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Improving Planning Standards for the Mechanical Recovery of Oil Spills on Water

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ABSTRACT 300512:

As observed during several recent major oil spills, most notably the BP Deepwater Horizon Oil Spill, the current regulatory planning standard for mechanical recovery equipment has been often scrutinized as an inadequate means for vessel and facility plan holders to calculate their oil spill equipment needs. Effective Daily Recovery Capacity, or EDRC, was developed during a negotiated rulemaking process following the enactment of the Oil Pollution Act of 1990.

During an IOSC 2011 Workshop sponsored by the American Petroleum Institute (API), the Bureau of Safety and Environmental Enforcement (BSEE), and the U.S. Coast Guard, there was general agreement among workshop participants that EDRC is not an accurate planning tool for determining oil spill response equipment needs. In addition, many attendees agreed that EDRC should account for the skimmer system as a whole, not individual skimmer components such as pump nameplate capacity.

In 2012, the Bureau of Safety and Environmental Enforcement (BSEE) and the U.S. Coast Guard initiated and completed a third-party, independent research contract to review the existing EDRC regulations and make recommendations for improving planning standards for mechanical recovery. The contractor's final report methodology is based on oil spill thickness as a fundamental component in calculating mechanical recovery potential, and it emphasizes the importance of response time on-scene and storage for recovered oil. This research provides a more realistic and scientific approach to evaluating skimmer system performance, and more accurately accounts for a wide range of operating conditions and external influences.
The federal government, with input from the oil industry, OSRO community, and other interested stakeholders, now has a sound methodology to serve as a starting point for redesigning the current planning standard that more accurately reflects skimmer system performance.

INTRODUCTION:

Effective Daily Recovery Capacity, or EDRC, is a calculation method established within the United States Coast Guard (USCG) and Bureau of Safety and Environmental Enforcement's (BSEE) regulations[1, 2] which is used to assign an oil removal capability value to an individual oil skimmer. Although it was finalized in the early 1990's and has been an integral component of industry response planning and readiness for the past 20 years, EDRC came under heavy scrutiny in the wake of the Deepwater Horizon oil spill. This spurred an open debate and ongoing dialogue, started in earnest at the 2011 International Oil Spill Conference, on how to best improve the EDRC planning standard. In late 2011, GENWEST Systems Inc. was contracted by BSEE and the USCG to evaluate the EDRC methodology and to develop recommendations for improving the planning standard for the mechanical recovery of oil on water. GENWEST's final report[3] produced the concept of Estimated Recovery System Potential (ERSP), an encounter rate-based calculator that evaluates mechanical recovery equipment as a complete system as opposed to focusing on an individual component such as a skimmer or an intake pump. Shortly thereafter, BSEE contracted the National Research Council's Ocean Studies Board to conduct an independent, third party peer review of the ERSP methodology. The National Academy of Science's (NAS's) Peer Review Letter Report[4] validated the ERSP standard as a sound methodology and a significant improvement over EDRC. The peer review also identified a number of areas for further consideration where ERSP might be improved. The regulatory agencies are now reviewing all of this data, and determining what additional work needs to be completed before incorporating the ERSP methodology into a future revision of their oil spill response plan regulations.

In this paper, the authors provide a brief description of the origins and application of EDRC and of the lessons learned that emerged after Deepwater Horizon. The authors then analyze the ongoing efforts to develop an improved mechanical recovery planning standard, using information from the 2011 IOSC Workshop, the GENWEST EDRC study, and the NAS Peer Review. In conclusion, the paper addresses some critical next steps for the transition from EDRC to ERSP, and urges the regulatory community to work together and expand the dialogue in future rulemakings from improving mechanical recovery to exploring the full potential of all response options, including dispersants and in situ burning.

