 267-6922.

Acknowledgments

I would like to sincerely thank the Cap Review Project Team and the Ecological Risk Assessment Project Team for their proactive efforts in advancing environmental protection and for the excellent data they have generated which has made this article possible. I would also like to sincerely thank Bob Pond of Soza & Company, Ltd, and Don Aurand of Ecosystem Management & Associates, Inc., for their assistance in writing and editing this article.

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Alternative Response Technologies– The Role of Research

This decade has seen some great advances in technology for mechanical recovery of oil spills. With the Oil Pollution Act of 1990 Congress asked the federal agencies responsible for oil spill response to research alternative response technologies. Among those that immediately rise to the top in any discussion are in-situ burning, dispersants application and bioremediation. We have already covered in-situ burning in a good deal of detail in M.F. Fingas's article but it is important to note that the USCG has funded, and is one of the key agencies, both nationally and internationally to advance this research. One challenge remaining in in-situ burning research is finding boom that is economical for multiple burns. Progress in this area has been slow but we continue to conduct joint testing with industry to improve response capabilities. In LCDR Caplis's article, reference is made to the fact that dispersant pre-approval status applies to open ocean application of dispersants. Beyond environmental risk analysis, research can help clear up gray areas in our factual knowledge of the real impact on ecosystems from long-term exposure to oil and dispersed oil. Such research will likely decrease objections of some stakeholders to near-shore dispersant use. Recent information has already shown some species do not seem to be impacted any more from dispersing oil into the water column than by leaving oil untreated on the shoreline. More study is needed. In addition, tracking and modeling of dispersed oil in the water column is within our reach with some additional research. Bioremediation also inevitably comes up during discussions of advanced response technology. In general, bioremediation is a restoration tool; it has seen some use in inland areas. The USCG has provided limited assistance in researching this due to the fact that it is mostly applied in areas designated to be under the responsibility of other federal agencies.

Public Communication

Perhaps the tallest order in any spill of significant consequence is influencing how the public and the media perceive the response effort. We have modified our approach to public interaction to include a shift towards risk communication and away from "public affairs." The first article deals with an approach to understanding your community before a spill takes place in order to better know how to successfully respond to their concerns. Then, in another short article we discuss the Joint Information Center Model to show how all of the incident command structure responds to the public's fundamental rights and needs to know what is happening in a spill response. We conclude with an article on Risk Communication and Public Affairs.

IMPROVING COMMUNICATION THROUGH PUBLIC RELATIONS RESEARCH

By CDR Jim Milbury, USCG, Honolulu, Hawaii

Public affairs programs often communicate with their customers, or the public, in simply one direction. During a pollution incident press releases are generated and sent to the news media, corporate executives give positive sound bites for the evening news, and reporters' questions are answered. Evidence of whether the response and cleanup was successful is typically evaluated by the slant of the television or newspaper reports. However, public opinion may radically differ with what is being reported. It is important, therefore, to have a public relations methodology established to directly measure public opinion. It is especially important to measure a "baseline" opinion before an incident occurs that will help determine the variance of public perception in your community and clearly determine if, and by how much, your corporate image has been damaged or improved. This paper will offer usable suggestions of how to measure, both quantitatively and qualitatively, public opinion.

"It ain't so much the things we don't know that get us in trouble. It's the things we know that ain't so." This quip by humorist Artemus Ward (Broom, 1990) clearly articulates the danger of believing something that just isn't true. As an example let's say that your company has been successfully transporting oil products for 25 years without a single incident; not even a drop has entered the water. In contrast another company in the area has a long history of spills that has often incensed the local community. You believe that even if you have a spill, the public will recognize your exemplary record and involvement in the local community and hardly raise an eyebrow. Can you be sure? Has the local community been so sensitized to oil spills that a spill from anyone could result in an extremely negative response from the public? Some basic research can help predict the public reaction and anticipate an appropriate communications strategy.

The following are some research methods you may be able to use to gauge current public opinion of your organization or corporation. While some may be better left to professional contractors for survey writing and implementation, your public relations staff may be able to implement others.

Quantitative and Qualitative Research

There are essentially two types of research: quantitative and qualitative. Quantitative is hard data, typically polling or surveying with a specific margin of error based on sample size. Qualitative research is often "soft" data that may be reliable but not scientifically valid, that is, you may not get the same numbers on a repeat survey. Both types, however, can produce valuable information upon evaluation.

Some of the more popular quantitative research methods include the typical phone and mail surveys, interviews, mall intercepts, and media content analysis. Phone and mail surveys typically sample large populations and are expensive and time consuming. For the money you're going to spend make sure you really need this type of survey and know exactly what you're after. And use a company that is trained in developing surveys using this type of research.

Mall intercepts, also known as "shopping center studies" (Lindenmann, 1992) are designed to poll customers at the local mall or shopping centers. The advantage is that you are gathering opinions and information directly from people who live in the community. It is also less expensive and more easily obtained than more formal surveys. However, potential exists that the results may be skewed simply by the fact that only a particular segment of the community visits shopping malls. A spin-off of this survey could be used at various gatherings or conventions. For instance, the U.S. Coast Guard might want to gather information about how small recreational boat owners feel concerning new federal boarding policies in the local area. One good method would be to simply poll visitors at a regional boat show. While this wouldn't be a sampling of the entire community, it would likely indicate the position of most local boaters.

Content analysis is the quantification of news clips (positive or negative), total circulation, media category, advertising dollar value, column inches, etc. These numbers are somewhat useful but really don't tell you how community feels or even if they were reached by this particular medium. For instance, there may be 25 minutes of positive video broadcast on a major news network concerning your organization but, since it aired at 2:00 a.m., hardly anyone saw it.

Qualitative research is different from quantitative research in that it deals with a small number of people but is more in-depth in its interview structure. The information gathered is reliable but it may not be scientifically valid, or repeatable with another sample population. Despite the statistical drawbacks, qualitative research can provide a relative idea of where your public image resides within the community. Qualitative research may include work with focus groups, in-depth interviews with key individuals (newspaper editors, government officials, CEO's), "soft soundings," or simple observation.

Focus groups are composed of 10 to 12 people who get together for about one hour for you or a facilitator to interview. A professional firm would likely conduct this type of group interview for you. You won't get absolute information from a focus group but you may be able to uncover specific issues within the community that need to be addressed by your company.

