BSEE Response Document for the Summary Peer Review Report for the Study *"Oil Spill Response Plan Equipment Capabilities Review"*

Project Background: BSEE is charged with the responsibility to permit, oversee, and enforce the laws and regulations associated with the development of energy (oil and natural gas) resources on the Outer Continental Shelf (OCS). BSEE's Oil Spill Preparedness Division (OSPD) is responsible for developing and administering regulations (30 CFR 254) that oversee the oil and gas industry's preparedness to contain, recover, and remove oil discharges from facilities operating seaward of the coastline. Current regulations require that operators of these offshore oil and gas facilities submit an Oil Spill Response Plan (OSRP) that identifies the procedures and contracted spill response resources necessary to respond, to the maximum extent practicable, to a facility's worst case discharge (WCD).

It has been nearly two decades since BSEE's OSRP regulations have been updated. During this time, changes occurred in drilling trends as well as the risks associated with oil spills. The national response system within the United States has also matured over time; Regional Contingency Plans (RCPs) and Area Contingency Plans (ACPs) have been approved that contain extensive oil removal and protection strategies, including the preauthorized use of dispersants and in-situ burning. New technologies, such as remote sensing, are now commercially available and stand poised to transform our abilities to respond offshore.

In an effort to understand this changing environment, BSEE awarded a contract to Booz Allen Hamilton (BAH) in 2014 to catalogue the changes in the WCD scenarios found in OSRPs for the OCS, and evaluate the oil spill response industry's capabilities to mitigate these spills through existing equipment stockpiles and technology using the strategies outlined in today's RCPs and ACPs. BAH completed the study, which is contained in *Volume I: Worst Case Discharge Analysis* and *Volume II: Oil Spill Response Equipment Capabilities Analysis*, in February 2016.

Peer Review Description: As parts of this two volume study may be used in the future to support an anticipated rulemaking effort, and may also meet the criteria for "influential scientific information" under the Office of Management and Budget's Memorandum on Peer Review (OMB M-05-03), BSEE determined that selected sections of the study should be subjected to a peer review. EnDyna was contracted in June 2016 to provide coordination and oversight of the peer review. EnDyna selected three scientific experts who prepared written comments and then participated in a 2-day peer review panel held on September 8-9, 2016. EnDyna summarized and synthesized the reviewer comments into a final summary report, which was completed in January 2017.

BSEE defined the scope of this peer review through the use of a prepared set of Charge Questions. The peer reviewers were directed to keep their written comments focused on the modeling and final recommendations contained within the study. The review was technical in nature, and did not extend to the regulatory benchmarking analysis, Deepwater Horizon spill response case study, the analysis of changing regional WCD profiles, or other sections of

Volumes I and II that were not related to the modeling or the recommendations. The peer reviewers could refer to these out-of-scope sections when providing written comments on the recommendations section. The following table contains the charge questions addressed by the peer reviewers:

Volume I–Worst Case Discharge Analysis	
1.1	Were the Worst Case Discharge (WCD) sites selected for analysis a valid sample to evaluate the probabilities and scope of oil contacting the environment in each region?
1.2	Are the limitations and uncertainties clearly identified and adequately characterized for the oil plume, fate and effects, and transport mechanisms used in the stochastic trajectory modeling?
1.3	Are the assumptions of the modeling clearly defined and appropriate?
1.4	Are there strengths or weaknesses of the analytical methods used for the modeling?
1.5	Do the modeling results describe with reasonable accuracy the probability, scope and minimum travel times for oil to potentially contact the environment in the event of a WCD for the selected scenarios?

Volume II–Oil Spill Response Equipment Capabilities Analysis

2.1	Are the limitations and uncertainties clearly identified and adequately characterized for the deterministic trajectory and response countermeasure modeling?
2.2	Are the assumptions of the modeling in Volume II clearly defined and appropriate? Assumptions evaluated should include, but are not limited to: a) Fate and transport of the oil b) Application of temporary source control measures c) Application of spill response countermeasures.
2.3	Are there strengths or weaknesses of the analytical methods used for the modeling?
2.4	Are the conclusions drawn from the oil spill response capabilities analysis logical and appropriate based on the modeling results?
2.5	Are the recommendations logical, appropriate, and supported by the analysis and modeling results? The scope of the recommendations pertains to all recommendations, not just those derived from the modeling results.

Peer Review Comments and BSEE's Response: The reviewers provided a range of comments on the study report, ranging from general agreement regarding the methodology and assumptions used, to concerns about the modeling complexity and various uncertainties associated with the modeling results. The reviewers provided their impressions on the choice of models that were used; the modeling in Volume I, including concerns regarding uncertainties, the sampling of the ensemble state or "situation space", and the generation of droplet size distributions (DSDs); the modeling in Volume II; and recommendations.

In general, the reviewers felt the models used were well-developed, tested, and widely accepted; however, they also stated using complex models over extended periods of time without a means of data assimilation results in data with compounding levels of uncertainty. The reviewers also cautioned that limiting the number of simulations and using fixed parameters for some of the scenario parameters results in data sets that may not necessarily describe the full variability of all the possible outcomes, which may also create uncertainties associated with the modeling results. Despite these observations regarding uncertainty and ensemble situation space, the reviewers generally agreed that the modeling results were adequate to support the objectives of the study and effectively informed the study's recommendations.

BSEE acknowledges the concerns regarding modeling complexities, sampling limitations, and resulting uncertainties, but believes the modeling outcomes represent the highest quality of data that can be generated under the circumstances. Given the general agreement of the reviewers that the modeling results were sufficient to meet the objectives of the study, BSEE does not believe it is necessary to conduct additional or revised modeling. BSEE also does not believe it is necessary for the research team to make additional changes to the study recommendations based on the overall feedback provided in the peer review report. BSEE will, however, give full consideration to all of the reviewer's comments, especially those concerning the nature of the modeling results with respect to uncertainty, etc, when evaluating the report's findings for the purposes of informing the agency's efforts to update the oil spill response plan regulations.

In many cases, the reviewers did suggest including more information in the study report on the internal processes and algorithms used within the models. This information was purposely not included in the report, mainly due to concerns over the very large size and complexity of the document. Given this constraint, and the fact that these two models are well tested and widely accepted, it was agreed by both BAH and BSEE that is was not essential to list out in detail the internal mechanics of the two models that were used. The study does provide a significant amount of detailed information on the assumptions that were made and the methods that were used in order to effectively model the application of the various response countermeasures. Reference documents containing detailed descriptions of the basic modeling mechanics were provided to the peer reviewers once it was made known that they needed access to this information in order to facilitate their review. While the information provided answered the reviewer's questions, and generally met their needs to finish the review, the reviewers still felt inclined to recommend that this detailed information be included in the study reports. BSEE, however, does not believe that this level of modeling detail needs to be present in the report, and does not intend to award a new contract to BAH for the purposes of including this information in the study report. BSEE can provide further references, separate from the report, to any parties that are interested in reviewing the internal mechanics of the models used.

A much more detailed listing and description for each of the subject areas addressed in the reviewers' comments, as well as BSEE's responses to these comments, are contained in the accompanying appendix, "Peer Review Comment & Agency Response Matrix".

BSEE would like to acknowledge and thank the peer review team; their efforts have better informed the agency on the inherent strengths and weaknesses of the processes used and the resulting information that was generated in the study report.

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General Impressions			
Choice of Models Used			
A1	11	Two reviewers commented that the study used industry standard models that have been well tested and are widely applied over many years.	BSEE agrees that OILMAPDeep and SIMAP are industry standard simulation packages that have undergone many years of application, testing, and refinement.
A2	11	One reviewer commented that the models used in the study were presumed correct or acceptable when they were used as part of a formal NRDA Type A process. This reviewer also noted that multiple technical reviews of these models exist because they have been used by the ongoing DWH damage assessment process and as the NRDA Type A model.	Noted. BSEE agrees that the models are widely accepted and used for various industry and government activities.
A3	12	One reviewer commented that many of the study's conclusions attributed to "the model" were actually little more than what an experienced spill responder would consider as common knowledge. Given that the models provided results that would be expected by an experienced spill responder, this reviewer noted that the selected models probably did not provide any obvious erroneous results.	Noted.
A4	11	One reviewer commented that the models used to develop the study's conclusions were essentially built around a set of quite complex models and algorithms. SIMAP was encumbered with many unused parametric algorithms that may have introduced more complexity to this study than was necessary. The reviewer expressed concerns that it was not obvious that the complexity of the model components was justified. The reviewer noted that any number of simple particle tracking models would work as well as SIMAP.	The study, especially in the case of SIMAP, did use all of the model's capabilities. BSEE believes that the models chosen by the research team were well suited for conducting the study tasks; however, BSEE acknowledges the reviewers concerns that model complexities have the potential to create greater uncertainties in the modeling results.

