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USING EXERCISES AS A SOURCE OF OIL POLLUTION RESEARCH IDEAS

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ABSTRACT 300172:

Advancing the state of the art in oil pollution prevention and response requires the identification of missing elements and developing research to fill in the gaps in information. Researchers rely on a wide range of methods to identify new areas for study. Previous research frequently identifies new questions that could not be addressed at the time, or were outside the scope of the study. Lessons learned during response to real events also provide valuable insights. However, Preparedness for Response Exercise Program (PREP) and Homeland Security Exercise Evaluation Program (HSEEP) exercises are often overlooked as a source of new ideas for research.

Exercises are widely used to identify emergency response capabilities, to test equipment, practice response protocols, and to train personnel in their duties. This paper presents a review of selected After Action Reports (AARs) from PREP and HSEEP oil spill exercises to determine the extent that new research ideas could be gleaned from the information and the extent that research opportunities were identified.

This paper also addresses factors that limit the utility of exercises for identifying research needs. These limiting factors include the exercise purpose, exercise design, evaluation criteria, and after action reporting protocols. Practical suggestions on approaches to considering research needs during the exercises are provided.

INTRODUCTION:

Inspiration for oil pollution research can come from a wide range of sources. Oil spill incidents often highlight operational problems or gaps in knowledge that easily point to research needs. Similarly, on-going research finds issues that must be further studied. After action reports for emergency management and response exercises are another generally untapped source for research ideas. Some organizations have drawn connections between exercises and research needs (GLCEPTF, 2012). However, a search of the International Oil Spill Conference (IOSC) proceedings found about 20 papers concerning exercise programs that also mentioned research; but none of these papers drew any connection between exercises and identifying research needs. (IOSC, 2013)

OIL POLLUTION RESEARCH:

Research, as well as research and development (R&D), encompasses a broad spectrum of activities and are defined several ways by different federal, academic, business, and international bodies (NSF, 2014). In a broad manner, the Encarta Dictionary defines research as the "methodical investigation into a subject in order to discover facts, to establish or revise a theory,

or to develop a plan of action based on the facts discovered." Similarly, the federal government defines R&D as activities that comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications. For U.S. federal oil pollution R&D, the Interagency Coordinating Committee on Oil Pollution Research (ICCOPR) relies on the following definitions:

Research – A systematic study directed toward fuller scientific knowledge or understanding of the subject studied. Research is classified as either basic or applied according to the objectives of the sponsoring agency.

Basic Research – A systematic study directed toward fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind.

Applied Research – The systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met.

Development – A systematic application of knowledge or understanding, directed toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

No matter how research is defined, oil pollution research should be considered as any study that contributes to the knowledge needed by decision makers and responders to address oil system safety by preventing spills, preparing to respond to spills, responding to spills, and addressing the effects of oil pollution. It can be a rigorous academic and scientific study including a hypothesis tested using empirical data. It can include surveys, measurements, and other observations by oil pollution response practitioners on how to improve preparedness and response. With these considerations in mind, we can see that oil pollution research can include:

Literature reviews and studies – This research includes searches of literature for data and information on operational and environmental baseline conditions, operating parameters, regulatory limitations and authorities, or chemical and physical properties. These searches are used to gather information from multiple sources and synthesize it for a different use. They are ideally suited for identifying background material, supporting policy decisions, and resource allocations.

Field studies and investigations – This research involves actual field studies to inventory environmental conditions, make measurements of field conditions both before and after spill, verify fate and transport models and parameters, and document environmental conditions. This type of research is particularly suited for establishing environmental baseline information, ecosystem science studies, and monitoring ecosystem recovery from oil spills.

Equipment tests – These tests are used to determine how well response equipment performs under simulated or actual conditions. These tests may be done under field conditions or in a test facility such as the Bureau of Safety and Environmental Enforcement's (BSEE's)

Ohmsett facility or the U.S. Army Cold Regions Research & Engineering Laboratory (CRREL). The Coast Guard Oil-in Ice Demonstrations and the Arctic Shield exercises are good examples of equipment tests.

Laboratory experiments – This research involves testing oils and treatment chemicals to determine their chemical and physical properties, product toxicity, and biological effects. These experiments provide vital basic information that supports decision makers in evaluating response options, designing response equipment, verifying effectiveness of treatment options, and determining effects of oil spills.

