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2014 INTERNATIONAL OIL SPILL CONFERENCE

Oil Spill Simulants Workshop Process and Outcomes

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ABSTRACT 299661:

In March 2013, a high-level workshop of national experts was held to consider the potential permitting and use of oil simulants in U.S. waters to improve oil spill response planning and operations. The workshop was the culmination of a six-month workgroup process that brought together researchers and responders with knowledge and experience in oil spill response, research and development, spill modeling, and regulatory oversight.

While nationally focused, the project was spearheaded by Alaska, where stakeholders and regulators had recognized the need for a simulant material to support research and development, testing spill response technologies, and training responders for Arctic and sub-Arctic spill response. The workshop yielded a strong consensus that there is a need for simulants to facilitate advances in oil spill response technologies, research and development, and training. There was also agreement that the current permitting regime is uncertain and untested, that a pilot project was needed to test the potential to permit an oil simulant release, and that there was a need to include oil simulants in the national response framework.

INTRODUCTION:

Background

The Prince William Sound Regional Citizens' Advisory Council (PWSRCAC) initiated the Oil Simulants Project to develop consensus among stakeholders regarding the use of simulant materials in Alaskan waters. PWSRCAC recognized that countries such as Norway, that allow the occasional experimental release of oil into the environment to test spill response equipment and tactics, are also recognized as the source of some of the most advanced on-water oil spill response technologies (Dickens, 2011 and D.F. Dickens and Associates et al., 2011). By contrast, intentional oil spills are not generally permitted in the US: the last experimental oil release was conducted in 1994 to test shoreline cleaners (Venosa et al., 1996).

Through their ongoing participation in drills and exercises in Prince William Sound, PWSRCAC observed that on-water response exercises incorporating oil surrogates provide an added element of realism. Particle-based surrogates, such as cedar chips or rice hulls, provide a target for responders and help to evaluate the effectiveness of booming tactics. Liquid simulants might provide a similar benefit for evaluating skimming and recovery systems, but the permissibility of releasing a liquid oil simulant during drills or exercises is unclear.

PWSRCAC initiated the Oil Simulants Project to explore whether oil simulants might provide a reasonable alternative to intentional oil spills and provide a pathway to improve oil spill preparedness. Simulants may afford better training opportunities for responders and allow for the testing of technologies and tactics used for tracking, containing, and recovering oil in the environment, and at a larger scale than test tanks. Incorporating an element of realism to oil spill drills by physically recovering substances from the environment may increase responder efficiency and investment in drills, while adding to observers' ability to make realistic predictions of response effectiveness. Using simulants to test technologies and tactics for tracking oil provides an opportunity to gauge and evaluate real-world applications and may enhance the ability to accurately track and predict the movement of oil on water. The Oil Simulants Project sought to identify preferred simulants that are permissible under international, federal, and select state and local regulatory regimes around the country, and to clarify the regulatory and permitting context for their use in Alaska waters.

National Focus

Though initially focused on Prince William Sound, PWSRCAC recognized that other regional entities shared their interests and that federal agencies may have permitting authority, under the Clean Water Act, over the release of simulants into the marine environment. The project was expanded to consider the current status of federal simulant permitting requirements and to determine whether a national policy was needed to incorporate oil simulants into response preparedness and research and development. PWSRCAC partnered with the Oil Spill Recovery Institute (OSRI) and the Spill Control Association of America (SCAA) as project co-sponsors, and contracted Nuka Research and Planning Group, LLC, as project facilitator.

Workgroup Formation and Charge

A workgroup was formed, consisting of subject matter experts with knowledge and experience in oil spill response, research and development, spill modeling, and regulatory oversight. Participation was by invitation, and the group's composition was balanced to ensure that the participants had the knowledge and authority to contribute to the project. In addition to the project sponsors and contractor, participating organizations included the Alaska Department of Environmental Conservation (ADEC), the Association of Petroleum Industry Cooperative Managers (APICOM), the Bureau of Safety and Environmental Enforcement (BSEE), the Cook Inlet Regional Citizens Advisory Council (CIRCAC), the Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration (NOAA), The Pew Charitable Trusts, the Pacific States/British Columbia Oil Spill Task Force, the United States Coast Guard (USCG), the University of New Hampshire Coastal Response Research Center (CRRC), and Washington Department of Ecology.