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Volume I – Modeling Uncertainty			
B1	12	One reviewer commented that the WCD scenarios were simulated using a multiple-ensembles approach (stochastic modeling) where the results of 100 deterministic spill simulations were analyzed to produce probabilistic maps of spill effects. The reviewer stated that 100 simulations was a modest number of simulations, but the reviewer commented that this decision likely balanced the competing needs of having a large number of simulations, while completing the analysis in a reasonable amount of time.	BSEE agrees.
B2	12,18	One reviewer expressed concerns about the complexity of the models selected for the study. A complex model used in a purely planning mode may not have the advantage of a reality check in the form of available assimilation data. A key issue with respect to the veracity of the overall study conclusions was that the plume rise and trajectory models were combinations of dozens of individual algorithms, each of which introduced some degree of uncertainty, which were then linked together in a chain of logic propagating uncertainties into a final compound uncertainty. This reviewer believed that, as a result, no expert really knows, for example, what "skill levels" to expect from SIMAP, or how rapidly its information content degrades with time.	BSEE acknowledges that there is a certain level of unavoidable uncertainty as a result of modeling complex activities that are involved with oil spills and response operations over long periods of time. Since this modeling dealt with planning situations only, there were no opportunities to conduct periodic data assimilation during the simulations. BSEE believes the uncertainty levels are acceptable for the purposes of this study.
Volume I – Modeling Ensemble State/Situation Space			
C1	13, 19	A reviewer noted that environmental forcing was selected at random from a database of existing weather and currents for each region. This reviewer commented that no attempt was made to ensure that the canonical variability of the climate in each region was sampled. Consequently, this reviewer commented that although the 100 simulations represented plausible outcomes for spills	Each of the 100 simulations had a randomly selected start date selected from multiple years of currents and wind data. Each of the simulations began on different randomly sampled start dates and was then run for relatively long simulation durations (ranging from 73 to 227 days depending on the scenario in each of the 3 geographic locations, Gulf of Mexico, Pacific and the Arctic). Therefore, over the course of all of

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		during the period of the measured data, the results from those simulations may not represent the full climate variability or the model uncertainty.	the 100 simulations for each of the scenarios, the climate data was sufficiently sampled. BSEE acknowledges that there may be some examples of environmental forcing data that fall outside of the sample set that was selected, however, BSEE does not believe that these potential omissions are significant enough to invalidate the overall plausibility of the results. For the purpose of this study, the research team and BSEE determined that the random sampling of start dates and simulation periods over multiple years of historical environmental metadata was sufficient to address the variability of the climate "situation space".
C2	13,19	The reviewer commented that a weakness of this study report is that it has virtually no discussion of the sampling approach for the "situation space" in which the models operated. The study report should provide further explanation about how this uncertainty was modeled; more specifically, whether start times were equally spaced over the available time span of input data or whether start times were selected from a random distribution. If a random distribution of start times was used, this reviewer recommended that the study report should provide the probability density function of the distributions.	The sampling for the environmental forcing was accomplished by random selection of start dates for the simulations. Detailed descriptions of the models internal processes and sampling algorithms were not included in the report in order to keep the final reports concise and focused on the study objectives.
C3	13,19	A reviewer concerned with accounting for uncertainties commented that the stochastic simulations had used fixed model parameters for all aspects of the modeling except for the ambient environmental forcing. Because of those fixed model parameters, this reviewer argued that the stochastic simulations did not account for any uncertainties in model or spill parameters. More specifically, this reviewer noted that plume entrainment rate, oil composition, biodegradation rates, initial DSDs, surface transformation process models,	While spill start date was randomly sampled, it is important to note that other model inputs were not varied due to the project's scope. For the purposes of comparing the use of different response countermeasures for a given scenario, the research team and BSEE determined that the random sampling of start dates over multiple years and environmental conditions was sufficient to address "situation space" or ensemble state. BSEE appreciates the comment that there may be additional uncertainties associated with the data that result from employing fixed variables for some of the modeling

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		and other elements were all identical in all simulations within each scenario. The reviewer acknowledged that an exhaustive analysis of model uncertainty was probably beyond the scope of the study. This reviewer commented that the choice to consider only the effects of environmental forcing still resulted in an adequate picture of the potential contact of the spilled oil with the environment.	processes; however, varying these other model processes was beyond the scope, purpose, and budget of this study.
C4	13	The reviewer stated there was no discussion about whether the 100 scenarios spanned the expected cardinality of the environmental forcing parameters, but this issue regarding the cardinality of the ensemble state or "situation space" should have been further explained. The reviewer commented that this problem applied to all of the basic OCS regions in the report, and emphasized that the modeling experts should address this issue in the study.	Each of the 100 simulations (for each scenario) featured a randomly selected start date drawn from metadata covering multiple years of currents and wind data (as outlined in Appendix D of the Task 1 report). Each of the individual 100 simulations was then run for relatively long simulation periods (ranging from 73 to 227 days depending on the scenario). The research team and BSEE believe that this long-duration testing, over the course of all 100 simulations, for each of the scenarios, sufficiently sampled the climate data situation space.
C5	19	This reviewer also noted that uncertainty was modeled in the stochastic simulations by initializing the blowout at different start times (i.e., on different days) throughout the time span of available model forcing, with each simulation representing a separate ensemble. The reviewer stated that this approach used in the BSEE study was reasonable for simulating the uncertainty of ambient currents and weather on the behavior of a blowout.	BSEE agrees.
C6	21	A reviewer expressed concerns about whether the assumptions inherent to the SIMAP and OILMAPDeep modeling were adequately described; the reviewer stated that the study report did not clearly identify all the processes used in these models. The reviewer emphasized it was important that the study report's clearly identify all processes used in the modeling in order to better understand	BSEE disagrees. Detailed descriptions of the models' internal processes and sampling algorithms were not included in the report in order to keep the document concise and focused on the study's main objectives. The details regarding the model processes were provided separately to the Peer Review Panel in order to facilitate their evaluation of the modeling. While the information provided satisfied their evaluation

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		the full capabilities of each model. Another reviewer also commented that the lack of information on the mathematical operations used in the modeling was a persistent shortcoming throughout the study report.	requirements, the reviewers were reluctant to withdraw their comments about including this information in the study report.
Volume I – Modeling Droplet Size Distributions			
D1	13,32	The reviewer noted that the simulations in the study likely used the DSD prediction equation developed by Applied Science Associates (ASA) for the DWH NRDA. The reviewer noted that this tool has been calibrated to a comprehensive set of available laboratory data. This reviewer emphasized that it was important to point out that no data are available for DSDs in the parameter space of a full-scale blowout, and no measurements were made of DSD near the DWH breakup region. Given the lack of data, the reviewer stated that it would be necessary to trust that extrapolation from the currently available laboratory data to the field scale is appropriate. The reviewer argued that this uncertainty was important because, especially in a deep water blowout, the initial DSD would control the fate processes of oil in the water column; the location, thickness, and properties of oil on the surface; and is an integral part in evaluation of the efficacy of SSDI. The reviewer emphasized that the validity of such extrapolation can only be verified by larger-scale experiments. The reviewer also suggested that the study report could perhaps recommend to BSEE the need to fill this current gap with initial DSD data from larger-scale experiments.	The equations used to predict the droplet size distribution for the study can be found in Crowley et al. (2014). BSEE acknowledges that there is a lack of existing data from full scale subsea blowouts, and that extrapolations from laboratory data into the models were necessary to conduct this study.
D2	13	A reviewer commented that the effect of the DSD prediction equation on the modeling was most significant for evaluating the efficacy of subsurface dispersant injection (SSDI), because SSDI	BSEE agrees.