THE ORIGIN AND APPLICATION OF EDRC:

The current EDRC planning standard was developed as part of a negotiated rulemaking process involving federal and state government, industry, and non-governmental organizations following the passage of the Oil Pollution Act (OPA) of 1990. This regulatory methodology was intended to quantify the amount of pollution equipment (i.e. skimmers) needed by plan holders for an effective response to their worst-case discharge (WCD) spill scenario.[5] The formula for EDRC has not changed since its adoption in 1992:

$$\text{EDRC} = \text{T} \times 24 \text{ hours} \times \text{E}$$

In this formula, "T" is a skimmer's throughput (or recovery) rate in "barrels per hour" and "E" is an efficiency factor that was set at 20% (or 0.2).[1]

In practice, the method has been simply applied as the hourly throughput rate (as determined by the manufacturer's assigned nameplate recovery capacity) multiplied by 24 hours and then discounted by a 20% efficiency factor. The result is an estimate of the number of barrels (bbls) of oil that can be recovered in any given operational period. If a skimmer requires a pump that determines the throughput of fluids, the pump capacity becomes the determining factor in assigning an EDRC value to a piece of skimming equipment.

The 20% efficiency (de-rating) factor was determined through consensus by an Oil Spill Response Plan Negotiated Rulemaking Committee The de-rating factor accounts for a mix of environmental and operational considerations (such as temperature, sea state, oil viscosity, hours of daylight, the presence of debris, and the ability to separate oil and water) that would limit or reduce the effectiveness of a skimmer's capability to recover oil over a 24-hour operational period. There are other critical influences on mechanical recovery that were not incorporated into the EDRC calculation. Some of the most important factors omitted include oil encounter rate (i.e. the rate at which a skimmer is able to access spilled oil), onboard storage capacity, and human factors (proficiency in skimmer operation).[5]

The EDRC standard is currently incorporated into the regulations of three agencies: the USCG, the Environmental Protection Agency (EPA) and BSEE. This paper focuses on the application of mechanical recovery standards in the nearshore and offshore areas as administered by BSEE and USCG. Although the USCG and BSEE have adopted the same basic methodology for calculating EDRC in their respective regulations, the agencies apply them in somewhat different manners. Due to the differing nature of the WCD scenarios in USCG and BSEE regulated plans, the methods for establishing equipment requirements and reviewing equipment inventories, while similar in many ways, also have some significant differences.

Under USCG regulations, plan holders for tank vessels and marine transportation-related facilities are required to ensure that enough mechanical recovery capacity is available to remove a WCD scenario from an instantaneous "batch release" of the entire oil cargo across the entire geographic area for which a plan holder will operate. EDRC requirements differ slightly based on the type of operating environment, and all are tied to a tiered framework of response times, with EDRC levels increasing over time as the spill progresses from Day 1 to Day 3. Each day's total requirements for EDRC are capped, with the maximum levels for EDRC being established at (12,500 bbls/day for Day 1), (25,000 bbls/day for Day 2), and (50,000 bbls/day for Day 3).[1] The USCG evaluates the EDRC totals for the equipment listed in the plan (or the EDRC ratings of the classified oil spill removal organizations (OSROs) listed in the plan) against the required EDRC caps and associated response times.

In contrast, offshore energy facilities seaward of the coastline that are regulated by BSEE are required to plan for a WCD that typically results from either a leaking pipeline or a loss of well control. In the case of a loss of well control, these WCDs involve a continuous release that occurs over a minimum 30 day period, and could be potentially longer if the time to cap, and permanently plug and abandon the well will exceed 30 days.[2] EDRC levels are evaluated against the discharge daily flow rate for the WCD scenario. BSEE requirements do not include any capped levels for EDRC or any minimum or tiered response times. BSEE does not apply a fixed ratio when comparing the total EDRC listed in a plan against the WCD daily flow rate volume; instead, BSEE employs a more scenario-based equipment evaluation that factors in all the circumstances contained within each individual plan.

DEEPWATER HORIZON OBSERVATIONS AND CRITICISMS:

During the Deepwater Horizon oil spill, a seemingly unprecedented quantity of skimmers, boom, and other types of spill response equipment were cascaded in from across the United States, as well as from other nations, resulting in a massive amount of offshore mechanical recovery capability that was used during the response. Despite this effort, significant amounts of shoreline oiling occurred across the Gulf of Mexico. As a result, both government and industry-sponsored lessons learned reports identified the performance and effectiveness of skimming systems as a focal point in their observations and findings. The National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling's Final Report, BP Deepwater Horizon Incident Specific Preparedness Review (ISPR) Final Report, and Joint Industry Oil Spill Preparedness and Response Task Force (JITF) Second Progress Report all highlight the limitations of the EDRC methodology, and recommend that the mechanical recovery planning standard be improved. The National Commission report states that EDRC should be revised to encourage the development of more efficient systems.[6] The BP Deepwater Horizon ISPR Report points out that the total EDRC for equipment used on-scene during the spill far exceeded BP's mandated oil spill response plan requirements, however, this extensive armada of mechanical recovery equipment was seemingly ineffective in recovering oil anywhere near the quantities that corresponded to their aggregated EDRC values. The ISPR Report goes on to recommend that the regulations should be revised to include a reliable, dynamic efficiency measure that accurately reflects the limitations of encountering significant volumes of oil on the water, and also should encourage more research and development to improve the effectiveness of skimmer systems.[7] The JITF Second Progress Report states that government and industry must recognize the limitations of existing mechanical recovery equipment, and pursue incentives to improve boom and skimmer designs, especially in the offshore environment. Furthermore, the JITF also recommends that the government revisit the EDRC regulations in order to determine if improvements to the planning standard are necessary.[8]

One of the most publicized statistics from the Deepwater Horizon oil spill was that only 3 percent of the total amount of oil spilled was mechanically recovered. The 3% statistic is misleading and distorts reality with respect to the effectiveness of mechanical recovery equipment deployed during the incident. Much of the spilled oil was not available for recovery; some was unavoidably lost due to environmental factors such as evaporation and natural dispersion, while other quantities where successfully mitigated through other means, such as subsea containment and recovery, dispersant use, and in situ burning.. When considering the amount of spilled oil that was actually available on the sea surface to mechanical recovery operations, the percentage of recoverable oil removed was actually much higher than 3%. This fact withstanding, the Deepwater Horizon oil spill dramatically highlighted how the success of mechanical recovery systems can be significantly limited by low encounter rates. Emanating from a well nearly a mile below the ocean surface, the spilled oil surfaced over a wide geographical area and was already much reduced in terms of oil thickness. As a result, the oil slick that was available for recovery was widely discontinuous, had an incredibly large, expanding areal footprint, and a rapidly diminishing surface oil thickness. These conditions worked against the mechanical recovery task forces operating offshore, and greatly reduced their overall effectiveness in encountering, containing and recovering the oil.

CONTEMPLATING CHANGE:

Following closely on the heels of the Deepwater Horizon oil spill, government and industry began to explore the lessons learned from the incident, and started discussing ways to improve the EDRC regulation and associated calculation method.

The EDRC Workshop at the 2011 International Oil Spill Conference

At the 2011 International Oil Spill Conference, the USCG, BSEE, and the American Petroleum Institute (API) sponsored a workshop that provided the opportunity for members of the oil spill response community to exchange observations, experiences, and opinions related to the EDRC planning standard and other topics related to the mechanical recovery of oil. Representatives from the federal government, oil industry, shipping industry, OSRO community, American Society for Testing and Materials (ASTM), and GENWEST Systems, Inc. delivered brief presentations and then engaged the audience in a facilitated discussion. The general consensus among workshop participants was that EDRC should account for influences on mechanical recovery that were not included during the development of the current regulations, such as encounter rate, and also should evaluate the entire skimming system as a whole rather than a few specific components.[5]

The USCG and BSEE announced their intent to review the current regulations and to look for a more accurate systems-based measure of a skimmer's recovery potential. The agencies also expressed an interest in creating incentives that would encourage the development and acquisition of more efficient skimming systems. ASTM stated that existing standards, such as ASTM F2709-08, might be useful in informing EDRC improvements. Representatives from the oil industry stated that they are looking at ways to improve encounter rate, and recommended that the government adopt standards that employ all available response options (including dispersants and in-situ burning) in the offshore environment.

The OSRO community emphasized that EDRC is a planning tool that sets the baseline for measuring the adequacy of equipment listed in response plans, but was never intended to represent actual performance during a spill. They stressed how the current EDRC methodology and associated equipment requirements define business relationships and agreements between plan holders and the OSRO community, drive capital investment, and influence equipment inventories. The OSRO community also endorsed the use of ASTM standards as a means to evaluate system improvements and create a level playing field, and mentioned the need to enhance skimming system technologies through more research and development.