Workgroup members were provided with background materials, including a 2008 white paper on the suitability and use of specific oil simulant materials (SAIC, 2008) and a briefing document that framed the issues and provided an overview of the workgroup process, goals, and intended outcomes (Nuka Research, 2013). The workgroup met several times via teleconference in advance of a one-day workshop held in Seattle in March 2013. The workshop yielded several consensus items regarding the need for a national policy regarding oil spill simulant permitting and use to enhance oil spill preparedness and response.

METHODS:

Oil Simulants Workshop

The Oil Simulants Workshop was held on March 21, 2013 at the NOAA Sand Point Campus in Seattle, WA. The workshop objectives were to:

- Determine if there is general consensus that oil spill simulants and/or experimental releases of oil are needed to improve oil spill response technologies and tactics in the US.
- Identify preferred substances for use as simulants in on-water oil spill response exercises and equipment trials.
- Identify state and federal permitting requirements for simulant materials or experimental oil releases to be used in on-water oil spill response exercises and equipment trials.
- Determine whether blanket permits may be issued for simulants or experimental releases to facilitate on-water oil spill response exercises and equipment trials while minimizing harm to the environment.

The workshop was organized into two panel discussions focused on specific issues and culminated in a group discussion where consensus items were established and next steps identified.

Panel Discussion: The Need for Simulants

The goal of this panel-led discussion was to establish a consensus about the need for oil simulants in the US. The session began with panelist presentations followed by a facilitated discussion. The discussion encompassed four broad topic areas: trajectory modeling, booming and containment, on-water recovery and skimming, and Arctic spill response. Panelists represented NOAA, PWSRCAC, the USCG Research and Development Center, SCAA, and APICOM. The major discussion questions were:

- Why are simulants needed?
- What purpose would simulants serve that cannot otherwise be accomplished?
- In what environments/settings would simulants be used?
- What types of simulants are best suited to each particular need?

- How are simulants being used at present?
- Are there alternatives to simulants?
- What are the costs and impacts associated with simulant use?

During the group discussion at the end of this session, a "business case" for simulant need was articulated, and issues requiring further exploration were identified.

Panel Discussion: Federal Permitting Requirements

The goal of this panel-led discussion was to identify the permitting authorities and requirements governing simulant use in US waters. The session began with panelist presentations followed by a facilitated discussion. Panelists represented EPA, BSEE, NOAA, USCG Headquarters, and the National Response Team (NRT). The major discussion questions were:

- Which agencies have permitting authority?
    - What is each agency's regulatory purview?
    - Are there specific permits/processes in place?
    - Who are the key individuals/departments with oversight/approval authority?
- Recent experience with federal permits for simulant use:
    - Have permits been issued in the past? To whom? For what purpose?
    - What are the criteria for issuing permits (retrieval, reporting, substance type, etc.)
- What actions are needed to streamline permitting requirements and make sure they are clearly understood?

The outcome of this panel discussion was to establish a common knowledge base regarding federal permitting requirements.

Group Discussion: Parameters for Oil Simulant Use

A facilitated group discussion provided an opportunity for participants to share information and experience in the use of oil simulants for training purposes. The discussion addressed liquid- and particle-based simulants, and provided an opportunity to review past experience and explore the benefits and drawbacks of specific simulant materials, including their environmental impacts, ease of recovery, costs, and other considerations. The outcome of this discussion was a synthesis of current practice and state-of-knowledge regarding the present use of oil simulants in training and research and development worldwide, with a focus on the U.S.

DISCUSSION: NEED FOR SIMULANTS

There was strong consensus that a need for simulants to improve oil spill response exists and must be clearly articulated to regulators and the public.