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		was modeled in the simulations by adjusting the interfacial tension (IFT) between the oil and water and predicting a new DSD with this IFT. The reviewer stated that this approach was the current practice for predicting the effects of SSDI. The reviewer emphasized that if the DSD prediction equation over- or under-predicted the treated DSD, then the modeling conclusions would over- or under-predict the efficacy of SSDI. The reviewer commented that the review of the DWH accident supported the conclusion that SSDI is an effective and important response strategy for accidental blowouts, and this conclusion was also supported by the model results.	
Volume II – Modeling, Recommendations, and Study Objectives			
E1	14	One reviewer commented that the deterministic model simulations in Volume II all appeared to overestimate the removal capability of mechanical removal and underestimate the removal rates for in-situ burning when compared to estimates of removal rates during the DWH accident.	BSEE acknowledges that the model results are different than the estimates developed for various countermeasures during the Deepwater Horizon (DWH) response. BSEE believes there is limited value in making this comparison. The modeling examined different spill scenarios with different sets of environmental forcing parameters. As a result, it is not surprising that the modeling results were different than the oil removal budget outcomes that were estimated for DWH by responders. BSEE believes that the final removal estimates for DWH involved high degrees of uncertainty, and should not be used as a measure of the validity of the modeling results for any of the scenario simulations in the study.
E2	14, 37	A reviewer noted that, among the various recommendations, was the requirement for operators to be capable of real-time response modeling and forecasting in the event of a spill. The reviewer observed that this was currently the responsibility of NOAA's Office of Response and Restoration (OR&R). The reviewer suggested that there should be a discussion about how forecasts by the	The focus of oil spill trajectory modeling conducted by operators is primarily a tool for developing their oil spill response plan. BSEE encourages operators to have resources at their disposal that could be used to predict and track spills in real time to support response efforts, however, oil spill modeling responsibilities for the operator are for pre-spill planning. BSEE agrees that conducting oil spill fate and transport modeling during

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		operator and NOAA might be reconciled, and a justification provided for why the operator will be asked to perform tasks that overlap with NOAA's responsibilities.	an actual incident is the responsibility of NOAA, and should not be a capability that is required in the OSRP.
E3	14	A reviewer commented on the recommendations for how much and how fast various oil spill response equipment should be on-scene during an oil spill response, which is addressed in detail in Tables 104-115, pages 289-302 of the study. The reviewer commented that the choices and recommendations in reflected in the tables made sense.	Noted.

E4	15	Another reviewer commented that the report did not list objectives for each task. For purposes of preparing review comments, this reviewer identified the study objectives as listed below:
		• Volume 1: Illustrate the overall scale of WCD releases from representative well locations (Gulf, Pacific, Arctic).
		• Volume II: Identify the potential for each countermeasure (source control, dispersant, mechanical, in-situ burning), to reduce oiling by using best practices that:
		    ○ Improve readiness through command/control, communications, and logistics planning
		    ○ maximize the effectiveness of oil spill response countermeasures.
			BSEE agrees with the comment. The commenter captured the primary objectives of the modeling used in each volume of the study.

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***Charge Question 1.1**: Were the Worst Case Discharge (WCD) sites selected for analysis a valid sample to evaluate the probabilities and scope of oil contacting the environment in each region?*			
WCD Scenario Sample Set			
F1	15	The reviewers generally agreed that the WCD sites selected for analysis were a valid sample. One reviewer stated that the study made reasonable efforts to select WCD sites that cover a wide range of potential blowout scenarios and environmental impacts, and that the study report provided a justification for selecting each WCD. Another reviewer stated that the scenarios selected adequately represented near-shore, offshore, and open-ocean WCDs in each region and made sense.	Noted. BSEE agrees.
F2	16,19-20	One reviewer commented that the study could have selected WCD sites that addressed smaller scale features that have proven to be important in historical spills. The reviewer emphasized that each of the regions had smaller scale circulation features in their areas and the study report did not provide sufficient information about how the analysis addressed these important smaller scale features. • Central Gulf: Details of the Mississippi Delta freshwater outflow and mixing close to the delta are intricate. • Western Gulf: A near-shore low salinity frontal interface caused by fresh water runoff typically extends from the Atchafalalya, past Calacsieu to Galveston, which results in a convergence band that traps floating pollutants and may locally offset trajectories tens of miles to the west. • Santa Barbara Channel: The complex eddy structure in the	The SIMAP model in most cases does incorporate the smaller scale circulation features that were identified by the reviewer. In the Gulf of Mexico, the Princeton Ocean Model (POM) was used. The POM simulation did include freshwater inputs (daily discharge from 34 rivers in the northern Gulf of Mexico). Data sources used for calibration ("assimilation) include satellite sea-surface height anomaly (SSHA), sea-surface temperature (SST), moored temperatures and currents, hydrography, and drifters. The Santa Barbara Channel modeling used the Navy NRL HYCOM model. In Chukchi and Beaufort regions, the TOPAZ model, with HYCOM hydrodynamics was used. Again, the described behavior and directional shifts resulting from these smaller scale features would be captured in the hydrodynamic data sets used by the model at various times. Thus, the needed forcing data to capture the small scale features were used, but specific hindcasting attempts might not show the exact timing of these features. The modeling in the study was not intended to be used to hindcast conditions for any particular past time

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		Santa Barbara Channel itself and the directional shifts associated with California Current versus Davidson Current periods around the channel are an issue. • Chukchi and Beaufort regions, Arctic: Details of the ice cover circulation and banded currents found along the North Slope will certainly degrade the veracity of forecasts	period or to accurately forecast future currents. The veracity of *forecasts or hindcasts* is therefore not an issue.
F3	16	A reviewer pointed out that the study was limited by the fact that only a fraction of existing wells have data within the OSRP dataset. The reviewer acknowledged that this dataset will limit the available range of sites that could be selected for the study. The reviewer stated that this limited dataset especially impacted the Gulf of Mexico Eastern Planning Area (where the selected WCD site was actually in the Central Planning Area) and the Gulf of Mexico Western Planning Area (where the sites in the OSRP dataset were well to the east of many existing wells within the planning area).[SS]	BSEE recommended scenarios to the research team based on the population of WCD sites that are listed in the OSRPs, fully understanding that each OSRP also covers other wells with lesser flowrate volumes. Because BSEE wanted to examine modeling scenarios that would challenge the existing response infrastructure within each region, BSEE focused primarily on the distribution of wells listed as WCDs across each area. BSEE and the research team believe the scenarios that were developed based on the OSRP WCD data is a valid representative sample of all the wells covered under the plans for the intended purposes of the study.
F4	16	A reviewer commented that in several regions, the spill sizes selected for analysis were smaller than the largest WCDs among all of the OSRP data points. The study would become more solid if the report explained why higher flow rate cases were not selected when they were present in the OSRP dataset.	Noted. Flowrate was not the only variable that drove the selection of various modeling scenario sites. BSEE and the research team worked together to select scenarios that covered a range of scenario site variables, including distance from shore, water depth, geographical locations, and oil types, in addition to flowrates. In nearly all cases, the report did provide a rationale for the selection of most sites. It did not provide a full description of why other sites were not chosen. In the case of the Southern CA planning area of the Pacific OCS Region, the 12,000 BPD WCD shown in the study scatter plots was an error, the 5,200 BPD WCD is more representative of the greatest WCDs in

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			the area. In the Arctic planning area of the Alaska OCS region, the site listed as 85,000 BPD has actually since been revised to 92,000 BPD and has yet to be drilled and numbers verified; however, this site was not chosen for WCD modeling primarily because it is an outlier for the Region at this time. Given the limited number of scenarios that could be evaluated in the Arctic given the scope, timeline and budget for the study, BSEE and the research team selected two examples that were more representative of the overall WCD portfolio for each region. If more scenarios were able to be run in the Arctic, then outliers such as the 92,000 BPD site would have been modeled for comparison purposes.