In-depth interviews with policy makers within your community can be very effective in determining your organization's image. Try meeting with the reporter that covers your beat in the local paper. For an enjoyable switch, ask the reporter to go "off the record" and tell you what impression your company or agency has with the local citizens. Do the same thing with the newspaper editors, the mayor, and other regional leaders. You may be surprised at what you hear.

Do another type of in-depth interview with the CEO or agency head within your office. What public image do they think is (and should be) portrayed to the community? Compare that with senior supervisors. Do they all agree? Also evaluate whether your CEO or agency head is in alignment with the community leaders mentioned in the paragraph above.

Soft soundings (Dozier, 1991), are used as method to validate your own intuition concerning issues affecting the public. While similar to a focus group, soft soundings are used on specific organizations like news media, government agencies, or customers in small groups of about ten. A twenty-minute interview is plenty of time to get the information you need.

Simple observation can often be your best data collection tool in determining your public image. Visit the reporter assigned to your beat. Stay with him/her as the reporter calls your agency or company looking for news stories. How does the operations center petty officer or plant manager deal with the reporter? Is it friendly and cordial or abrupt and rude? Is their media training necessary or does the response match the feelings of the CEO or plant supervisor?

Establishing a Baseline

By using quantitative or qualitative measures you can establish a "baseline" of public opinion which is essential for most public relations programs. The following paragraph is an example utilizing a baseline and some of the techniques listed above to improve the public's knowledge and assistance for reporting oil spills.

Example

The morning newspaper has an article that describes a small oil spill that occurred the previous day. The reporter alludes to a slow response due to a lack of notification to responsible authorities. A phone call to the reporter reveals that is indeed the case. Concerned this may be a prevalent problem within the community; I survey several people entering a local shopping mall concerning their knowledge about who to call if they observe an oil or chemical spill. Virtually everyone I speak with knows nothing about the National Response Center and its toll-free phone number. While not "statistical evidence," it does give me the indication that oil spills may simply go unreported because the public is unaware of who to call. After receiving the reporting data from the NRC for Hawaii (this will be my baseline), I implement a public relations strategy incorporating public service announcements on television and radio, as well as information booths at mall, shopping centers, etc., which provides the NRC's toll-free number. After six months I can re-measure the NRC reporting statistics from Hawaii. Depending on the results of this data I can continue to implement the strategy or change the type of medium used to reach the public.

Without the establishment of a baseline I would have no idea of whether my tactics and strategy were working. A baseline measurement of public opinion or support before a pollution incident occurs is also essential. It's difficult to determine whether your response has been "successful" in the public's view if you haven't measured opinions prior to an incident.

Conclusion

Understanding the community where you live and work is critical to ensuring your organization or company is meeting the expectations of the public before, during and after a pollution incident. You can't be sensitive or responsive to their needs by only having a "one-way" flow of information. You must open your public relations program to input from the community through some sort of quantitative or qualitative feedback mechanisms in development of an effective communications program.

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What is a Joint Information Center?

A Joint Information Center (JIC) provides a framework to bring together expertise and resources from multiple public or private agencies, offices, or organizations. Working within this structure, the JIC staff is able to manage the information flow to the public during an event or incident efficiently.

The JICs organizational structure is based on the National Inter-agency Incident Management System's Incident Command System. Using this proven response organizational structure the JIC staff is able to perform the duties of media relations, public outreach and counseling the incident coordinators in order to meet the goals of the unified command. The JIC structure provides for clear lines of assignments and supervision of the functions as well as accountability for the processing of information.

During the Coast Guard's response to the M/V New Carissa on the Oregon coast near Coos Bay, a flexible JIC was established. The staff consisted of members from various federal, state, and responsible party agencies. At its height, the JIC was staffed by more than 20 people. The average stay of a JIC staff member was five days. The JIC stayed in full operation for most of February. The staff not only dealt with a dynamic response but with a fluid resource pool from the various participating agencies. Without an adaptable system to manage the public information needs of the response, the efforts to inform the public would have been very difficult.

In general, JIC tasks are assigned to people in the organization who are best suited to perform them. Like tasks are sometimes assigned together to facilitate the process. People assigned tasks are grouped together in the organization to improve supervision.

The JIC's organization must be flexible to meet the dynamic needs of the public and the response organization. Supervisors must be open-minded and ready to change with the situation. This is critical to success and essential to meeting the expectations of various public components.

A simple, well planned, and flexible organizational structure that is understood by those working in it will provide public information responders with the tools they need to accomplish their tasks.

Teaching Risk Skills to Build Public Trust

By PA1 Frank Dunn, PIAT, National Strike Force Coordination Center, Elizabeth City, NC

U.S. Coast Guard marine safety professionals work daily with many moods, beliefs, and interests of the public they serve. Sometimes events occur putting these professionals face-to-face with a particularly difficult side of the public: its outrage.

Recently, people in the Coast Guard have discovered that the job of dealing with the public's outrage or concerns may be just as important as diminishing a risk or hazard to the community. To address this outrage, marine safety professionals are being taught skills in risk communications.

"The one risk communication skill that is most important is developing the public's trust," said LCDR Gary Merrick, the Assistant Chief of the Marine Safety Branch at the Reserve Training Center in Yorktown, Va. "Determining who is best to present your message and what the best way is to deliver that message is important in establishing creditability with the public," Merrick said.

The Coast Guard's risk communication program is based on almost 20 years of work by highly respected researchers. Risk communications skills are currently being taught as part of various courses at the Coast Guard's Reserve Training Center in Yorktown, VA.

"We started teaching these skills last year based on needs identified by surveys distributed to the response community and analysis by subject matter experts," said LT Dirk Greene, the Chief of the Port Operations School at the Reserve Training Center in Yorktown, Va.

Students at the Reserve Training Center learn communication is a skill. It is something that must be developed in an individual and used correctly to be effective.

"We have identified a need in the Coast Guard response community to develop skills in order to communicate effectively with a concerned public, which may not trust us," Greene said. "This could be a home owner impacted by an oil spill or a Coast Guard family member who is upset."

Research has indicated that people who are upset, untrusting, or highly concerned do not process information in the same way as when they are calm, trusting, and supportive of a particular situation. According to the documentation used by the instructors at the Reserve Training Center, people in low trust, high concern environments are able to process about 20 percent of the information presented to them. The simplified answer to dealing with a public in these environments is to keep the information simple, positive, and focused on the subject at hand.

"It is very important to show the public that you care and are empathetic to their situation," Greene said.

"We teach our students not to talk in facts and figures or use words the public will not understand. We are teaching these skills to students in every course, officers and enlisted," Green said.