GENWEST Systems, Inc. provided an overview of several web-based spill planning tools they developed for use by government and industry with a focus on the Response Options Calculator (ROC). In particular, they highlighted how the ROC, as an encounter rate-based response model, can be used to account for the spreading of oil and other parameters that influence a skimming system's actual recovery potential.

The workshop highlighted that EDRC is an important issue to many different groups for many different reasons. Most could agree on some fundamental statements: the existing EDRC methodology should be improved, encounter rate and a systems approach were critical missing elements, and that advances in skimming technology, as well as improvements in surveillance and equipment spotting techniques, could improve the effectiveness of mechanical recovery systems. Almost all participants felt, however, that the oil spill response plan regulations needed to embrace a "complement of response options", including dispersants and in situ burning, in order to be fully effective as in mitigating the impacts of an oil spill.

The EDRC Study

Following the IOSC EDRC Workshop, the USCG and BSEE initiated a third party, independent research contract to 1) evaluate existing EDRC methodologies, 2) examine de-rating in order to identify the key variables that impact skimming system recovery rates, 3) develop recommendations for an improved mechanical recovery planning standard, and 4) create a user-friendly, computer-based planning tool based on those recommendations. GENWEST Systems, Inc. was awarded the research contract in September 2011 and completed their final project report in December 2012.

The capstone of the GENWEST report is a new methodology and computer-based calculator for estimating mechanical recovery capability called the Estimated Recovery System Potential (ERSP) Calculator.[3] Based on algorithms similar to those within the ROC, the ERSP calculator is an encounter-rate based planning tool that measures the performance of an entire mechanical recovery skimming system.

The ERSP calculator addresses the effect of encounter rate on a skimmer through three key variables: the swath width of the skimming system configuration, the speed of advance of the skimming system relative to the motion of the oil slick, and the thickness of the oil being collected. The calculator uses three different nominal oil thicknesses that decrease with time over a 3-day period in order to model the reduced amounts of oil available to a skimming system due to the effects of spreading. The selection of the nominal oil thickness values (0.1 inch for Day 1, 0.05 inch for Day 2, and 0.025 inch for Day 3) are based on the results of over 400 computer simulations of oil spreading where temperature, wind, discharge volume, and oil type were varied in different combinations. The three resulting thicknesses that were selected are representational values that are reasonably acceptable across a wide range of scenarios. The calculator enables the plan holder to input customized values for both the swath width and the speed of advance for a skimming system, which are then used to estimate areal coverage for a recovery system during an operational period. The calculator then applies the nominal oil thicknesses to the areal coverage achieved in order to estimate the volume of oil encountered.

The next steps in the ERSP methodology apply the "recovery" parameters of the skimming system to the amount of the oil encountered. These parameters include an estimate of the oil recovered compared to the total volume of the fluids recovered (i.e. the oil/water recovery ratio otherwise referred to as the system's Recovery Efficiency), an estimate of the oil removed compared to the oil encountered (i.e. the effectiveness of the containment and removal elements of the skimming system as opposed to entrainment of the oil, referred to as Throughput Efficiency), the skimmer nameplate recovery rate, the amount of onboard fluid storage, decanting or oil/water separation abilities, intake and offload pump rates, and offloading set up and transit times. The application of the "encounter rate" and "recovery" system variables, when applied to the available oil thicknesses on any given day, create estimates of the system's effective recovery potentials for Day 1, Day 2 and Day 3 of a spill. If a skimming system's configuration remains fixed over time, then the recovery potential of the system will decrease from day to day as the oil available for skimming also decreases; however, a skimming system's configuration can often be adjusted during subsequent operational periods to maintain or minimize the loss of recovery potential.

The National Academy of Sciences Peer Review Letter Report

In the spring of 2013, BSEE contracted the National Research Council's Ocean Studies Board to conduct an objective technical evaluation of the GENWEST EDRC report and the ERSP methodology. The Ocean Studies Board assembled an ad hoc study committee of five subject matter experts that completed and delivered their Peer Review Letter Report in November of 2013.[4]

The Letter Report concluded that the ERSP methodology was sound and a substantial improvement over the current EDRC methodology. While the Committee cited many improvements, they felt that the greatest strength of the new ERSP methodology was its evaluation of the entire skimming system as a whole as opposed to any single part of it.