Charge Question 1.2: *Are the limitations and uncertainties clearly identified and adequately characterized for the oil plume, fate and effects, and transport mechanisms used in the stochastic trajectory modeling? Please note that the impact of a WCD is not a probable impact, or representative of risk; but the largest volume possible from an uncontrolled blowout (30 CFR 257.47 (b)), a very unlikely and low probability scenario.*
(See Comments A2, A4, C1, C2, C3, C5, F2)

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Charge Question 1.3: *Are the assumptions of the modeling clearly defined and appropriate?* (See below as well as Comment C6)			
Modeling Processes			
G1	21	A reviewer expressed concerns about whether the internal assumptions operating within the models were adequately described; the reviewer did state that the assumptions of the OILMAPDeep model were adequately described, with the exception of whether the model accounted for ambient currents.	OILMAPDeep is run with ambient stratification and currents from a select point. For a full description of the fate processes modeled for SIMAP simulations refer to French McCay, D.P. (2004), "Oil spill impact modeling: Development and validation. Environmental Toxicology and Chemistry" 23 (10): 2441-2456.
G2	22	This reviewer also stated that it was not clear in the study report whether dissolution was considered as a fate process for the SIMAP simulations.	Dissolution was considered in SIMAP and in the weathering and fates results (e.g., mass balance), but was not specifically presented in the report. For a full description of the fate processes modeled for SIMAP simulations refer to French McCay (2004). See reference cite above (comment G1).
G3	20	A reviewer stated that the modeling assumptions were generally clear and well stated, with the notable exception of how the Eulerian field data were calculated from the aggregated Lagrangian particles. The study report also presented the thickness of the floating or beached oil, which was Eulerian field data and was dimensional (mass/area). The reviewer stated this should be calculated from the aggregated Lagrangian particles and possibly corrected for individual "spillet" spreading. The reviewer commented that the mathematics of these calculations were tricky and noted that the study report did not explain how the model operated for those calculations.	The model calculates mass loading (e.g., g/m^2) as opposed to a real thickness. The spillets (or Lagrangian particles), each representing some known volume of oil are overlaid on a fixed grid (e.g., the habitat grid) and the mass of the spillet is projected into the fixed grid cell. Then, the mass of all spillets are then summed within one fixed grid cell. The mass of MAHs and PAHs in the water column is contoured on a three-dimensional Lagrangian grid system. This grid (of up to 200 X 200 cells in the horizontal and up to 100 vertical layers) is scaled each time step to just cover the volume occupied by aromatic particles, including the dispersion around each particle center. This maximizes the resolution of the contour map at each time step and reduces error caused by averaging mass over large cell volumes. Distribution of mass around the particle center is described as Gaussian in three dimensions, with one standard deviation equal to twice the diffusive distance (2*Dgxt* in the horizontal, 2*Dgzt* in the vertical, where

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			Dgx is the local small-scale horizontal diffusion rate, *Dgz* is the local small-scale vertical diffusion rate, and *t* is particle age). The values of *Dgx* and *Dgz* are user inputs, and need not equal *Dx* and *Dz* that apply to spillet centers (which are on a larger scale). The plume grid edges are set at two standard deviations out from the outer-most particle. As a default, the physical fates model in SIMAP uses a variable time step to resolve transient concentrations in the water column, and to efficiently compute long-term concentration changes in the sediments. The model computes a reference time step, Δ*t*, based on the Eulerian (fixed) grid size established on the seafloor and the (time-variable) maximum water column transport velocity Umax: $\Delta t = (\Delta x\ \Delta y)½ / (2\ Umax)$ where x and y are the grid cell dimensions in the x and y directions. A second constraint is that the time step may be limited by horizontal mixing. $\Delta t < 0.25\ (\Delta x\ \Delta y) / 6Dxy$ In shallow water, the time step may be limited by the vertical mixing velocity, in which case an imbedded time step, $\Delta t = 0.25\ d2 / (6\ Dz)$ where d is depth, is used in the advection computations. The initial time step is then set equal to a fraction of the reference value, and allowed to increase with time to the reference value. A small initial value is necessary to allow resolution of evaporation processes for floating oil. Thereafter, the time step is equal to the time-variable reference value, until all water column concentrations are below a

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			specified threshold value, and all contaminants in the water column have been advected outside the fixed grid boundaries or settled to the bottom sediments.
G4	32	One reviewer commented that the analytical methods assumed no mechanical breakdowns and also did not assume any aircraft, equipment, crew, or weather limitations.	The research team did account for limitations on the amount of equipment employed, as the team went to great lengths to survey the availability of response equipment in each area. The team also applied a "discounting" factor to the removal rates of each countermeasure used in each OCS region that included downtime due to weather delays and equipment malfunctions. These discounting factors are located in Tables 10, 12, and 13 in Volume II of the study.
Charge Question 1.4: *Are there strengths or weaknesses of the analytical methods used for the modeling?* (See Comments A2, C3, D1)			

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Charge Question 1.5: *Do the modeling results describe with reasonable accuracy the probability, scope and minimum travel times for oil to potentially contact the environment in the event of a WCD for the selected scenarios?*			
Stochastical Modeling Results			
H1	25	A reviewer emphasized that the oil hit, or cumulative spill footprint (independent of an estimate of quantitative values), and the minimum time of travel raster data were likely some of the strongest outputs from study. The reviewer concluded those outputs were the strongest because these fields were determined by the time dependent particle position information. The reviewer noted that Lagrangian models provided this as primitive data. The reviewer stated that this type of forecast was inherently stronger than derived information such as Eulerian density fields.	Noted.
H2		One of the reviewers commented that the study used industry-standard models, which were developed based on all available data. This reviewer also commented that the study modeling used the best understanding of input parameters for the selected WCD scenarios. The reviewer concluded that the study simulations provided the best available estimate of the scope, probability, and time scales of oil contact with the environment for such discharges.	Noted.
H3	25	A reviewer commented that the study used validated models that have benefited from lessons learned during DWH. This reviewer concluded that the study simulation results provided the best available estimate with reasonable accuracy for the probability, scope, and travel times for oil to potentially contact with the environment.	Noted.

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Charge Question 2.1: *Are the limitations and uncertainties clearly identified and adequately characterized for the deterministic trajectory and response countermeasure modeling?*			
Deterministic Modeling Results			
I1	26	One reviewer stated the response countermeasure modeling was adequately characterized (i.e., met the study's objectives) in evaluating how much each response countermeasure would reduce WCD exposures, specifically because the modeling used validated approaches (e.g., BSEE Calculators) and expert input on variables such as environmental conditions.	Noted.
I2	26	One reviewer stated that the study approach for analysis of oil spill response equipment capabilities was reasonable, but commented that the study report should define the approach more clearly and provide more justification for the metrics used to select the deterministic worst case simulation used in the response countermeasures modeling.	Noted. The metric for selection of the stochastical model run that would be used for the deterministic modeling was based on the simulation that provided the highest amount of shoreline stranding in terms of miles of shoreline oiled.
I3	32	One reviewer commented that one weakness of the Volume II analytical methods was that a single, deterministic simulation was evaluated instead of using the entire ensemble of all 100 stochastic runs from Volume I. This reviewer stated that this weakness was justified if the primary metric of concern was shoreline oiling, because the simulation with the worst shoreline oiling was selected for the deterministic modeling.	BSEE concurs. Evaluating more simulations using different stochastical runs from each scenario would have provided results with less uncertainty and would have better normalized the results. Using a single deterministic run provides results that are heavily influenced by the environmental forcing parameters (such as weather) for that simulation. This does not detract from the validity of the simulation results, but it can't be determined how these results compare to the overall distribution plot of results that would ensue if all 100 simulations had been run. While the simulation that was selected was determined using a metric of length of shoreline oiled, no value was placed on this metric over others. Rather, it was selected on the premise that using a simulation with high degrees of shoreline oiling would provide a good indicator of the oil removal contributions gained from the application of different response countermeasures. It

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			should be noted that surface oiling and volume of oil stranded onshore were also used as indicators in addition to the length of shoreline oiled.
I4	33	One reviewer emphasized that the documentation in the study report regarding the details of how oil thickness values were calculated was questionable, and suggested that a more complete explanation was needed to fully evaluate the conclusions that are based on the modeling results. This reviewer commented that it would be interesting to provide a mass balance of the thick to thin portions of the developing plume in the modeling scenarios. This reviewer could not find any information about how the model calculated oil thickness and argued that the incomplete explanation of the details of oil thickness values in the study report raised questions about this component of the response countermeasures modeling.	It is important to note that the model calculates mass loading (e.g., g/m^2) as opposed to a real thickness. The spillets (or Lagrangian particles), each representing some known volume of oil are overlaid on a fixed grid (e.g., the habitat grid) and the mass of the spillet is projected into the fixed grid cell. Then, the mass of all spillets are then summed within one fixed grid cell. It was beyond the scope and outside of the purpose for the final report to lay out in great detail the methodologies and algorithms used by the SIMAP model to calculate oil thickness, fate, and transport. This information was later provided to the review panel, which satisfied their questions and concerns regarding the study processes involved. The reviewers however elected to not change their comments due to the fact that the information necessary to answer their questions was not contained in the final report.