Business Case for Use of Oil Simulants

Simulants add realism to drills and exercises. Simulants can illustrate efficiency losses in on-water recovery through loss of containment, encounter rates, and other processes. They provide a target and incentive for responders and drill participants, and can remove the sense of "make-believe" that pervades some drills. Training to use oil recovery equipment without actually recovering anything is analogous to training firefighters without fire present. The manner in which oil spill response equipment and personnel are trained is different than most other sectors; simulants provide an opportunity to change the manner in which spill responders train and exercise.

Simulants also provide an opportunity to test response system components that are often missing in drills and exercises. For example, liquid simulants require decontamination and waste management: two elements of spill response that are rarely practiced. Simulants could be used to train field observers for a variety of spill response functions.

Simulants present an opportunity to foster continuous improvement in spill recovery technologies. While both government and industry engage in research and development, there is no clear incentive system for improving efficiency in on-water recovery systems, as long as they meet basic regulatory standards. The use of simulates to calibrate oil recovery would provide a quantitative measure of system performance that could be used to compare techniques and foster decision-making. They may be used to measure and calibrate response system performance under real-world conditions. The need to improve the ability to estimate on-water response system recovery rates has been long recognized, and recent work has gone into developing better models for connecting planning assumptions to actual capabilities (Genwest Systems, Inc., 2012). Response effectiveness estimates developed through simulant-based testing and exercises provide an opportunity to foster measurable improvement in tactics and equipment for oil recovery.

Simulants also have value to modelers, because they may be used to validate modeling assumptions.

Present Use of Simulants

There is no clear national policy governing the use of oil simulants. Simulants are used more frequently in jurisdictions where there are processes and procedures in place for using them. Regions where simulants have been recently used include New England, California, Alaska, Florida, and the Great Lakes. There are some jurisdictions, like Washington State, where it is very unlikely that simulant use would be permitted. Particle-based simulants are used more frequently than liquid simulants, primarily for on-water containment or geographic response plan/strategy (GRP/GRS) exercises. Participants had firsthand experience with a range of liquid and particle-based simulants including: dyes, dog food, popcorn, rice hulls, oranges, grapefruit, cotton seed hulls, coconuts, peat, tracking buoys, drift cards, sugar cane, sorbent pads, and other miscellaneous fruits and vegetables.

There are significant knowledge gaps, even among oil spill professionals, about the extent to which simulants are being used and the lessons learned through their application. There is a need for better knowledge management, and for a clearinghouse of information on simulant use, research, and lessons learned.

Suitability and Constraints of Simulants

There are pros and cons associated with each simulant material such as ease of physical recovery, environmental toxicity, availability, and cost. Particle-based simulants are more appropriate for nearshore use, boom testing, and more frequent use. Liquid-based simulants may be more appropriately used offshore, less frequently, and only when there is sufficient justification for their use.

Participants had experience with a range of particle-based simulants. Field experience with liquid simulants was limited to dyes, and the group was not familiar with any liquid simulant material that would behave like oil but not actually be made from some oil-based material, whether petroleum based or other types of oil.

It is difficult to conceive a non-oil based simulant that would match the complex and changing nature of oil when it is spilled to the environment. Any liquid simulant that closely approximated oil behavior would have the potential to adversely impact wildlife. Any oil-based liquid simulant, even non-petroleum based, has potential toxicity. Birds and mammals are vulnerable to coating by any oil. Some oils – like fish oil – may actually attract wildlife. It is subjective to apply terms like "safe" to simulants. It may be more effective to come up with criteria for acceptable risks.

There may not be a one-size-fits-all simulant. It is more likely that different materials will be appropriate for different environments and testing or research objectives. In some cases, more than one type of simulant might be used during a test or exercise. For some purposes, it would be useful to have simulant materials that can be broadcast across a large area to better simulate how oil slicks spread and diverge. It may be appropriate to establish geographic or seasonal parameters for simulant use, similar to the process used for dispersant use authorization.

There is interest in developing simulants that can be used to model submerged and sunken oils, as well as submerged oil plumes. A related topic of study would be the development of simulants to model sinking in-situ burn residues. Simulants could also be used to better understand how oil behaves in ice packs and flows.