The Committee's most significant concerns regarding the ERSP's methodology focused on the nominal oil thicknesses selected by the GENWEST team. These thicknesses were meant to be representative of the "thickest" oil available during each operational period. The ERSP methodology assumes that a skimming system will be able to operate in oil at these nominal thicknesses for the entire time it is skimming on the first three days. The Committee, however, felt that the real distribution of thick oil will be discontinuous, or patchy, and that the ERSP model should address this factor in its calculations. The Letter Report also goes on to suggest that some field observations for slick thicknesses are generally less than those used by the ERSP calculator. The Committee concluded that the GENWEST thicknesses are likely to overestimate actual encounter rates and would provide an overly optimistic assessment of skimming system's actual recovery potential. The Committee recommended applying a "patchiness de-rating factor" to the encounter rate calculation, and also suggested adding the ability to enter different oil thickness values into the calculator. Encounter rates would then be adjusted for the discontinuous nature of the thick oil patches, and more customized thicknesses could be entered into the calculator based on the circumstances of the release scenario and the particular properties of the plan holder's oil type.

The Committee also recommended that regulators work with the GENWEST team to develop a more detailed user manual that would further explain the ERSP calculator assumptions, provide additional guidance to users on the selection of certain input values, and would provide default values for some of the more uncertain or unknown parameters. The Committee also recommended the use of the ASTM standard F2709-08, as the means to estimate the Nameplate Recovery Rate value in the ERSP calculator. Finally, the Committee recommended that a broader "systems of systems" approach using all potential response options should be considered in future rulemakings, and that other calculators similar to the Dispersant Mission Planner 2 (or a similar tool) should be used in conjunction with the ERSP calculator in the offshore environment.

MOVING TOWARD AN IMPROVED MECHANICAL RECOVERY STANDARD: STRENGTHS, WEAKNESSES, AND NEXT STEPS FOR ERSP:

The GENWEST EDRC study provides a solid foundational work for building an improved mechanical recovery planning standard. The ERSP methodology has necessarily sacrificed the increased accuracy of a more complex and customizable model in order to create a simple, accessible planning tool that is applicable across a wide range of planning scenarios. In striking this important balance, the ERSP methodology successfully addressed many of the criticisms levied against EDRC, but was also forced to incorporate some key compromises into its assumptions and algorithms that regulators will have to examine carefully.

ERSP Creates Incentives for More Effective Skimming Systems

The ERSP methodology is a practical approach to evaluating skimming systems that includes incentives for improving system performance. The ERSP calculator rewards skimming systems that maximize encounter rate and minimize skimming downtime during offloading periods. The calculator provides plan holders and OSROs with a very useful tool for assessing and comparing different configurations for almost any type of skimming system. Plan holders can experiment with variables, such as swath width, speed, decanting, onboard storage, and pump rates, in order to explore the effects on encounter rate and recovery potential. Plan holders and OSROs will be able to identify the parameters that will best increase a system's recovery potential, and should be able to use this information to guide their design, investment, and operational deployment decisions.

The calculator's algorithms will encourage plan holders and OSROs to acquire and configure skimming systems with higher areal coverage rates (through increased swath widths or increased speed over ground), higher nameplate capacities and recovery efficiencies, and more effective collection and containment arrangements that limit entrainment. The calculator will also create incentives for developing skimming systems that have increased onboard storage, faster oil transfer rates, and effective decanting capabilities.

Challenges in the Nearshore and Inshore Operating Areas

ERSP algorithms and operating incentives are well suited for offshore skimming operations, but are less so for the nearshore and inland operating areas. Decanting in the offshore environment provides a tremendous advantage that maximizes the use of onboard storage and reduces offload times. However, decanting is not realistic for many nearshore and inshore scenarios. In more confined, shallow areas, skimming systems with large swath widths and large onboard or tethered storage solutions are likely to be ineffective. Advancing skimmers used in nearshore areas will still require high recovery efficiencies; however, shallow drafts and maneuverability now become more important than large swath widths and bulky onboard storage arrangements. As a result, existing stocks of nearshore skimming systems are likely to have ERSP potential values significantly below their EDRC ratings, despite being optimally configured for their operating environments. Mechanical recovery in inshore areas is even more disassociated with many of the incentives of the ERSP calculator, as mechanical recovery in these settings often relies on deflection and collection booming and stationary skimming arrangements.