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***Charge Question 2.2:** Are the assumptions of the modeling in Volume II clearly defined and appropriate? Assumptions evaluated should include, but are not limited to:* *a) Fate and transport of the oil* *b) Application of temporary source control measures* *c) Application of spill response countermeasures.*			
Oil Fate and Transport Modeling			
J1	28	One reviewer expressed concerns that the documentation in the study report did not explain what combination of algorithms was used in the analysis related to assumptions about oil fate and transport. The reviewer suggested including additional documentation in the study report to explain how oil fate and transport assumptions were defined.	Providing a detailed description in the final report of how each fate and transport process is incorporated into the SIMAP model is not necessary information to support the objectives of the study. Information on these assumptions and processes can be reviewed in French McCay (2004) and French McCay (2016), for a description of the algorithms used in SIMAP for oil weathering. French McCay, D.P. (2004), "Oil spill impact modeling: Development and validation. Environmental Toxicology and Chemistry" 23 (10): 2441-2456. French McCay, D.P., Zhenghai. Li, Mathew Horn, Deborah Crowley, Malcolm Spaulding, Daniel Mendelsohn, and Cathleen Turner (2016), "Modeling Oil Fate and Subsurface Exposure Concentrations form the Deepwater Horizon Oil Spill". Please also refer to French McCay et al. (2015), which is RPS ASA's oil fate modeling technical report for DWH, which is available for download at: https://www.fws.gov/doiddata/dwh-ar-documents/830/DWH-AR0285776.pdf.
J2	28	One reviewer suggested that the study report should clearly itemize all fate processes modeled for the SIMAP simulations, especially whether dissolution was considered as a fate process for the SIMAP simulations.	BSEE disagrees. Providing a detailed description of how each fate process is incorporated into the SIMAP model is not necessary information required to support the objectives of the study final report. Instead, this information was provided to the peer review panel members for their assessment of the project.

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J3	28	Another reviewer commented more generally that the assumptions in the report were documented by experienced experts and met the study's objectives. More specifically, for oil fate and transport, this reviewer stated that the model simulations provided reasonable oil thickness and viscosity thresholds used to determine suitability for mechanical, in-situ burning, or dispersant applications. This reviewer referenced page 8 of the report.	Noted.
Temporary Source Control Measures			
K1	29	One reviewer stated that the timelines for application of temporary source control measures appeared to be a reasonable compromise between the times required during DWH (which were longer due to the fact that this technology was being designed during that spill) and what the reviewer anticipated were likely response times during future spills.	BSEE agrees.
K2	29	One reviewer argued that the study report did not address one element of temporary source control, which was the possibility that a capping stack might be installed, but for various reasons (mostly well bore integrity) it might not be allowed to be closed. The reviewer stated in that case, responders might try to produce all of the spilled fluids to the surface, but noted that there was no discussion in the study report about whether the full well flow rate could be stored and transported allowing full spill control. This reviewer suggested that the actual spill impact will likely lie between the baseline and the source controlled simulations.	BSEE agrees. Simulations using "cap and flow" systems, where oil coming from the well head is captured with a subsea containment device and flowed to surface for processing, were beyond the scope of this study and therefore were not modeled as a response countermeasure. BSEE agrees with the comment that the environmental contact outcomes for such scenarios would fall somewhere between the results of the simulations involving a successful capping stack deployment and the "no response" baseline, where oil flowed until a relief well was drilled.
K3	29	One reviewer commented more generally that the assumptions in the study report were documented by experienced experts and met the study's objectives. More specifically, for	BSEE agrees. The timing and availability of source control measures was based on a comprehensive analysis that involved information from source control providers, information from relevant industry well

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		temporary source control measures, this reviewer noted assumptions about the availability and timing (15-45 days) of source control measures, and referenced pages xii, 282, 283, and 254 of the study.	control documents, and input from knowledgeable subject matter experts.
K4	30	One reviewer expressed concerns about source control assumptions, and commented that the report needed to explicitly state that source control was assumed to reduce the oil discharge to zero. Given the sequence of events at DWH, this reviewer suggested that it would be valuable to more explicitly state in the report that source control was assumed to be 100% containment and that there was no gradual reduction in flow before source control was achieved.	The commenter is correct. The research team did not feel it was necessary to simulate a reduced flow for the short period of time when the containment device would be closed to shut in the well. Since the temporary source control implementation times were gross estimates that were an average between optimal and sub-optimal timeframes, reducing the flow for a short period of time when the measure is being activated would suggest trying to add a level of precision to the modeling that is not achievable given the other assumptions and estimates used in assessing the source control response times.
Oil Spill Response Countermeasures			
L1	29	One reviewer stated that the spill response countermeasures appeared to be modeled reasonably, and for the most part, the amount of oil removed by these response countermeasures was similar to what has been historically achieved	BSEE agrees, however, just as every spill and response is unique, so are the results of different modeling simulations for a given scenario. The model results were highly dependent upon the sum of all the situational variables present in the scenario and the simulation period, and may not always compare closely with historical results of similar spill occurences; BSEE believes that this fact does not make the modeling results any less valid.
L2	30	One reviewer suggested that the study report should specify quantitatively how the mechanical removal methods were simulated. The reviewer noted that for spillets with the appropriate characteristics (e.g., thickness, viscosity), the study assumed that these spillets will be removed at a level up to the available removal capacity of equipment sited within the response division that is occupied by the spillet. The reviewer stated that, in other words, the modeling assumptions did not account for	While the reviewer is correct about the removal of spillets being dependent upon meeting certain ambient conditions, BSEE disagrees with the later statement regarding what assumptions were not addressed in the response modeling. The response modeling applied calculated oil removal rates for each specific countermeasure that was located within a specific division. These oil removal rates were applied when oil was available in the divisions and the oil properties and ambient weather conditions were within the allowable operating parameters. The timing

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		accessibility of skimming vessels to appropriate surface oil, travel time for skimmers between slicks and staging sites, the limited spatial extent of the coverage provided by the skimming vessels, and the difficulties of finding and tracking recoverable oil. This reviewer commented that these details were not specified in the study report and argued that providing those details would make it easier to evaluate the model simulations for mechanical removal.	of the application of the oil removal rates factored in initial response times that involved transits from staging bases to the removal areas. For mechanical recovery, the modeling assumed these assets would conduct offloading operations onsite to other secondary storage resources, and therefore did not factor in additional transits back and forth between the removal areas and staging sites. Removal rates for surface dispersants did factor in transit times back and forth between staging airports and the spill site. The study also makes an assumption that aerial surveillance and tracking is being effectively used to keep all removal assets actively working in thick oil. Oil encounter rates and the spatial coverage for each removal system were factored into the development of each system's oil removal rates through the use of the ERSP, EBSP and EDSP Calculators.
L3	30	A reviewer commented generally that the assumptions in the report were documented by experienced experts and met the study's objectives.	Noted.
Charge Question 2.3: *Are there strengths or weaknesses of the analytical methods used for the modeling?* (See below and Comments A4, B2, D1, G4)			
L4	31	One reviewer stated that the modeling for Volume II had the important strength of using an industry-tested, process-oriented comprehensive spill modeling systems. This reviewer also commented that the study included tremendous efforts to quantify the available removal equipment infrastructure for each spill scenario and to simulate realistic removal efficiencies. The modeling used validated approaches (e.g., Calculators) and expert input on variables such as environmental conditions. The reviewer noted that using the ERSP Calculator was a good approach. This reviewer commented that the analytical methods met the	Noted, and BSEE agrees. The team went to great lengths through surveys and research to validate the availability of the response equipment, and then used the capability calculators, such as ERSP, to estimate their assigned oil removal rates. BSEE believes the ERSP Calculator offers a state of the art tool for estimating the oil removal capability of a skimming system that is based on encounter rates.