"We want all levels of the marine safety program to be proficient in these skills," Merrick said.

According to Greene, this is not "spin doctoring." The public must know Coast Guard members are concerned about their problems and are addressing their needs. Their outrage must be addressed before any of the hard work the responders are doing will be noticed.

Based on facts in the risk communication information, instructors at the Reserve Training Center have learned that the government is considered to be one of the most knowledgeable sources of information available to the public. At the same time, the government is considered by that same public to be one of the least trusted sources of information when it comes to risks or hazards to them. This paradox can build a large amount of concern in a community looking for answers.

To help local communities address their

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concerns, the Coast Guard is enhancing its risk communication protocols.

"The three primary objectives that were identified for the National Strike Force Risk Communications program are to: train decision-makers and communicators (Information Officers, Public Affairs Officers) in the principles and practices of risk communications; develop a network of experts who can provide support in risk communication interventions during a response; and develop measurement tools and methodologies to provide focused information on public perception during a response and evaluating perception and outcomes after a response," said LT Todd Hall, the subject matter specialist for the National Strike Force.

To achieve these objectives, selected Coast Guard members were trained to be educators in risk communication skills.

According to Hall, 13 Coast Guard members from around the country attended a Train-the-Trainer program designed specifically for the Coast Guard. Graduates from this program now make up a network of individuals who can provide training to Marine Safety Office staffs, as well as support Federal On-Scene Coordinators during an incident response.

"The Coast Guard's current focus is on the marine safety community," Hall said. "It is important, however, that risk communications becomes a tool to be utilized in all areas within the Coast Guard, wherever there lies a possibility that someone will stand before a microphone and tell the Coast Guard story."

Another tool has been added to the marine safety professional's bag. Now, in the process of protecting the public, its interests and the environment, these professionals must be able to communicate effectively to allow the community to see through any walls of distrust.

Stakeholder Service and Support

This section, while related to the previous section, is significantly different. The goal is that all stakeholders perceive the response as successful. One way to ensure this is effective use of partnerships. The first article discusses some key stakeholder partnerships that we have recently consolidated through formal agreement. In the article on the Liaison Officer, we explain the real purpose of this position and how to use it to your best advantage.

MOR Homepage

http://www.uscg.mil/hq/g-m/mor/default.html

The Office of Response's website provides information to our customers on a variety of oil spill prevention, preparedness, and response topics as well as links to other relevant sites of interest to the maritime community. Projects currently being showcased on our page include response plans and exercise evaluations, updates on oil spill response initiatives in response technologies, spill management and maritime national security issues. You can find links to the Coast Guard's Vessel Response Plan site, the Coast Guard's Sea Partners campaign, and to several maritime organizations including IMO. Coming soon to our website is the Chemical Hazards Response Information System database, which will provide our customers with information on over 1400 chemicals.

STAKEHOLDER SERVICE & SUPPORT

Achieving the Best Response Through Quality Partnering

By LT Steve Wischmann, USCGHQ

UPDATE ON THE QUALITY PARTNERSHIP BETWEEN THE COAST GUARD AND THE SPILL CONTROL ASSOCIATION OF AMERICA AND THE ASSOCIATION OF PETROLEUM INDUSTRY COOPERATIVE MANAGERS.

As reported in the last issue of *Proceedings*, the Coast Guard signed a Quality Partnership Agreement on February 3, 1998 with the Spill Control Association of America (SCAA). The partnership was expanded on July 16, 1998 to include the Association of Petroleum Industry Cooperative Mangers (APICOM). The three groups agreed to cooperatively work toward improving the effectiveness of spill response operations.

Through this partnership, the private sector response community and the Coast Guard have the opportunity to develop solutions to operational problems of mutual interest. Each of the three participants brings a different perspective and considerable spill response experience. This combination provides for very dynamic possibilities.

Three Opportunity For Improvement Work Groups (OWGs) have formed to study topics of particular interest to the Partnership Action Team (PAT), the oversight body for the partnership. The topics are:

- The Basic Ordering Agreement (BOA) process–finding improvements to the process, as well as ensuring that myth is separated from fact regarding how the Coast Guard administers the BOAs.

- The interface of public and private resources during spill response operations–finding the right mix and doctrine for ensuring available commercial resources are not inadvertently excluded from response operations.

- The federal/public role in dispersant delivery–determining what role, if any, exists for the Coast Guard to provide dispersant delivery support to industry.

The OWGs have been meeting and making progress in their analysis of their respective issues. The PAT is expected to meet in Washington, D.C. in June of this year, at which time the work groups will present progress reports. In addition, the PAT will consider any proposed actions regarding these issues.

As expected, this partnership has encouraged invaluable dialogue among its participants. Indeed, the greatest benefit of this initiative to date has been the opportunity for the partners to discuss their views in a structured and predictable format.

The enhanced understanding and mutual respect garnered from this partnership make the effort uniquely worthwhile. These innate benefits will be built upon by the discrete operational and process improvements produced by the work groups. This kind of stakeholder involvement can only positively impact the Coast Guard's understanding of what makes a *best response.*

Liaison Officer: A Vital Link to Stakeholders

By LT Todd Hall, PIAT, National Strike Force Coordination Center, Elizabeth City, NC

At a recent pollution incident, some concern arose over the relationship that existed between those that responded to the incident, and those that watched it from their back porch steps.

In interviewing the townspeople on the overall effects the response had on their community, the one subject that continually arose was the amount of information exchanged between the Command Post and the assisting/cooperating community, or stakeholders. According to those interviewed who had a role in the response, this perception of inadequate information often resulted in operational delays, flared tempers, confusion and unfortunately, several missed opportunities.

The term stakeholder is described by the National Interagency Incident Management System (NIIMS) as any person, group or organization who is affected by, or has a vested interest in an incident and/or response operation. This includes not only assisting and cooperating agencies (i.e. National Oceanographic and Atmospheric Administration, Department of Environmental Quality, Cleanup Contractors, etc.) but also your local community interests as well. (i.e., marina owner, city government, hotel manager etc.)