While ERSP may still be a useful measure of potential in the nearshore area, regulators will have to set limits on the use of certain ERSP variables, such as swath width and decanting. Regulators will also have to consider adopting a mixture of different equipment rating schemes and requirements for mechanical recovery in these areas. The rating of skimming systems and the reviews of oil spill response plans in these operating areas may require a more scenario-based approach than regulators have used in the past.

Emphasis on Rapid Response

As the calculator applies substantially decreasing oil thicknesses over the first three days of a spill, the ERSP methodology creates a powerful incentive for skimming systems to arrive onsite as quickly as possible. The calculator clearly demonstrates that plan holders and responders will reach a point of diminishing returns for bringing in additional mechanical recovery equipment as time progresses and oil becomes less available for skimming. While this circumstance is somewhat mitigated during a sustained release such as a well blowout (where there may be fresh, thick, concentrated oil available each day), the fact remains that mechanical recovery equipment performs at its highest recovery potential in the earliest hours of a spill when encounter rates can be maximized.

This facet of the ERSP calculator implies that changes may be necessary that go beyond simply changing the methodology from EDRC to ERSP. The USCG should weigh the costs and benefits of increasing the cap for Tier 1 response capabilities, while BSEE should consider establishing Tier 1 response times and capability levels that must arrive on site on the first day of a spill and begin operations as quickly as possible.

ERSP does not Address Staging, Mobilization, or Delivery Times

While the ERSP methodology emphasizes a rapid response, it does not factor into its calculations the time it takes to mobilize and deliver a skimming system to the site of a spill. GENWEST, at the direction of BSEE and the USCG, used a fixed operational period of 12 hours for the EDRC Study, and did not incorporate the effects of equipment mobilization and delivery times on recovery potentials. The ERSP calculator does, however, have an input variable for each day's "operating period", which could be reduced to account for these factors related to response time.

OSROs and plan holders could adjust the operating period accordingly if guidance is provided by regulators on how to account for each mobilization factor. As noted earlier, BSEE does not factor response times into its regulations and currently does not require adjustments to EDRC values based on mobilization times. The USCG, however, does have mobilization factors within its existing regulations (and OSRO classification system) that are used to account for response times and adjust EDRC totals. Additional guidance will be needed in order to adequately account for mobilization times when inputting the operational period into the ERSP calculator.

ERSP Calculations Assumes the Use of Best Practices and Best Available Technology

In the selection of representative oil thicknesses for each operational period, the ERSP calculator assumes that operators will be using best available technology and best practices in their skimming operations. This is especially important for ensuring operator proficiency, and for identifying, tracking, and keeping recovery systems in thick oil continuously during skimming operations. If operators do not employ such technology and best practices, then the ERSP calculator is likely to provide an overstated recovery potential for a system. The calculator does not include any built in incentives for the use of these critical best practices and technologies. Creating these incentives or requirements will therefore have to be addressed through regulatory requirements, industry standards, and recommended practices.

More Guidance is Necessary for the Use of Some ERSP Variables

The NAS Peer Review Letter Report raises some important issues for regulators to consider as they begin to develop a regulatory solution for improving the existing EDRC methodology. In particular, the NAS Committee recommendations to further explore and define the use of various input variables in the ERSP calculator are important next steps.

ASTM F2709-08 offers promise as a low cost, easily replicated test for producing Nameplate Recovery Rates values. This testing method provides an assessment of optimal recovery rates measured under ideal skimming conditions, however, the regulations call for equipment capabilities that are able to respond to a WCD under adverse weather conditions. To address this issue, BSEE has been in discussions with the ASTM F20 Committee with regards to any necessary changes that might need to be considered for the F2709-08 standard. Regulators could also consider whether they should apply any de-rating factors to the Nameplate Recovery Rates for a given skimmer before it is entered into the ERSP calculator.