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		study's objectives for evaluating how much each countermeasure would reduce WCD exposures.	
L5	32	One reviewer commented that one weakness of the Volume II analytical methods was that a single, deterministic spill scenario was evaluated instead of an ensemble of all 100 stochastic runs from Volume I. This reviewer stated that this weakness was justified if the primary metric of concern was shoreline oiling, because the simulation with the worst shoreline oiling was selected for the deterministic modeling.	BSEE acknowledges that the results of the selected simulations do not span the total range of possible outcomes for the scenarios, and that the outcomes would vary depending upon the simulation selected from within the stochastical data set. The modeling results in Volume II reflect the outcomes for single deterministic modeling simulations that were performed for each scenario. This is an important distinction, since the countermeasure outcomes appear to be closely tied to the intensity of the environmental forcing parameters that were experienced over the duration of the simulation period (such as the predominance of calm versus rough sea surface conditions). As the focus of the analysis for the modeling in Volume II is on the relative contributions of the different countermeasures to reduce oiling, rather than the exact numerical amounts of shoreline or surface area oiled. Selecting the simulations with the greatest amount of shoreline oiling (in terms of miles oiled) provided modeling results that allowed for useful comparisons in the outcomes resulting from the application of different response countermeasures. Given the limitations in time and budget afforded to the study, using a single deterministic simulation that had a "no response" baseline with a high degree of shoreline oiling, was deemed an acceptable approach for the purposes of the study.

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***Charge Question 2.4:** Are the conclusions drawn from the oil spill response capabilities analysis logical and appropriate based on the modeling results?* (See below and Comments I4, N1)			
L6	34-35	One reviewer provided a detailed description of one element of the analysis that was confusing, and suggested that this should be addressed in the study report to provide clarity. This reviewer further explained that, in many cases, the fraction removed by dispersants shown in the bar chart appeared to be the largest fraction and did not always appear to be in agreement with the fractions shown in the pie chart. Moreover, this reviewer explained that the summary paragraph for most of the response countermeasures stated that, among other mechanisms, "mechanical recovery was the primary tool that removed oil." This reviewer emphasized that, in many scenarios, the bar chart appeared to indicate that dispersants removed more oil. This reviewer concluded observations on this issue by stating that the tables and pie charts seemed to agree and usually agreed with the summary paragraph text. However, the bar charts always appeared to show different fractions for the achieved removal, especially for dispersants. The reviewer stated that there was no error in the study report, and noted that the bar chart presented mechanical removal separated by type, and the table and pie chart summed all mechanical removal together. The reviewer suggested that even though there was no error, this apparent contradiction between the bar charts and the tables and the pie charts, which occurred in almost all of the scenarios, should be addressed in the study report to remove the possibility of confusion.	BSEE acknowledges that the bar charts in question, while not incorrect, are easily misinterpreted if not evaluated with careful observation.

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L7	65	One reviewer stated that somewhere in the report it should be explained what the criteria is for which subsea dispersants are applied, and what the rationale is for application.	The study assumed Corexit 9500 would be used as the dispersant for any subsea applications since it comprises the vast majority of existing stockpiles that are available for SSDI. The application of SSDI generally followed what is currently set out in the National Response Team's guidance for Monitoring during Atypical Dispersant Operations. In the GOM, this translates to the use of SSDI in deep waters below 300 meters and below the average pycnocline. For the Arctic scenarios, since the ambient operating conditions that are present create limitations on the use of surface-based response resources much of the time, the use of SSDI in shallower waters was applied and evaluated for comparison purposes.
Response Equipment Analysis Conclusions			
M1	33	One reviewer stated that a major conclusion of the study was that response countermeasures employed against an overwhelming WCD have limited success. For example, see the DWH baseline: dispersant 8%, in-situ burning 5%, mechanical removal 4% (pages 237-239)	BSEE partially agrees. Due to the nature of how oil spills spread, are transported and weather in the offshore environment, an important observation of the study is that most responses will have low numbers for the percentages of oil recovered, chemically dispersed, and/or burned. This is an important fact of life for most oil spills originating in the offshore environment, which carries important ramifications for managing public expectations during a response. However, the study also showed that under favorable environmental forcing conditions, with the right amounts and types of equipment, very effective responses can be mounted that significantly reduces the amount of oiling that occurs in the environment. BSEE does not agree with the reviewer's observation that a response to a WCD, by default, can never be more than marginally effective.
M2	34, 39	One reviewer stated that a major conclusion for the study is that source control has the most significant impact in reducing WCD exposures (page xii). This reviewer stated that a critical finding of the report is that the prompt	BSEE agrees that effective temporary source control measures, if quickly implemented, can result in the most significant reductions in the amount of oil discharged into the environment, and therefore, also potentially result in the most significant reductions in

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		implementation of source control should be the first priority in a spill. The reviewer referred to pages 282 and xii.	oiling contact with the environment.
M3	34	One reviewer stated that a major conclusion to the study was that surface dispersant application, and to a larger degree SSDI, reduces shoreline oiling more than mechanical removal (page 235).	BSEE disagrees. The study shows that a well-coordinated combination of response countermeasures involving both mechanical recovery and dispersant applications will usually result in the largest reductions to surface and shoreline oiling to the environment.
M4	34	One reviewer stated that a major conclusion of the study is that the use of SSDI is a powerful response option (pages pxxii, xvi).	BSEE agrees. Used in the appropriate circumstances, the study suggests SSDI can greatly reduce oil contact with the environment.
M5	34	One reviewer stated that a major conclusion of the study was that increasing mechanical removal equipment resources does not (necessarily) reduce shoreline oiling (page 235).	BSEE partially agrees. The modeling results suggest that when increasing mechanical recovery resources in response to a WCD, at some point there will be diminishing returns with respect to the amount of oil recovered. At what level this point of diminishing returns occurs, however, is very situationally dependent upon the circumstances of the scenario and the environmental forcing factors that are present (such as weather conditions). It was beyond the time allotment and budget limitations of the study to conduct enough sensitivity analysis in the modeling to identify these inflection points. In fact, these points are likely to vary from scenario to scenario, and from simulation to simulation within a specific scenario, which would suggest there is little value in attempting to numerically define such points.
M6	35	One reviewer stated that a major conclusion of the study was that sufficient dispersant stockpiles are not available (pages 292, 293).	BSEE partially agrees. The veracity of this observation is dependent upon the scenario and is contingent upon the premise that both surface and subsea applications will be used simultaneously for an extended period of time on a continuous discharge with a very large flow rate. When responding to subsea blowouts with a very large flowrate in the Gulf of Mexico, the stockpile of existing dispersants will have to be carefully managed and rationed between surface and

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			subsea usage if it appears that the spill may require an extended period of time to secure the discharge.
M7	33	All the reviewers generally agreed that the study conclusions were logical and appropriate based on the results of the response countermeasures modeling. One reviewer stated that the general distribution and timing of the forecasts seemed reasonable. Another stated that the analysis for each of the response countermeasures modeling scenarios was logical and sound. One reviewer stated that the scenarios modeled provided a capacity to recognize which response countermeasures would be the most successful, by location, in reducing WCD exposures.	Noted. BSEE agrees.
Charge Question 2.5: *Are the recommendations logical, appropriate, and supported by the analysis and modeling results? The scope of the recommendations pertains to all recommendations, not just those derived from the modeling results.*			
Response Equipment Recommendations			
N1	33	One reviewer commented in detail about the planning values for how much and how fast various response countermeasures should be on-scene during a response, which were highlighted in Tables 104-115 (pages 289-302). The reviewer stated that these recommendations were based on critical partnerships with expert analysis of detailed response countermeasure capabilities or limitations, and detailed analysis of all oil spill response equipment for the oil spill modeling. This reviewer commented that such collaboration met the study's root objectives and was a foundation for the report's technical merit.	Noted.
N2	36	Two of the peer reviewers generally agreed that the study recommendations were appropriate. Of those two reviewers, one reviewer stated that the	Noted. BSEE agrees.