Until the Coast Guard's adoption of NIIMS, or National Interagency Incident Management System's Incident Command System (ICS) in August 1998, the stakeholder community was often left out of the information loop, having to depend solely on word of mouth, town hall meetings or random gatherings. Not only did this add to the confusion already associated with an oil spill response, but it made it particularly frustrating when assisting and/or cooperating agencies arrived ready to respond, only to find a lack of adequate direction or guidance. To share this pain and suffering from information starvation was the local community stakeholders. The fisherman, fire chief, and mayor who reside in the affected area and who know the terrain, the back roads, and the city council members, were neither informed nor consulted. This, in turn, not only left the townspeople upset and confused, it cost the Federal On-Scene Commander (FOSC) open access to precious area resources, as well as useful information.

The impact that stakeholders can have on a response is a very real one. Outside of the fact that they can provide valuable support in terms of assets and information, their concerns, beliefs, and perceptions during the response can greatly influence the outcome of the operation, especially when those perceptions and beliefs ultimately reach the media.

With the introduction of ICS came the position entitled Liaison Officer (LO). A member of the Command Staff, the LO is charged with communicating with all members of the stakeholder groups.

Because of the fact that the ICS concept is reasonably new, the LO position has not been fully utilized, primarily due to a general understanding of the purpose of the position. As a result of this misconception, the individual filling the role as LO has been essentially used as an "aide," providing on-site tours to VIPs and extinguishing brush fires within the Incident Command.

Contrary to this improper use, the LO is, in fact, a pivotal player in the overall success of an incident response because they are the information link between the stakeholders and the Incident Commander (IC)/Unified Command (UC). The Liaison Officer contributes to the efficiency of the response by ensuring the best use of available assisting/ cooperating agency resources and contributes to the positive public perception of the response and by effectively handling community stakeholders and their concerns.

In ensuring the best use of available agency resources, the LO would first identify the agency representatives. This is achieved via the IC or by reviewing the Incident Action Plan (IAP).

Information, including representative location and contact numbers, is then gathered on each identified agency and recorded in the LO's Incident Logbook. A series of stakeholder meetings are then scheduled daily to exchange information such as incident status updates, IC/UC direction, agency activities, and available agency resources. As an example, if a local police representative was temporarily assigned to an incident as a police liaison, the individual would be identified and listed by the LO as an agency stakeholder. In turn the police representative would exchange information via the daily stakeholder meetings and would subsequently forward the information on to their respective agency.

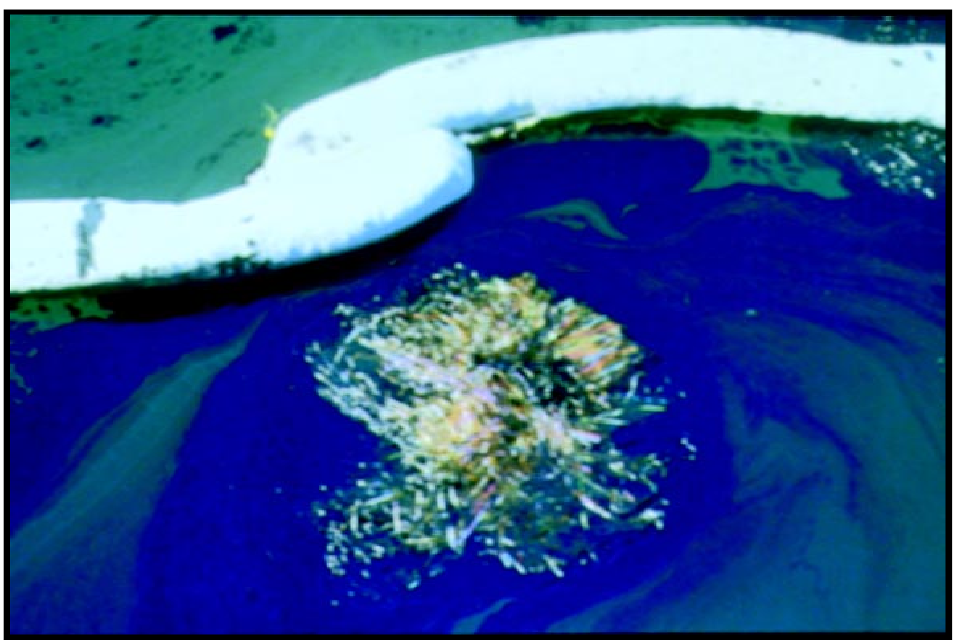
In identifying who the community stakeholders are, the process is not as clear and concise as that of the agency representatives. There is no list routinely maintained by the IC and there is usually no mention of them in the Incident Action Plan.

While each member of the community is a stakeholder to some degree, the LO is responsible specifically for stakeholder groups that "fit" the general category of political, economic or environmental, or groups with more focused interests such as natural resources damage assessment, damage claimants, or civil/criminal investigators. Sources that are often used to identify appropriate stakeholder groups are the Area Contingency Plan and the Information Officer.

Once the stakeholders have been identified, they too are invited to the scheduled daily meetings to receive a copy of the IAP, IC /UC directions etc., as well as given the opportunity to exchange information.

It is important to realize that the job of the Liaison Officer during an emergency response is a critical one. It can have a large impact on the efficiency of resources used during the operation, and on the perception of stakeholders regarding the success or appropriateness of the response activities.

With the establishment of an Incident Command, it is vitally important that the IC is aware of those that comprise the stakeholder community. It is more important though, that the IC appoint a Liaison Officer savvy enough to interact effectively with the community…a critical factor in the operation's success.



Deployed disposable sorbents.

Economic Impact

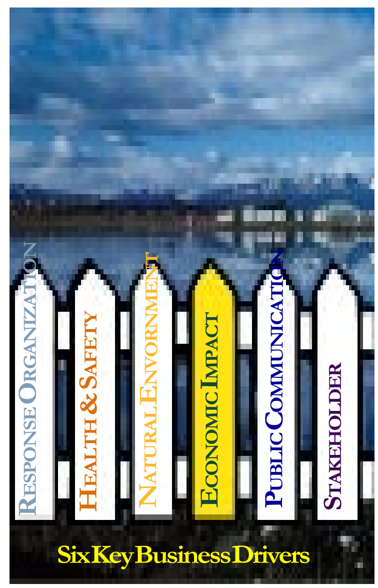
To establish economic impact as a key business driver acknowledges that pollution may also pose a serious economic threat to a region or locale, in addition to putting the environment and human health & safety at risk. It suggests that the Unified Command must understand and factor into their decision making the economic impacts resulting from both the incident and their actions to respond to that incident.