ICCOPR is currently revising its Oil Pollution Research and Technology Plan (OPRTP) to include a new Oil Pollution Research Categorization Framework for identifying and tracking research activities (ICCOPR, 2014a). This Framework categorizes oil pollution research into four Classes: Prevention, Preparedness, Response, and Injury Assessment/Restoration. These classes are further divided into 23 Standing Research Areas. In preparing the OPRTP, ICCOPR reviewed more than 60 sources including lessons learned documents from oil spill responses, oil spill workshop and conference proceedings, legislative requirements, stakeholder recommendations, industry documents, agency research plans, and other documents. These reviews identified more than 550 "Research Needs" as a starting point for research planning. ICCOPR plans to track research activities on the top priority Research Needs in the 23 SRAs and update the OPRTP every six years. In doing so, the research community and ICCOPR should consider the use of exercises as additional sources for identifying research needs.

OIL POLLUTION EXERCISES:

Exercises are used around the world to practice emergency responses, test emergency plans, train emergency personnel, and verify compliance with regulatory requirements. The U.S. has used the National Preparedness for Response Exercise Program (PREP) since 1994 to test the capabilities of oil spill response organizations and others involved with oil pollution response. PREP exercises are conducted pursuant to section 311(j) of the Federal Water Pollution Control Act (FWPCA) as amended by section 4202(a) of the Oil Pollution Act of 1990 (OPA 90). PREP exercises include: qualified individual notification exercises; emergency procedure exercises for vessels, barges, or facilities; spill management team tabletop exercises (TTXs); equipment deployment exercises, and government-initiated deployment exercises. They serve to test preparedness for spills from marine sources, onshore and offshore facilities, and pipelines.

Exercises in the U.S. follow the guidelines of the Homeland Security Exercise Evaluation Program (HSEEP). The HSEEP guidelines provide a common basis for all exercise programs to conduct exercise planning, evaluation, and reporting of results and recommendations. The two basic types of exercises that address oil pollution response are discussion-based exercises and operations-based exercises. Both types are potential sources of ideas.

Discussion-based exercises include seminars, workshops, TTXs, and games. (DHS, HSEEP 2013) Seminars are particularly valuable for sharing information, training personnel on new processes, making changes to plans and procedures, as well as for assessing capabilities or interagency or inter-jurisdictional operations. Workshops use increased participant discussion to

improve plans, procedures, and agreements. TTXs provide opportunities to practice and improve understanding of emergency management concepts, identify strengths and areas for improvement, change participant perspectives on issues. Games are used to simulate operations by having two or more teams competing against each other using rules, data, and procedures designed to depict an actual or hypothetical situation. Discussion-based oil pollution exercises include the Spill of National Significance (SONS) Exercise, and TTXs to discuss area contingency plans (ACPs) and facility contingency plans (FCPs).

Operations-based exercises include drills, functional exercises (FEs), and full-scale exercises (FSEs) involving actual participant reaction to a scenario in increasing level of complexity. (DHS, HSEEP) These exercises all involve deployment of personnel and/or response assets to react to a scenario. Drills are used to test readiness, provide training, practice response, and to determine if plans can be executed. FEs are used to test one or more elements of a response system without deployment of response assets. The most complicated operations-based exercises, FSEs, generally involve multiple agencies or organizations addressing a complex situation or scenario with deployment of personnel and resources to the scene. Operations-based oil pollution exercises include:

- Arctic Shield Exercises and Great Lakes Oil-in-Ice Demonstrations are exercises led by the USCG Research and Development Center to conduct research on equipment and techniques for oil spill response.
- PREP equipment deployment exercises and emergency plan exercises used to meet requirements by the Coast Guard, U.S. Environmental Protection Agency, and the Pipeline and Hazardous Materials Safety Administration.
- Deployment Drill Exercises required by the Bureau of Safety and Environmental Enforcement (BSEE) for offshore drilling lessees to demonstrate that they can mobilize equipment to a spill site.
- HSEEP Exercises, which can address all-hazard scenarios including oil spills and other hazardous material incidents.

All exercises involve establishing a set of goals and objectives to guide the exercise development and conduct, an evaluation of the exercise play, and an after action report that documents the exercise results and includes recommendations for improvement.

EXERCISE DESIGN:

An exercise can only be successful if the exercise is properly designed to meet clearly defined goals and objectives. PREP exercises focus on the organizations' readiness to deploy personnel and equipment, condition of equipment and systems for a response, ability of the responders to manage operations, and the adequacy of the applicable response plans. (DOT, et. al, 2002) Most other oil spill exercises have similar objectives. However, additional objectives may be added to address specific needs of the participants. This provides an opportunity to expand the exercise objectives to identify oil pollution research needs in addition to the primary objectives.