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		study recommendations appeared to be comprehensive, covering all possible OSRP requirements that might be chosen by BSEE. This reviewer commented that the rationale for including each recommendation seemed to be supported by the modeling results and analysis. The other reviewer emphasized that the study recommendations should be based on the study's root objectives, which this reviewer identified as: 1) best planning practices (strategically focused for command/control, communications, logistical) that can improve response readiness; and 2) operational best practices that maximize the effectiveness of oil spill response countermeasures (source control, dispersant, mechanical, in-situ burning).	
N3	36	Another reviewer stated that the BSEE study recommendations seemed to be overlapping and unduly complicated.	BSEE cannot comment on this statement without more information from the reviewer.
N4	36	One of the reviewers that agreed the BSEE study recommendations were appropriate also noted that it was not clear whether interactions among the BSEE study recommendations were considered, and stated that an optimum set of recommendations may include a subset of all the BSEE study recommendations currently listed in Chapter 6 of Volume II.	Noted.
N5	36	One reviewer stated that Effective Daily Recovery Capacity (EDRC) based almost entirely on pump rates did not make sense, and commented that it was an appropriate recommendation for BSEE to migrate toward using ERSP instead.	BSEE agrees. ERSP is a much better measure of equipment capability than EDRC due to ERSP's inclusion of system-wide variables that include encounter rate, efficiencies, and storage in addition to removal rates.
N6	36	One reviewer commented that the study states plan holders will be affected if the oil recovery rates of their equipment are reduced when switching to ERSP. The reviewer noted that this would be true if the required capacity is not adjusted. This reviewer commented that because	BSEE agrees that plan holders may be affected in that many recovery systems will have lower ERSP ratings than the corresponding EDRC values that would be calculated using the skimmer and pump throughput rates. BSEE does not agree that equipment capacity requirements using ERSP

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		BSEE's current capacity requirements are measured and credited using the EDRC metric, it was logical for BSEE to consider reducing the required capacity when measuring equipment capacities using ERSP. The reviewer suggested that BSEE's threshold requirements should be aligned so that equipment levels under EDRC would also meet adjusted threshold requirements using ERSP.	should be lowered in order to ensure that the same amount of equipment is required whether using ERSP or EDRC. The study does not recommend this posture. Instead, the study recommends using equipment requirements that are be based on factors such as an offshore facility's distance from shore and the size of the WCD, up to certain "capped" levels. BSEE is closely evaluating the logic scheme and recommended capability levels in the study as a possible model for inclusion in a future proposed rulemaking.
N7	38	One reviewer commented that the list of oil properties included in the recommendations for oil characterization (NAT 1) should be developed in coordination with NOAA, which maintains an oil properties database. This reviewer argued that all inputs to the NOAA database and forecast models should ideally be included in this list under NAT 1.	BSEE agrees. Any list of oil properties that would be required from plan holders and obtained through the use of oil characterization studies, should be developed by BSEE in coordination with NOAA.
N8	38	One reviewer commented that gas chromatography/mass spectrometry (GC/MS) measurements will not be available for exploration wells and, furthermore, that it may not be possible to estimate GC/MS measurements for exploration wells.	Noted.
N9	38	One reviewer commented that the best practices that were outlined (using an offshore response concept of operations) met the study's root objectives by increasing situational awareness for what is possible during an oil spill response. This reviewer stated that it was appropriate that the study recommendations listed best practices that optimize the effectiveness of oil spill response equipment (because oil moves, spreads, changes viscosity, water content, and thickness). This reviewer commented that access to "good" oil (ie oil with the best properties for recovery)	BSEE agrees with the principle that plan holders should use a concept of operations to plan for and coordinate different response countermeasures that may be used simultaneously and to ensure that the response capabilities employed are well matched to the oil they are best suited for removing.

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		by competing oil spill response equipment would be improved by the use of the recommended management controls.	
N10	38	One reviewer suggested that it is important for BSEE to use the study results to understand and communicate to the public information on the scale of "what-is-not-possible" during and oil spill response.	BSEE agrees that the study is useful for informing the public's expectations about oil removal and the potential for oil contact with the environment during a response. Understanding the limitations of what is achievable by various countermeasures in the offshore environment as a result of oil transport and weathering is an important aspect of preventing unrealistic expectations for what is possible during a response.
N11	38	For NAT 2, one reviewer asked why deterministic trajectory modeling should be used to establish the CONOPS. Instead, this reviewer stated that stochastic modeling at the planning stage should be used.	While deterministic modeling was used during the study to develop a Concept of Operations for the application of response countermeasures, BSEE agrees that plan holders could also use stochastical modeling for that purpose.
N12	39	One reviewer noted that NAT 7 would result in dramatic reductions in shoreline impact by the implementation of source control measures. The reviewer noted that NAT 8 would require sustained oil spill response resources, NAT 9 would require effective source control plan coordination with the OSRP, and NAT 10 would require coordination between subsurface and surface activities. The reviewer commented that these prescriptive best practices met the study's root objectives (as defined above by the reviewer).	Noted. BSEE agrees.
N13	39	One reviewer commented that this (recommendations for readiness and mobilization time factors) met the BSEE study's root objectives (as defined above by the reviewer).	Noted. BSEE agrees.
N14	39	One reviewer commented that the recommendation for oil spill tracking and surveillance capabilities met the study's root objectives	Noted. BSEE agrees.
N15	39	For NAT 14 (recommendations for oil spill tracking and surveillance capabilities),	NOAA is responsible for providing science support to the federal onscene coordinator,

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		one reviewer commented that NOAA OR&R was responsible for tracking the fate and transport of the oil during a spill and providing forecasts to the USCG in the event of a spill. The reviewer suggested that the study report should consider how NAT 14 should integrate with NOAA responsibilities.	including the tracking and forecasting of oil fates and movements in the environment. The operator or owner of a facility that spills oil must be prepared to surveil, record the movements of oil in the field, and provide this information to responders for ensuring the effective direction of cleanup resources, as well as provide critical assimilation data to NOAA for their oil tracking and forecasting.
N16	39	One reviewer commented that the recommendations for mechanical recovery met the study's root objectives.	Noted. BSEE agrees.
N17	40	For NAT 25, under Specific Observations (for page 290, paragraph 4), one reviewer stated that the recommendation that ERSP thresholds be significantly greater than the WCD is not supported by the modeling. The reviewer noted that ERSP ratings are already lower than EDRC values. This reviewer stated that the modeling showed that present removal capability was not maximized due to limitations of daylight and weather (see summarization on page 290 in paragraph 2). This reviewer expressed concerns that requiring a significantly higher capacity for removal was not consistent with modeling conclusions.	BSEE disagrees with this comment. One of the observations drawn from the modeling of the various scenarios was that matching the WCD volume to a commensurate amount of recovery capability often is not adequate to prevent significant oiling of sensitive environmental compartments (such as coastal shoreline habitats). While it is difficult to state what level of resources is necessary to prevent or minimize such oiling, it was observed in the study that, in general, having a greater amount of removal capacity that exceeds the WCD amount generally resulted in better environmental outcomes. This observation was readily apparent when environmental forcing conditions were generally favorable for oil removal. In fact, the study states in the paragraph referenced by the reviewer "overall, the model results suggest that the removal potential of the combined response countermeasures must be significantly greater than the volume of the oil discharged in order to achieve significant oil removal levels in large WCD events." It was also observed, however, that in some of the less favorable scenario simulations, the modeling demonstrated that there is a point where increasing mechanical recovery resulted in levels of diminishing returns with regard to oil removal. This level of diminishing returns is likely not a single fixed number; rather, it is going to be lower when

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			conducting recovery operations in unfavorable conditions, and higher when engaged in favorable conditions. The analysis also recognized that there are practical limits for how much equipment can be maintained and stockpiled in a high state of readiness and still be economically sustainable. In an attempt to address all these factors, the study recommends a scaled set of requirements that involves higher ratios of equipment for most WCD scenarios, and adopts gradually decreasing ratios as the WCD volumes get larger. These lower ratios are the result of setting "caps" on the capacity levels that are required to be maintained for the largest of the WCDs (which reflects the idea that there are limits to what size equipment caches can be economically sustained in a high readiness posture). That said, where existing equipment stockpiles do allow for resources to be maintained and deployed in higher ratios, this is a desirable state of readiness that may result in more favorable environmental outcomes if the right ambient conditions are present. Additional Note: Due to the fact that oil rapidly thins on the surface and spreads out geographically over a very large area, there is an "areal coverage" aspect to oil removal that is often overlooked when assessing resources. Increasing the number of skimming assets employed will increase the areal footprint that can be covered for oil removal, which may in fact be more important than necessarily increasing the "volume" component for oil recovery in many spill situations. Unfortunately, trying to compare the areal footprint of the oil simulation with the areal footprint of the removal resources and conduct a sensitivity analysis on that aspect of the response was beyond the scope and abilities of the modeling done for this study.