The array of economic consequences that must be considered varies widely from location to location and spill to spill. For instance, closing the only entrance to a port might be necessary for a period of time in the interest of safety to the port. It is well understood by our waterways managers that, eventually, the rising costs of delays to arriving and departing vessels, as well as downstream costs to those waiting on the goods to be delivered or picked up, will heighten the sense of urgency associated with reopening the port to commerce. Likewise, the impact to a beach, recreation & tourism dependent economy or to an area with significant commercial fishing interests can be highly significant. Less obvious, but equally important may be costs that defy immediate measurement but that may be of concern to a community long after the cleanup ends.

Establishing an Economic Impact key business driver signifies the importance of this issue. That doesn't make it easy to handle. We still have much to do in that area. If, in the time of crisis, we hope to adequately deal with all of the competing factors and, in fact, deliver Best Response, we must build the relationships that will enable each port area to adequately understand and deal with each of the business drivers, including the economic impacts.

The bottom line for the response organization is that there is no simple formula for managing the highly complex array of trade-offs that will inevitably arise as the consequence of efforts to minimize and balance impacts to the environment and the economy. Notwithstanding the vexing, win-lose nature of these trade-offs, however, they must be dealt with because they are critical and essential to success in pollution response.

The "Economic Impact" key business driver differs from the economic-related "Stakeholder Service & Support" key business driver. The first KBD focuses on financial impacts; the latter deals with people. Minimizing "Economic Impact" is concerned with the hard numbers and actual financial impacts while economic-related "Stakeholder Service and Support" focuses on how the response organization deals with the people involved. Stakeholder efforts are judged on the level of service and support provided—how well responders worked with the stakeholders.



Preparedness

This final article in the set lays out a concept that is undergoing a genesis. A "How Ready Are We?" working group has been meeting as the Proceedings issue goes to press. We expect to add a great deal of detail to this conceptual model in the coming weeks and months. Once shaped up, it will form the base that drives the Coast Guard Marine Safety business plan and also the key measures of success. We look forward to sharing this with you.

How Ready Are We?

By LT Claudia Gelzer, G-MOR-2, USCGHQ

It seems everyone is talking about "readiness" these days. Organizational leaders throughout the country are asking the same questions. Are we ready? Do we have what we need to do the job? The Coast Guard is no exception. Having endured broad streamlining measures with no reprieve of its responsibilities, the Coast Guard is faced each day with doing more with less.

In a recent speech, the Commandant cited the Coast Guard's deep-seated tradition of Semper Paratus–its "can do" spirit–that has shaped an "organizational identity" that makes it extremely difficult to say no to additional tasking despite shrinking resources. "We take a perverse pride in performing our missions with no money, old equipment, too few people, and seat-of-the-pants training," Admiral James Loy said, adding that this very mantra has "rendered extraordinary service to America." However, he cautioned, "The extension of the 'do more with less' logic is 'doing everything with nothing'."

In short, the Coast Guard may be starting to fray around the edges according to its most senior leadership. We need to be better equipped in order to continue to do the job well. And while we have plenty of compelling anecdotes to illustrate this predicament, in order to persuade Congress the organization needs hard supporting data. Hence, the Commandant has directed the Assistant Commandants for Marine Safety and Environmental Protection (G-M) and Operations (G-O) to establish standards, design assessment methods, and identify and remedy systemic shortfalls in ensuring readiness for all Coast Guard missions.

How does this relate to environmental response–a program that has devoted the last 10 years to improving readiness for pollution spills? Since the EXXON VALDEZ oil spill, government and industry have worked feverishly on this front. Coordination has improved markedly in the form of Area Committees and through use of Area Contingency Plans. Industry diligence has been enhanced by the requirement that certain vessels and facilities handling oil must maintain spill response plans designed to minimize the impacts of

Preparing	Responding
Leading Indicator	Lagging Indicator
Apparent Ability to Minimize Consequences	*Actual* Ability to Minimize Consequences

This table delineates the two general categories of pollution response measurement, before and after a spill.

pollution incidents. Response operations have been honed via the Preparedness Response Exercise Program (PREP), which exercises the people and response equipment as realistically as possible.

There is no question that responders are more ready than ever to react to spills. The problem exists in trying to determine levels of readiness and where any gaps may exist. Are all Coast Guard units equally prepared? Are port areas equipped proportionately from state to state and area to area? We don't know. The Coast Guard has no commonly accepted tool to gauge the level of pollution response preparedness. The purpose of this article is to describe the efforts currently underway to develop such a tool.

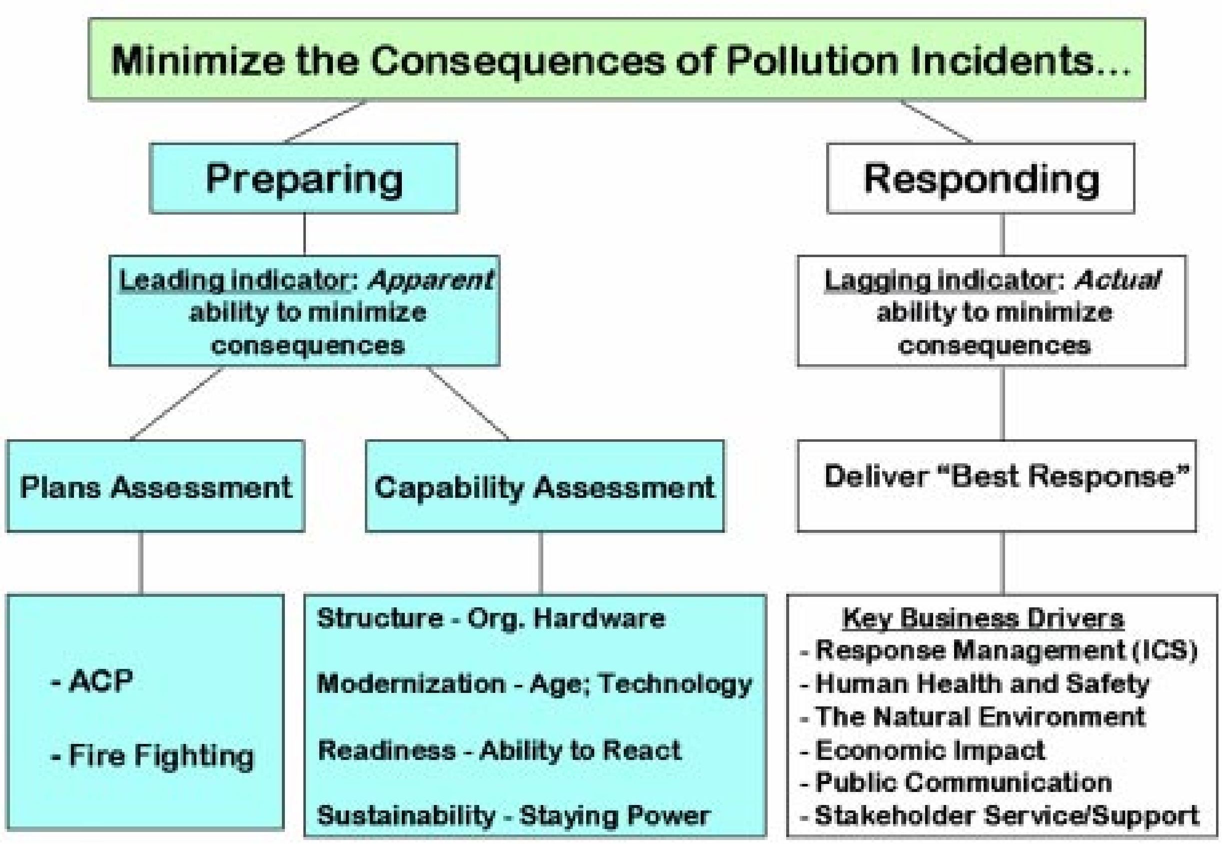
The idea appears to have merit. What Captain of the Port would not want to know how ready his or her unit is to successfully respond to a spill? Response managers would clearly benefit from a system that predicted ability to respond, and pinpointed gaps in preparedness where improvements could be implemented. Such an assessment tool would also meet the requirements of the Government Performance and Results Act (GPRA) which mandates federal agencies to develop assessments of performance correlating government activities to measurable outcomes.