Costs and Impacts

Simulant costs vary, but most particle-based simulants are generally inexpensive and readily available. The cost of simulant materials should be weighed against the total cost of the exercise. The incremental cost of incorporating simulants into a large-scale exercise may be minimal by comparison to the total exercise budget, although the cost considerations for simulant use should also factor in ancillary costs like additional labor to recover or remove the substance. Because simulants provide an opportunity to enhance realism and improve evaluation of response tactics, field exercises that do not use simulants may be missing the opportunity to enhance the overall training and preparedness value.

Net environmental benefit should be considered in determining when and how to use simulants. There could be situations where the knowledge gained from simulant use outweighs the potential environmental harm.

Alternatives to Simulants

There are several alternatives that provide similar benefits to oil simulants, and any consideration of the need for simulants should weigh their benefits and drawbacks against these other options. Simulant alternatives include experimental oil spills, opportunistic testing during actual spills or at sites of natural oil seeps, and laboratory, bench or wave tank tests.

Experimental spills are typically limited in size and held in less sensitive environments (e.g. offshore). Experimental oil spills are not typical in the US, but are used in other countries. Norway has a process in place to conduct experimental oil spills to improve spill response equipment and tactics. Canada has also had experimental oil spills in the past. Since experimental spills are infrequently conducted, they must be done with significant pre-planning and maximum efforts to extract as much information as possible. Norway is encouraging other countries to consider experimental spills to continue to build the body of knowledge, and the US Interagency Coordinating Committee on Pollution Research (ICCOPR) is involved in ongoing discussions. A critical issue to consider is whether and how oil simulants might provide a more benign alternative to intentional spills.

While intentional spills are not used in the US, actual oil spills can and have been used to test response techniques. Natural oil seeps also provide an opportunity to conduct exercises or experiments under field conditions.

Because of the limited opportunities to conduct drills or test equipment in the field with actual oil, laboratory, bench and tank tests are frequently used instead. There was strong concurrence that a liquid simulant that could be safely used in the field would provide a number of advantages over laboratory and tank tests. There are many situations that cannot be addressed or replicated in test tanks or laboratories, including wind and wave interactions, variability in currents and sea state, and sea ice behavior and movement and oil-ice interactions. Tank tests are typically very artificial, and are often focused on individual components rather than full response systems. Field trials using oil simulants might be used to validate or calibrate test tank results.

DISCUSSION: REGULATIONS AND PERMITTING

The US national regulatory and permitting backdrop for simulant use is unclear, even to the regulatory agencies. This discussion focused on capturing the knowledge and agency doctrine of participants and considering potential permitting pathways for future oil simulant applications in US waters.

Agency Authorities

The Clean Water Act emerged as the statutory authority best fit to oil simulant use, giving the EPA primary authority under the Office of Water. EPA representatives concurred, but recognize that additional work was needed to clarify authorities and permitting processes.

The Refuse Act may also have some role in permitting oil simulant use, but federal agency primacy is unclear. Other agency permitting or regulatory authority may be triggered by violations (e.g. disturbing fish habitat or endangered species), but these do not require advance permitting. However, anyone using a simulant must be aware of activities and impacts that should be avoided.

Application of Existing Permitting Processes

Not only is there is no permitting process in place specifically designed for oil simulants (liquid or particle-based), but the permitting pathway for each type of simulant is probably different. It is unclear whether particle-based simulants necessitate federal permits; recent examples of particle-based simulant use during drills and exercises, when permitted, were done through state authorities. The two major permitting pathways for liquid simulant use appear to be (1) experimental oil spill for research purposes and (2) National Pollution Discharge Elimination System (NPDES), both of which are under EPA purview. In addition, the National Product Schedule under the National Contingency Plan (NCP) was considered as a possible pathway to pre-authorize simulants but there is no clear nexus between simulants and the Product Schedule, which was developed for oil-treating agents. (The EPA indicated that it would initiate additional internal discussion as to whether there is a place for simulants on the Product Schedule or separately under the NCP.)