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N18	40	For NAT 25, under Specific Observations (for page 289-291), one reviewer commented that the tables (and other tables that follow in the study report) relating to response times and stockpiles of available supplies were presented as resulting from detailed analysis based on the whole study, but the reviewer expressed concerns that there did not seem to be any discussion in the study report about how the details in those tables were derived. The reviewer commented that it was logical that local environmental conditions were likely to be determinative, and this reviewer suggested that it might be appropriate for BSEE to consider modeling ensembles based on local climatology data.	Noted. The recommendations developed by the study team were based on a synthesis of information drawn from the various modules of the study, including benchmarking, the case study of the Deepwater Horizon report, OSRO surveys, the ACP survey, and the response modeling for the WCDs. Local climatology played a huge role in the modeling done in the study. BSEE agrees that any modeling done by plan holders to assist in the development of the OSRPs should use local climatology, which should improve the quality of their response concept of operations in the OSRP. However, attempting to use local climatology in order to determine response equipment thresholds for operators would be an overly complex process for the purposes of developing spill planning regulations, especially since local climatology can vary temporally as well as geographically within a region.
N19	40	One reviewer commented that the recommendations on dispersant stockpile requirements met the study's root objectives.	Noted. BSEE agrees.
N20	40	For NAT 37, one reviewer agreed that BSEE should promote additional research in order to establish improved guidance regarding SSDI DORs.	BSEE acknowledges that additional research on dispersant-to-oil application ratios for subsea discharges would be beneficial to determining what are appropriate dispersant stockpiles. However, this recommendation is outside of the scope of the study.
N21	40	The reviewer argued that improved guidance should include additional experimental modeling. Assuming that experimental modeling might be either cost prohibitive or impossible given the need to obtain environmental permits, the reviewer suggested that BSEE write a regulation that would allow the responsible party for the next spill to test different DORs and demonstrate a minimum DOR that satisfies their SSDI objective. The reviewer stated that unless nearly full-scale experiments can	While BSEE understands the need for more experimental data, BSEE does not agree with the recommendation as written. The experimental-testing of dispersant application rates in an intentional discharge or a spill-of-opportunity are outside of BSEE's authorities and jurisdiction, and also beyond the proper scope of the study. It is not possible for BSEE to draft a preparedness regulation that would authorize a responsible party to test dispersants on an actual spill, as the use of dispersants on any actual incidents is authorized through

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		be conducted to test SSDI effectiveness, there was not a very good basis to specify DORs using currently available data.	procedures established in the National Contingency Plan and implemented under the direction of the Federal Onscene Coordinator.
N22	40	One reviewer commented that the recommendations for in situ burning capabilities met the study's root objectives.	Noted. BSEE agrees.
N23	41	One reviewer commented that the recommendations for offshore logistics met the study's root objectives.	Noted. Offshore logistical support for sustaining a response was not the focus of the study; however, BSEE agrees this is an important aspect of planning that must be addressed in OSRPs.
N24	41	One reviewer commented that the recommendations for RCPs and ACPs in the Gulf of Mexico (GOM) met the study's root objectives.	Noted. BSEE agrees. There is a lack of specific response strategies identified for the offshore environment. BSEE plans to work with Area Committees to actively address this shortcoming.
N25	41	One reviewer commented that the requirements for dispersant capabilities was "already a given" due to the fact that the Region IV and VI RRTs have pre-approved surface dispersant use greater than 3 nautical miles offshore with the caveat that "mechanical recovery is the preferred oil spill response option." The reviewer referred to page 25 with respect to this comment.	BSEE disagrees. The fact that certain regional contingency plans have pre-authorized dispersant use in certain areas under certain conditions does not ensure that plan holders will have dispersant capabilities available when needed for a response. RCPs and ACPs in the GOM only provide guidance on when dispersants may be used, they do not have any power to require that a dispersant capability is maintained by operators and is ready to be used by responders under the direction of the FOSC.
N26	41	One reviewer commented that the recommendations for mechanical recovery in the Pacific OCS Region met the study's root objectives.	Noted. BSEE agrees with PAC 1, and closely evaluates how available secondary storage will affect local response capabilities. For PAC2, BSEE only partially agrees. Response capabilities ensured available by an OSRP should be well matched to the oil(s) that are covered by that plan. As oils may be different from one plan holder to another in the Pacific OCS region, it would not make sense to require that all plan holders in a region have mechanical recovery equipment that is primarily adapted to recovering heavy oil. While this may in fact be the case for many operators in the Pacific, it may not be

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			the best arrangement for all operators.
N27	41	One reviewer commented that the requirements for dispersant capabilities was "already a given" due to the fact that the Region IX RRT has pre-approved surface dispersant use greater than 3 nautical miles offshore, except for areas within the National Marine Sanctuaries or within 3 nautical miles of the Mexico border or Oregon state boundary. The reviewer referred to page 141 with respect to this comment.	BSEE disagrees. The fact that regional contingency plans have pre-authorized dispersant use in certain areas under certain conditions does not ensure that plan holders will have dispersant capabilities available when needed for a response. RCPs and ACPs in the Pacific OCS region only provide guidance on when dispersants may be used, they do not have any power to require that a dispersant capability is maintained by plan holders and is ready to be used by responders.
N28	41	One reviewer commented that the recommendations for in situ burning capabilities in the Pacific OCS Region met the study's root objectives.	Noted. BSEE agrees.
N29	42	One reviewer commented that the recommendations for RCPs and ACPs in the Arctic OCS region met the study's root objectives.	Noted BSEE agrees.
N30	42	One reviewer commented that recommendations for OSRP review in the Arctic OCS Region met the study's root objectives.	Noted. BSEE agrees, with the exception of ARC 6. Response capabilities ensured available by an OSRP should be well matched to the oil(s) that are covered by that plan. As oils may be different from one plan holder to another in the Arctic OCS region, it would not make sense to require that all plan holders in a region have mechanical recovery equipment that is primarily adapted to recovering heavy oil. While this may in fact be the case for many operators in the Arctic, it may not be the best arrangement for all operators.
N31	42	One reviewer commented that dispersant capability requirements are "already a given" due to the fact that dispersants are not pre-approved. The reviewer referred to page 160 with respect to this comment.	BSEE is not sure what statement is being made by the commenter. The comment refers to the fact that the use of dispersants is not pre-authorized by the Alaska Unified Area Contingency Plan for the Arctic region. While this is true, the Alaska Unified ACP does allow for the potential of incident-specific use of dispersants, so it is completely credible that dispersants may be used on a spill in the Arctic under certain conditions if determined to be appropriate by the natural

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			resource trustee agencies and the Federal Onscene Coordinator. These conditions, as outlined in the ACP, describe the procedures for considering the use of dispersants, however, they in no way require plan holders to maintain a dispersant application capability that is readily available for operations in the Arctic.
N32	66	One reviewer stated that it is surprising that the amount of oil collected by skimmers during Deepwater Horizon was not accurately measured. This capability is a necessary part of the recommendations, and it is important going forward that skimmers have the capability to report the amount of oil collected.	Amounts of oil collected by skimming resources were measured by some oil spill removal organizations during the Deepwater Horizon BP oil spill. However, these measurements were often lacking in breadth or precision across the overall response. BSEE agrees that operators of skimming systems should develop the capabilities to not only report amounts of oil recovered, but also the oil-water recovery efficiencies that were achieved.