Research Exercise Objectives – For research exercises, such as the Arctic Shield Exercises, the exercise objectives are to test the equipment and response approaches of

participating units. By its very nature, these exercises are specifically designed to provide research results and /areas that require additional research. Objectives for Arctic Shield already focus on research.

Discussion-based Exercise Objectives – These exercises offer numerous opportunities for participants to explore research ideas. Most discussion-based exercises focus on validating plans and procedures, operational issues, capabilities, and coordination between response elements. Exercise planners should consider adding objectives for participants to identify knowledge gaps that could be resolved through additional research. Such objectives can guide the development of discussion topics and evaluation criteria that focus on research topics. Example objectives could include: Identify missing information needed to establish pre-approved dispersant zones; identify environmentally sensitive area and restrictions on operations; etc.

Operations-based Exercise Objectives – The objectives for most operations-based exercises will focus on testing elements of the applicable plans and procedures, actual deployment of response equipment, and personnel capabilities. However, they could easily be expanded to include an examination of the underlying factors affecting the performance of personnel and equipment and what is needed to overcome these problems. These factors are best explored as part of the exercise hot wash or development of the AAR.

Exercise Planning – Exercise planning teams should include individuals that are aware of potential limitations to the player's decisions or actions. It would be beneficial for researchers from government, academia, or industry to participate in the exercise planning team to help design the exercise and scenario to provide an opportunity for participants to face challenges that can reveal unmet research needs. The scenario can then be designed so the players must address the issue or find an alternate way to achieve their response objectives. The research goal of the scenario would be to uncover data or information limitations that adversely affect decisions and to determine what research is needed to fill in the gaps. The exercise design should consider potential interactions between the players and the research community.

EXERCISE CONDUCT AND EVALUATION:

A thorough and well executed exercise evaluation process is critical to determining whether exercise objectives have been met and documenting areas for improvement. Evaluators should not only consider information from exercise play but also determine the root causes of areas for improvement as they develop the AAR. A search of 96 AARs for Oil and Hazardous Substance Response exercises dating back to 1990 in the Coast Guard Contingency Planning System's "CGSails" database identified only 10 exercise AARs that addressed the need for additional research, or suggested a topic for further research, related to oil pollution (USCG, 2013). The recommendations included five for research into information management and communication systems; four into response assets and capabilities; and only one for research to test response equipment.

Two of the exercises in the CGSails database included objectives and discussion aimed at finding research needs during the exercise. The 2011 Canada/United States Dixon Entrance (CanUsDix) exercise (USCG, 2012) included a workshop where participants brainstormed a list

of possible topics for additional research by the Coast Guard Sector. The MEXUSGULF 2008 exercise (USCG, 2008) also included discussion and identification of several topics for additional research in the areas of salvage, wildlife, and waste management.

Facilitation during discussion-based exercises, or during after-action conferences for operations-based exercises, is a key component for eliciting discussion of research needs. A facilitator with knowledge of operations as well as potential topics for research provides an ideal situation. Regardless of the facilitator's expertise, the exercise planning team should develop a facilitator's handbook that includes a list of potential topic threads that can lead to discussion of research needs. When an area of missing information is identified, a well prepared facilitator might ask participants questions such as: What missing information (or data) would you need to resolve this issue? Who is doing (or could do) research to develop the missing information?

IMPROVING RECOMMENDATIONS IN THE AAR PROCESS:

Development of recommendations in the AARs is a good opportunity to identify research needs. Unfortunately, many recommendations for improvement only go just far enough to resolve an issue in the short-term but not far enough to address an underlying root cause. The reason is that the primary objectives of the exercise are to determine readiness for response, adequacy of contingency plans, or other operational issues. When a deficiency is indentified, it is often relatively easy to recommend that the participants obtain resources or training needed to improve readiness or make revisions to contingency plans. The recommendations appropriately focus on actions that the participants could take to resolve the issue. However, taking a deeper look at the underlying root causes could identify actions that other parties should undertake. These examples illustrate this point:

Example 1 – An exercise (USCG, 1998) determined that containment booms were stored approximately 10 minutes away from the facility, which could hamper a prompt delivery during a spill, because the personnel wanted to prevent excess weathering of the boom material. The resulting recommendation was to pay attention to storage locations in future exercises. However, a deeper look at the issue would show that there was potential uncertainty about the service life of the containment booms. The recommendation could be expanded to suggest research into durability of the boom material.

Example 2 – A Port Readiness TTX (USCG, 2000) determined that there may be significant delays for responders to move between ports under some conditions due to limited tie-down equipment and trained personnel. The AAR recommended that an alternative transportation plan be developed and for deployable units to evaluate their need to have tie-down gear. While these are valid, additional recommendations are possible. For example, research to determine limitations of existing deployable units would be a good starting point for addressing the issue.