In February, Coast Guard leaders from the First District, chartered by LANTAREA and PACAREA, coordinated an effort to begin tackling the issue on a national scale. An academic symposium was held in Newport, RI to bring together the various groups grappling with this concept, and consider the many independent readiness measurement initiatives currently underway in the Coast Guard.

G-M recently began formulating its own strategy to measure Coast Guard unit and national readiness in regard to pollution response. The Office of Response (G-MOR) has been considering the initiatives already underway at Marine Safety ("M") field units and district offices to measure performance.

PREPAREDNESS

This flow diagram illustrates the connection between preparedness and delivering Best Response.



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Before outlining G-MOR's current thinking on measuring pollution response preparedness, it is worth noting that there has been some debate over terminology. While DOD and the Coast Guard's "O" community use the word "readiness" most often, the "M" community may find "preparedness" to be a more palatable translation for the response world. "Preparedness" has long been recognized and used by our non-DOD partners (e.g. the Federal Emergency Management Agency, the Environmental Protection Agency, and industry). It may arguably be considered a more comprehensive term, with readiness serving as a subset of preparedness (as outlined below). From an academic standpoint, while the Coast Guard translates its motto Semper Paratus as "Always Ready," most Latin dictionaries define Paratus to mean either "Ready" or "Prepared," including C. T. Lewis' Elementary Latin Dictionary.

Semantics aside, we are faced with the fact that there are no commonly accepted preparedness measures for pollution response. In order to begin to tackle this deficiency, we must focus on the overall goal of the National Response System and the Coast Guard's target as defined under "Best Response:" *Minimize the consequences of pollution incidents.*

The Best Response survey tool is built around delivery of this outcome. Developed for use in evaluating responses to spills greater than 10,000 gallons, the survey is expected to offer "lagging indicators" of response performance that answer the question, "How well did we do?" It follows that a more complete picture of response capability could be provided by supplementing the Best Response measurement instrument with "leading indicators" of preparedness–a pollution response measurement tool that reflects how ready we are to respond.

In order to determine how to measure preparedness, we need first to decide what the word means to us. Literally dozens of definitions have been suggested from within the Coast Guard. The following definition has achieved consensus and recently evolved from the National Readiness Symposium.

Semper Paratus… "Always Ready"… is: the ability of Coast Guard system(s) to execute mission requirements in accordance with standards.

A definition that parallels this thinking, but is more specific to pollution response is suggested as follows:

Preparedness is a process intended to ensure response plans, capability, and organization for prompt and effective reaction to pollution incidents, thereby minimizing impacts.

This implies that preparedness represents more than a state or condition–it is a process, and one that ensures Best Response. Preparedness requires some level of continuous activity to ensure effective response to a contingency, in this case, a pollution spill. It includes planning, training, exercising, and maintaining the organization's capability to respond in a way that minimizes the impact of a spill on people, the environment, and the economy.

The goal is to develop a preparedness assessment tool that will provide Captains of the Port with a snapshot of unit and Area readiness using established mission standards. The measure will be linked to the "critical success factors" of Best Response. As currently envisioned, the preparedness measure will focus on the two key components of preparedness: 1) contingency plans, the storehouse of our collective knowledge of how to respond, and 2) the response community's capability, our ability to implement the contingency plan.

When attempting to measure the plans component of this equation, we need to identify the criteria or "critical success factors" for achieving quality and utility. A "Best Area Contingency Plan" presents valuable information in a straightforward manner. It's a document that people actually use, not a door stop.

Capability is determined by measuring whether an organization has what it needs to do the job well. In order to rate capability, we have initially adopted for study the four readiness pillars identified in G-O's readiness measures system:

Structure – Modernization – Readiness – Sustainability.

Structure is defined as the organization, the hardware and the financial instruments necessary for Best Response. Is there an effective Response Management System in place?

Modernization is comprised of age and technology issues. Do you have the right equipment? Is it up to date? Do R&D efforts exist to ensure future improvements?

Readiness here is used as a subset of Preparedness and captures our ability to react. Given that you have what you need, is it ready to go? Is the equipment properly maintained? Are people trained and qualified? Have they been exercised?

Sustainability is defined as staying power. Does your system have the capacity to endure during a response? Can you keep people fed and housed? Do you have a process to relieve response assets?

One illustration of how a preparedness assessment could be useful to the field might be when a commanding officer is trying to determine why the unit does not meet its training standard. The assessment tool would be designed to help drill down to increasingly specific levels of detail, for instance:

- Not enough unit personnel have the required ICS training.

- Not enough unit personnel have used, developed, or maintained their skills.