Recovery efficiency, or the volume of oil recovered in comparison to the total oil/water mixture recovered by the skimming system might also best be determined in a controlled setting such as a test tank like the Ohmsett testing facility in Leonardo, New Jersey. Throughput efficiency, or the volume of oil encountered in comparison to the volume of oil that is actually recovered by the skimming system, is more difficult to test, even in a controlled setting; however, protocols should be considered for the proper measurement of this input value.

Where tank testing may not be practical, other options, such as the use of government and industry working groups to develop consensus-based values, may be an effective option. This may be the most feasible means to establish an acceptable range of values for some of the key ERSP variables, such as emulsification and recommended swath widths in nearshore applications.

The discussion at the 2011 IOSC workshop highlighted the multi-faceted and complex issues at stake with the EDRC standard. Changes to this foundational planning standard can have far reaching implications and impacts, both economically to industry and the OSRO community, as well as functionally to the nation's overall response inventory. Regulators will have the especially challenging task of balancing the accuracy (and complexity) of any calculators such as ERSP with the necessity to maintain a relatively simple planning tool that is easy to understand and use by plan holders, OSROs, and plan reviewers. While there is much to gain in adopting an improved mechanical recovery planning standard such as the ERSP methodology, a deliberate and cautious process will be required in order to successfully address the wide array of regulatory and stakeholder needs. Additional research and continuing dialogue will be necessary to properly fit test the ERSP calculator and its components for adoption into USCG and BSEE regulatory frameworks. Finally, a robust regulator or third-party verification process will have to be put in place in order to verify, validate, and improve the configurations and variables used by plan holders and OSROs when inputting skimming systems into the calculator.

MOVING BEYOND EDRC TO A RESPONSE OPTIONS-BASED STANDARD:

Beyond EDRC and ERSP, regulators must begin to consider the GENWEST and NAS recommendations for incorporating a "systems of systems" approach regarding the various response options made available to responders. This is especially true for the offshore environment, where a more balanced set of oil spill response tools would better enable responders to select the methods that produce the greatest net environmental benefit for conditions present. In particular, offshore drilling in deepwater and in remote areas is increasing the risks of a large oil spill in areas that are far from traditional mechanical recovery equipment stockpiles and supporting infrastructure. These new challenges will call for innovative regulatory solutions.

USCG regulations already contain requirements and minimum response times that plan holders must meet for dispersants where preauthorization agreements have been set in place by the applicable Regional Response Teams. USCG regulations use the Dispersant Mission Planner 2 calculator to estimate the application capacity of the contracted dispersant stockpiles and application equipment listed in a plan. USCG regulations do not require in situ burning capabilities, nor do they provide any means of response "credit" for those plan holders who have in situ burning capabilities available in their response plans. BSEE currently does not have any mandatory requirements for dispersant or in situ burning capability levels or response times in their regulations. BSEE does require plan holders to list equipment and procedures in their OSRPs if the plan holder intends to use these response options as part of their planned removal efforts in responding to their WCD.

The usefulness of the various response options to extend the range of operating conditions in which an effective response can be mounted, as well as the particular advantages that each option brings, have been well documented, and do not need to be repeated here. As regulatory agencies prepare to implement a groundbreaking new mechanical recovery planning standard, a rare opportunity exists to also recast the mixture of required response capabilities that will be available to future generations of responders. The last opportunity to make substantial improvements to the response capabilities required by oil spill response plans came on the heels of the Exxon Valdez oil spill and the passage of the Oil Pollution Act of 1990. While new oil spill legislation did not emerge as a result of the Deepwater Horizon oil spill, there is nevertheless a rare, but fleeting opportunity, to again substantially improve the metrics, methods, and capabilities by which we prepare and respond to oil spills in the future.

The Deepwater Horizon oil spill punctuated EDRC's well-known and long recognized shortcomings, and was a showcase for how various response options such as in situ burning and dispersant can play a major role in responding to a WCD. While we previously lacked the momentum necessary for a substantial change in our response paradigms, today an opportune window has opened and the status quo is simply no longer an acceptable option.

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2. 30 CFR 254, BSEE Code of Federal Regulations.
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