Regarding the permitting for liquid simulants for research or under NPDES, both terminology and thresholds are important. Are simulants intentionally added to the water a "contaminant" or "pollutant"? To the extent that a liquid simulant could be considered a "pollutant" under federal regulations (40 CFR 112.2), it may be possible to use an intentional oil spill for research permitting process for a liquid simulant release.

Since simulants are not used during a spill but as a training or research tool, they would likely be considered a pollutant rather than a spill treating agent.

NPDES has never been applied to a liquid simulant, but it may be a pathway for blanket national approval. While NPDES may also be used for individual exercises, this would be an unusual application of that permitting process.

Since existing permits and tools like the Product Schedule are not directly applicable to simulants, it was suggested that a new regulatory process be established to pre-qualify substances to be used as oil simulants, roughly analogous to the one in place for the NCP Product Schedule. If simulants could be vetted at a national level, then Regional Response Teams (RRT) or On-Scene Coordinators (OSC) could direct their use at a state/regional level. It was agreed that while a regulatory process would provide opportunity for public and stakeholder review, and would address many of the unique considerations of simulants, it may be extremely lengthy and not necessarily successful.

It might be possible to incentivize the use of simulants through oil spill contingency plan approvals, drill and exercise programs, or oil spill removal organization (OSRO) certification. Creating such a requirement would help to justify the need for permitting simulants. However, this is a complex issue and there is a bit of a Catch-22. Regulators cannot require the use of

substances that have no clear permitting process or approval. Properly securing all applicable permits does not necessarily remedy the issue of potential liability or responder immunity.

Past Permit Experience

It became clear during this workshop that there is a general lack of clarity regarding the legal and regulatory requirements for simulant use. Some past exercises with particle-based simulants have had permits or approvals issued by state regulatory agencies, while others have proceeded with no associated permits.

The only federal permit ever issued for an experimental oil spill was in 1994, in Delaware. The permit was used to oil a shoreline segment to conduct experiments on bioremediation agents (Venosa et al., 1996). No permit applications have been filed with EPA for experimental oil spills since 1994. There have been no federal permit applications for the use of liquid or particle-based simulants.

Way Forward for Federal Oil Simulant Permits

While state tolerance of simulant use seems to vary, a more defined national policy might facilitate state approval of simulants. The working group suggested that national policy should provide both a decision-making framework and a clear permitting process that could be used to provide a uniform federal standard. A decision-making framework, such as an ecological risk assessment, might help to inform decisions about when simulant use is appropriate or when environmental risks are acceptable. The permitting framework may need to address threshold quantities of various simulant substances, or this could be left to local or state jurisdictions. Threshold values will likely vary by location.

Developing a pathway for simulant permitting is the first step. The next step will be incorporating simulants into national preparedness, in cooperation with the NRT, whose role is to create federal guidance regarding oil spill preparedness and response. As with all successful and important policy, it is critical that industry, oil spill response organizations, stakeholders, and the public should be part of the process.

In support of developing a simulant policy, there is also a need to catalog existing science on environmental impacts of the various simulant materials. Additional information should be compiled as needed about the permitting processes in other jurisdictions, such as Norway and Canada, allowing us to benefit from their experiences and potentially making the implementation process more efficient.

CONCLUSION:

The Oil Simulants Workshop yielded a number of consensus decisions regarding oil simulant use in US waters.

There were several consensus decisions about the value of simulants in enhancing spill response technologies and methods:

- Simulants provide a mechanism to evaluate and improve oil response technologies. Information collected through simulant use could supplement

experience from actual spills, which are infrequent, and tank trials, which lack realism.

- Simulants provide a target and incentive that may enhance the training and preparedness value of exercises.
- There should be incentives to use simulants to measure and improve response capacity.
- Before simulants can be incorporated into oil spill training and exercises, there must be a clear path for permitting approval.

There was also consensus about the need for a clear national policy and process:

- Oil spill simulants should be built into the framework of national spill response policy using a broad, inclusive process.
- The NRT should issue a simulant policy, with input from other regulatory agencies.
- The rationale and need for simulant use needs to be clearly communicated to stakeholders and the public. The national policy development process should be inclusive of all stakeholders.
- Once a national policy is in place, states or regions should have the opportunity to build on or refine their own local requirements.