Example 3 - During a full-scale exercise (USCG, 2004), deck personnel did not have adequate means to get on top of mini-barge stacks to unhook and prepare for the next barge. The AAR addressed this safety concern and recommended that the responsible party should research/consider installing a davit on the side of the barges to assist in lowering Ocean Boom

and its associated equipment to the receiving vessels. In this case, the evaluators properly recognized that some research would be needed to identify the best system to address the issue.

Example 4 – During a PREP equipment deployment exercise, crane movement limitations precluded deployment of the Vessel of Opportunity Skimming System (VOSS) on the port side of the ship (USCG, 2009). The AAR recommended that standard procedures for deploying the VOSS consider the limitations and constraints inherent in the platform vessel. Improvements to the standard procedures would help responders select a suitable platform for the VOSS. At the same time, this exercise illustrates a need to conduct research to overcome these limitations or to more accurately document the limitations.

Example 5 – During a PREP functional exercise, booming strategies for protecting natural resources were not based on sufficient consideration of lost human use of resources (USCG, 1999). The AAR recommended better involvement of Natural Resource Damage Assessment (NRDA) personnel in the decision making process. It also recommended including economic priorities in the Area Contingency Plan. In cases such as this, economic priorities can only be properly established if there is solid information to document the human use and economic value of that use. This is an opportunity for local research into pre-spill baseline conditions.

CONCLUSIONS:

Most oil pollution research ideas will be identified by reviewing research results and documentation of responses to oil spills. However, exercises provide another viable source of resource ideas. Well planned objectives and lines of inquiry can set the stage for identifying research needs during discussion-based exercises. Operations-based exercises can help identify research needs through an examination of the root cause behind problem areas. Expanded analysis during the exercise evaluation process can, and should, be used to identify research that other parties could undertake to provide additional information useful to the response community.

REFERENCES :

Allen Press, Inc. 2013. IOSC Proceedings Website (www.ioscproceedings.org) Accessed December 31, 2013.

Great Lakes Commission Emergency Preparedness Task Force (GLCEPTF). 2012. Emergency Preparedness and Response Programs for Oil and Hazardous Materials Spills: Challenges and Priorities for the Great Lakes – St. Lawrence River. Great Lakes Commission, Ann Arbor, Michigan. September 2012

ICCOPR. 2014a. Oil Spill Research and Technology Plan [In preparation – to be released in 2014]

ICCOPR. 2014b. Interagency Coordinating Committee on Oil Pollution Research Biennial Report to Congress for Fiscal Years 2012-2013. In preparation [insert date]

NSF. 2014. Definitions of Research and Development: An Annotated Compilation of Official Sources. National Science Foundation, Washington, D.C. Available at http://www.nsf.gov/statistics/randdef/start.cfm. [Last accessed March 17, 2014]

USCG. 1998. ST Piney Point - UNEX PREP – 98 After Action Report 15 Dec 1998 – 15 Dec 1998.

USCG. 1999. Providence PREP After Action Report 21 Sep 1999 – 24 Sep 1999.

USCG. 2000. Port Readiness Exercise (PRX) - Anchorage, AK After Action Report

USCG. 2004. Prince William Sound Area Exercise 2004 (PWS AreaEx) After Action Report 04 Aug 2004 – 05 Aug 2004

USCG. 2008. MEXUSGULF 2008 After Action Report 03 Jun 2008 – 05 Jun 2008. August 14, 2008

USCG. 2009. VOSS Equipment Deployment Exercise-CGC Sturgeon Bay – FY09 After Action Report 01 Jun 2009 – 03 Jun 2009.

USCG. 2012. Canada/United States Dixon Entrance (CanUsDix) 2011 Exercise After Action Report. February 27, 2012

USCG. 2013. CGSails Database found at: http://cps.uscg.mil/cps/iCGSails/RetrieveReports/NonSSI/ReportList.asp. Accessed December 31, 2013

U.S. Department of Homeland Security (DHS). 2013. *Homeland Security Exercise Evaluation Program (HSEEP).* April 2013 (source 1)

U.S. Department of Transportation, U.S. Coast Guard Research and Special Programs Administration, U.S. EPA, and U.S. Department of the Interior. 2002. National Preparedness for Response Exercise Programs (PREP) Guidelines. August 2002. (available at http://www.au.af.mil/au/awc/awcgate/uscg/prep_gid.pdf).