While this is just a simple example, it shows the benefit of a preparedness assessment tool that identifies unit response gaps where improvements can be made. However, a complete assessment of pollution response preparedness must consider outside response organizations as well. For this reason, the measurement tool is envisioned to look beyond the unit and capture preparedness levels within the larger "OPA 90 Area" (federal, state, local government, and the private sector). Such an assessment will address G-M's performance target to

PREPAREDNESS

P R E P A R E D N E S S

improve Coast Guard unit preparedness for pollution response, and increase the level of response preparedness nationwide. A viable measurement tool would provide separate measurements of unit and Area preparedness so that shortfalls could be specifically linked to the appropriate process owner.

An obvious concern about this kind of a process is the source of data to be used in conducting preparedness assessments. It is not our intention to put additional requirements on the field. Rather, data needed to measure pollution response preparedness shall be culled from already existing databases including G-M's "workforce capability" database of personnel training, education, and qualifications. The key to the success of a preparedness assessment tool is that it be useful, not burdensome to the field.

We are still in the conceptual phase of this complex process. The immediate goal is to refine the framework described by further clarifying the criteria that should be measured to gauge preparedness. We will then seek consensus among the various stakeholders (district staffs, field units, Area Committees, industry and other stakeholder organizations) and determine the best nationwide approach. That approach will ultimately become a component of the overall Coast Guard-wide readiness system.

An effective measurement tool will enable the response community to determine its position on the preparedness spectrum. It will also arm the Coast Guard with the information necessary to link activities to measurable outcomes, identify gaps in the response system, and justify additional resources when needed. Ultimately, it has the potential to reduce some of the frays in the Coast Guard system and provide a response organization that is better prepared to achieve its primary goal of *minimizing the consequences* of oil and hazardous material spills.

Preparedness for Response Exercise Program

The Preparedness for Response Exercise Program (PREP) was developed in 1994 to reduce duplicative exercise programs and requirements for industry response plan holders. To effectively do this, the PREP Guidelines were written and adopted by CG, EPA, Office of Pipeline Safety, and Minerals Management Service. Additionally, four workshops were held around the country to solicit input from industry, as well as, state and local governments.

In the last five years, PREP has sustained the spirit of partnership that existed when it was first conceived. The Coast Guard has conducted more than 70 Area Exercises. These exercises have involved more than 100 industry representatives. The Area Exercises, which involve full field deployment, have provided an opportunity for industry to work with Federal, State, and local government representatives to exercise their plans within the context of the entire response community and the Area Contingency Plan. To further insure preparedness in a Captain of the Port Zone, the Area Exercises have been augmented by Government-Initiated Unannounced Exercises. More than 160 unannounced exercises have been conducted around the country on vessels and at facilities.

Recently, the exercises have transcended the boundaries of oil pollution as we begin to better prepare for hazardous substance releases and share exercise development experiences with the Operations community. In 1998, two Areas conducted hazardous substance exercises and in December 1999, the National Strike Force Coordination Center will assist the Houston/Galveston Area with their hazardous substance Area exercise. Since 1997, the NSFCC has assisted in developing search and rescue exercises using experiences from the oil spill response exercises.

These exercises have enabled the Marine Safety community to further develop their skills and brought insight, not otherwise found, to a complex model of exercising industry, federal, state and local governments, as the many other stakeholders involved in any emergency response.

Mariners' Seabag

The Merchant Mariner, His Credential Renewal and His Health

Soo Long (a fictitious mariner) navigates the 700-foot tanker into the port of New Orleans. It has been another good coastwise voyage for him. He has been doing this since he was 20 years old. He is now 60 years old, and thinking "Only a few more years to retirement." He checks his license posted on the bulkhead and thinks "It is time to renew my license. What do I need to do? First I must call my doctor to schedule a physical."

For many mariners, this starts the process of renewing their merchant mariner credentials (license/document). The process could take anywhere from one week to six weeks. It depends on the workload of the Regional Examination Center (REC), how complete the application package submitted by the mariner is, and (if a medical waiver is needed,) the availability of the Medical Review Board. It is not uncommon for a mariner to submit an application on Monday and be sailing with a new license by Friday afternoon. This is possible only because the mariner did his homework before submitting an application for approval. The ever-increasing number of medical waivers is due to an aging mariner population, new medical technology and improved gathering of information.

Every year, over a thousand merchant mariners apply for a medical waiver. Over ninety percent are approved. The other ten percent either appeal the decision or renew for continuity only (in cases where the condition is being resolved). When an applicant is unable to meet the requirements to renew his/her license or merchant mariner document, they may renew for "Continuity Only." They are not allowed to sail with this type of endorsement, but it may be rescinded at any time by satisfying the renewal requirements, in this case, the physical requirements.

Every year, over a thousand merchant mariners apply for a medical waiver. Over ninety percent are approved.

The standards used to determine a mariner's fitness to hold a license or document are derived from several sources. The first is the United States Code that states "the applicant must provide satisfactory proof that he/she is qualified as to sight, hearing, and physical condition to perform the seaman's duties." The next source is the Code of Federal Regulations (46CFR) which gives more details about the extent of the physical examination. It also covers when and how a medical waiver is requested.

The latest addition to the medical standards is the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended. This convention, signed by 71 countries, promotes safety of life and property by establishing standards to be followed by all of the member countries maritime industries. These medical standards clearly address age, vision, and potentially life threatening medical conditions controlled by medication.

A new regulation requires an applicant for a merchant mariner document with entry level endorsements who will be sailing on a seagoing vessel 200 gross tons or more to have a document issued by a medical practitioner. The document must state that he/she is medically fit to perform the functions and duties for which the document will be issued. This had an impact on applicants for the entry level ratings, because they were not required previously to have a physical (NVIC 2-98 lists the requirements. Applicants for entry level ratings on the Great Lakes or Inland waters are not required to show any medical certification.

The final standards are found in the Navigation and Vessel Inspection Circular (NVIC). This document was recently amended to reflect the latest advances in the medical field, which

Mariners' Seabag

ultimately effects the mariner's ability to receive a waiver. Also, it combines into one document all of the standards contained in the before mentioned documents.

After the mariner has a physical examination form (CG-719K) completed by a medical practitioner, it is submitted, along with other needed paperwork to a regional examination center. The paperwork is reviewed by an examiner to make sure all information is complete. If there is a physical or medical problem, additional information may be needed. This additional information could consist of a narrative written by the doctor giving in-depth information about the condition, an exercise stress treadmill test for cardiac patients and extremely obese people, or a diabetes test for a mariner who has a sugar problem. Some vision and hearing conditions can be waived at the REC level. Other potentially disqualifying conditions are forwarded to the National Maritime Center for review by the Medical Review Board.