There were several consensus decisions about the inputs that should be considered in simulant use decision-making:

- The type of simulant used should be linked to the exercise/training/research objectives, the operating environment, the equipment and tactics being tested, and the environmental sensitivities.
- Liquid and particle-based simulants differ in purpose and will likely require different permitting efforts.
- The principle of *causing the least harm commensurate with meeting the objectives of simulant use* should guide the selection of the correct simulant for each application.
- There may be tradeoffs involved in using simulants, and the potential for toxicity and wildlife impacts must be considered. A systematized approach such as net environmental benefit analysis or ecological risk assessment could be used to assess potential impacts and benefits.

Finally, there was consensus that better knowledge management is needed:

- Major knowledge gaps exist regarding past and present use of oil simulants in field exercises. A state-of-knowledge review is needed to catalogue how simulants have been used and permitted in the past.

- A knowledge-management system should be developed to collect and catalogue information going forward. Compilation of ongoing information and study outcomes might inform decisions about future use of simulants and could also be valuable in making permitting decisions.

REFERENCES:

Clean Water Act. 33 U.S.C. §1251-1387.

Dickins, D. (2011). *Behavior of Oil Spills in Ice and Implications for Arctic Spill Response.* Presented at Arctic Technology Conference. Houston, Texas. http://www.arcticresponsetechnology.org/wp-content/uploads/2012/11/Dickins-Review-Paper.pdf

D. F. Dickens and Associates, Ltd., SINTEF, The University Center in Svalbard, and Boise State University. (2006). *2006 Svalbard Experimental Spill to Study Spill Detection and Oil Behavior in Ice.* Final Technical Report. http://www.bsee.gov/Research-and-Training/Technology-Assessment-and-Research/tarprojects/500-599/569AC

Discharge of Oil. 40 C.F.R. pt. 110.1. (1996).

Genwest Systems, Inc. (2012). *ERDC Project Final Report.* Prepared for Bureau of Safety and Environmental Enforcement, U.S. Department of the Interior.

National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. (2011). *Response/clean-up technology research & development and the BP Deepwater Horizon oil spill* (Staff working paper No. 7*).* Retrieved from National Commission website: http://www.oilspillcommission.gov/resources

National Oceanic and Atmospheric Administration. (2010). *BP Deepwater Horizon oil budget: What happened to the oil?* Retrieved from National Oceanic and Atmospheric Administration website: http://www.noaanews.noaa.gov/stories2010/PDFs/OilBudget_description_%2083final.pdf

Nuka Research and Planning Group, LLC. (2013). *Oil spill simulants materials: Workshop briefing document.* Seldovia, AK.

Office of Emergency Management. (2010). *Application for EPA permits to discharge oil for research purposes.* Revised interim guidelines. Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency. Retrieved from U.S. Environmental Protection Agency website: http://www.epa.gov/osweroe1/docs/oil/edu/research.pdf

Oil Pollution Prevention 40 C.F.R. pt. 112.2. (2008).

Rivers and Harbors Act of 1899. 33 U.S.C. §407 *et. seq.*

Science Applications International Corporation. (2008). *Oil spill simulation materials review.* Retrieved from the Prince William Sound Regional Citizens' Advisory Council website: http://www.pwsrcac.org/wp-content/uploads/filebase/programs/oil_spill_response_operations/oil_spill_simulation_materials_review.pdf

U.S. Environmental Protection Agency. (2013). *National Pollution Discharge Elimination System permit program basics.* Retrieved from U.S. Environmental Protection Agency website: http://cfpub.epa.gov/npdes/home.cfm?program_id=45

Venosa, A.D., Suidan, M.T., Wrenn, B.A., Strohmeier, K.L., Haines, J.R., Eberhart, B.L. , King, D., Holder, E. (1996). Bioremediation of an experimental oil spill on the shoreline of Delaware Bay. *Environmental Science & Technology, 30*(5), 1764.