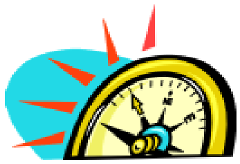
The Medical Review Board consists of physicians from the Public Health Service. The board reviews the narrative report received from the mariner's doctor along with the medications, prognosis, and the duties and requirements of the position held by the mariner. The Medical Review Board makes a determination whether the mariner's condition is stable enough for the mariner to undertake a long voyage, or if he/she needs to be close to a medical faculty. The Board also determines whether the condition would allow the mariner to act in the event of an emergency situation. Would the mariner be able to rescue himself/herself as well as others? Or would the mariner become a casualty?

Some conditions may warrant a waiver with limitations, such as "Day-light Only" waivers for color vision deficiency. This waiver gives the mariner the opportunity to continue working, but takes into consideration his/her limitations. Also, a medical condition that is unstable, such as diabetes, could warrant a conditional waiver. This would have the mariner's condition reviewed on a yearly basis for the five-year duration of the license. At the time of the next renewal, the entire physical will be reviewed and the four yearly physicals will be considered in determining whether the conditional waiver should be removed or continued.

In cases where the mariner is denied a waiver he or she is advised of the appeal procedures. If the mariner elects to appeal, it is very important for the mariner to provide additional information to support his case that the physical condition does not pose a possible hazard to safety.

Fortunately for Mr. Soo Long, he is still in very good health, and he received his renewal without any problems.

Nautical Queries



Deck Questions

1. The effects of free surface on initial stability depend upon the dimensions of the surface of the free liquids and the _________.

A. volume of liquid in the tank
B. volume of displacement of the MODU
C. location of the tank in the MODU
D. height of the center of gravity of the MODU

2. Contour elevations on this chart refer to heights in feet above mean _____________.

A. lower low water
B. high water
C. low water
D. sea level

3. On a vessel of 125,000 GT on an international voyage, how many international shore connections must be provided?

A. 1
B. 2
C. 3
D. 4

4. Which is supplied to the vessel by the U.S. Coast Guard?

A. Bell book
B. Cargo gear register
C. Official Logbook
D. Rough Logbook

5. A shore is a piece of securing dunnage that _____________.

A. runs from a low supporting level up to the cargo at an angle
B. is also known as a "distance piece"
C. is placed on the deck under the cargo to distribute its weight evenly
D. is run horizontally from a support to the cargo

6. BOTH INTERNATIONAL & INLAND RULES OF ROAD, A sailing vessel is NOT required to keep out of the way of a _____________________.

A. power-driven vessel
B. vessel not under command
C. vessel restricted in her ability to maneuver
D. vessel engaged in fishing

7. You are proceeding along the right bank of a narrow channel aboard a right-handed single-screw vessel. The vessel starts to sheer due to bank suction/cushion effect. You should _____.

A. stop engines and put the rudder left full
B. back full with rudder amidships
C. decrease speed and put the rudder right full
D. increase speed and put the rudder right full

8. The small circle of the celestial sphere parallel to the celestial equator, and transcribed by the daily motion of the body, is called the _______________.

A. hour circle of the body
B. parallel of declination
C. vertical circle of the body
D. parallel of altitude

9. Which type of line would have the LEAST resistance to mildew and rot?

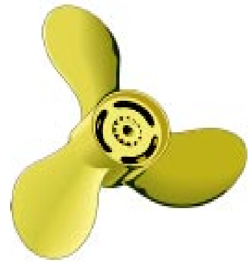
A. Manila
B. Nylon
C. Dacron
D. Polypropylene

10. What is the difference between net tonnage and gross tonnage?

A. Net tonnage is the gross tonnage less certain deductible spaces.
B. Net tonnage is tonnage of cargo compared to tonnage of whole ship.
C. Net tonnage is gross tonnage minus engine and bunker spaces.
D. Net tonnage is the net weight of the ship.

ANSWERS: 1-B, 2-D, 3-A, 4-C, 5-A, 6-A, 7-D, 8-B, 9-A, 10-A.

Engineering Questions



1. The heat of compression is partially removed from compressed air by___________.

A. intercoolers
B. aftercoolers
C. compressor water jackets
D. all of the above

2. Scale accumulation on evaporator heating surfaces will cause____________.

A. immediate loss of vacuum
B. increased distillate quality
C. immediate tube failure
D. reduced evaporator capacity

3. Expansion of the tube bundle in a shell-and tube type cooler may be provided for by the_____________.

A. packing and lantern rings
B. floating end tube sheet
C. shell foundation bolts
D. directional transverse baffles

4. Pitting in the suction areas of the centrifugal pump bronze impeller is usually caused by____________.

A. cavitation
B. electrolysis
C. abrasion
D. corrosion

5. A distinguishing feature of an eductor, when compared to other pumps, is the__________.

A. discharge end being smaller than the suction end
B. small size of the impeller
C. lack of moving parts
D. ease at which the wearing rings may be changed

6. When opening or closing compressor service and line valves on a typical refrigeration system, you ______________.

A. should turn valves slowly to avoid thermal stresses due to low temperatures
B. must first remove the seal cap
C. should examine the gasket frequently to ensure that it is flat
D. should never tighten the packing gland

7. The flash point of a petroleum product is an indication of its___________.

A. viscosity
B. pour point
C. volatility
D. lower explosive limit

8. If a centrifugal pump were continually operated with the discharge valve closed, the _________.

A. motor controller overload would open
B. pump would eventually overheat
C. relief valve would continuously cycle open
D. motor would overheat

9. Leakage of hydraulic fluid from around the shaft of a hydraulic motor may be caused by__________.

A. permanent loss of pump suction
B. worn shaft seals
C. high level in the oil sump
D. low motor RPM

10. Which of the following statements is correct concerning requirements for propellers?

A. A propeller may not be changed with one of a different pitch unless stress evaluations are supplied and permission is granted by a Marine Surveyor.
B. When steel propellers are used, zinc anodes are to be fitted on the aftermost strut bearing housing and on the forward most section of the rudder assembly.
C. The exposed steel of the shaft is to be protected from the action of the water by filling all spaces between the cap, hub and shaft with a suitable material.
D. Ultrasonic examinations of the propeller may be performed in lieu of required dry-docking periods, provided certified copies are distributed to the proper regulatory bodies.

ANSWERS: 1-D, 2-D, 3-B, 4-A, 5-C, 6-B, 7-C, 8-B, 9-B, 10-C