Executive Summary

Final Risk Assessment and Cost Estimate (FRACE) Workshop

The purpose of this document is to provide a chronology and synopsis of all studies and technical analyses performed, including studies and assessments performed by the U.S. Coast Guard (Coast Guard or USCG), the Department of the Interior's (Interior) Bureau of Safety and Environmental Enforcement (BSEE), Taylor Energy Company LLC (Taylor or TEC), independent consultants, and Unified Command as a whole, related to the toppling and destruction of the MC-20 platform as a result of an unprecedented and unanticipated global slope failure triggered by Hurricane Ivan in 2004.

This synopsis comprises the complete technical record, hyperlinked to the actual research documents, which will form the basis for answering the questions posed by the BSEE Worst Case Discharge Working Group Charter of January 13, 2014 and the Coast Guard's Cost Estimate Working Group Charter of November 27, 2013.

The goal of the March 25-26, 2014 Final Risk Assessment and Cost Estimate (FRACE) Workshop is to fully explore and finally resolve all remaining scientific and factual issues based upon the best scientific data available and the complete record that has been compiled. Where possible, the Workshop will also include recommendations for further mitigation and action items. The factual conclusions and recommendations for further mitigation resulting from the FRACE Workshop will form the basis for the subsequent negotiations by the senior decision-makers and, hopefully, lead to final resolution of this matter.

It is the hope of everyone that Unified Command will achieve concurrence on the level of risks that remains at MC-20, the steps recommended to mitigate that risk and the anticipated cost of each mitigation step.

EXECUTIVE SUMMARY

I. Background.

Taylor Energy Company LLC's (TEC) MC-20A Platform was installed in 1984 at a location about 10 miles southeast of the mouth of South Pass of the Mississippi River in Block 20, Mississippi Canyon Area (MC-20). At the time of the design and installation of the MC-20A platform it met or exceeded all regulatory requirements of the Department of the Interior for new platform installations in the Gulf of Mexico (GOM).

Hurricane Ivan. In September 2004, Hurricane Ivan entered the GOM, passing about 60 miles east of MC-20. Ivan alternated between a Category 4 and Category 5 storm as it traveled northward towards the coast, with maximum wave heights near 100 feet and peak wave periods near 18 seconds. These wave heights and wave periods were much larger and longer than those wave conditions used in structural designs for the Eastern GOM.

The MC-20 platform was toppled by a regional slope failure, an unforeseen and unprecedented underwater sea floor collapse and mudslide, during Hurricane Ivan. The platform now lies about 550 ft. down slope and southeast from its original location. Under the direction of Unified Command, TEC conducted a series of studies and investigations in the years that followed to determine the sources and magnitude of oil and gas leaks from various locations in the debris field.

Federal Response. The complex nature of this response effort has been unprecedented. Response actions, decommissioning efforts, and potential impact analyses have been performed for almost a decade. In the summer of 2008, the USCG established a Unified Command (UC) composed of TEC, USCG, and Interior agencies, the Minerals Management Service (MMS), since divided into Bureau of Ocean Energy Management (BOEM) and BSEE, to direct response efforts for the ongoing releases. These actions included developing new technologies and drilling intervention wells to plug nine of the wells which posed an unacceptable environmental risk. In addition, containment domes were placed over three observed hydrocarbon plumes and daily over-flights were conducted to monitor sheen sizes.

As a result of the response efforts, Taylor eliminated two plumes and the third plume seepage dissipated to minimal levels through containment and seepage rate decline. Daily

observed sheen has steadily diminished, to the current average observed sheen volume of about 3.1 gallons per day. To date, there has been no evidence to suggest that sheens from the downed platform have ever impacted the shoreline, fish, benthic organisms, or any other natural resource category.

II. **Current Site Status.**

At present, there continues to be a low volume hydrocarbon release at the site, resulting in a sheen expression on the surface, averaging less than 4 gallons per observation. The rate of release equates to approximately one drop of oil being released each minute from a two square foot area on the mud line. There are occasional larger surface expressions of hydrocarbons. The source or cause of these irregular but periodic larger surface expressions (still reflecting gallons, not barrels) has been linked to the lunar cycle and the influence of tidal movements.

The sheen on the ocean surface disperses naturally, being more than 11 miles from shore and, as a result of prevailing winds and currents together with the outflow from the Mississippi River, has very limited potential for landfall or other coastal impacts. Benthic organisms and fish sampling show there are no adverse impacts on sea life, even in the immediate area. The conclusion that there are, at most, "negligible" environmental impacts was confirmed in a recent Consensus Ecological Risk Assessment, with further confirmation established in Response Cost Estimate modeling.

Analysis has been performed showing that the gas source recovered by the containment system near the buried platform jacket is biogenic (not thermogenic). The U.S. Coast Guard Marine Safety Lab has provided analysis concluding that there is a definite match between the sheen and the hydrocarbons in the soils. Multiple sonar surveys over the last few years have confirmed an absence of any plumes remaining in existence.

III. **Decommissioning Actions and Well Interventions.**

To date, the Interior agencies have authorized, and Taylor has successfully completed, decommissioning activities for: (1) the platform deck; (2) the pipelines; (3) debris removal; and (4) plugging and abandoning 9 wells by drilling intervention wells.

The decommissioning work being performed at MC 20 is unrivaled in its complexity. Conventional plugging and abandonment of the wells was not an option due to the sheer volume and consistency of overlying mud and sediment, the tangled web of wellbores left in the wake of the regional slope failure, and the environmental risks posed by these factors.

Both TEC and MMS recognized the impossibility of pursuing conventional plugging operations. While conventional plugging and abandonment of wells typically proceeds by reentering the target well from the surface, maintaining well control, and inserting cement plugs, the MC 20 wellheads are mangled and submerged under vast quantities of mud and sediment—making them inaccessible.

Well intervention at MC 20 entails a multitude of inherent technical, operational, and environmental risks. Simply put, these risks stem from drilling new wells in a tangled web of mangled well bores and possibly triggering an environmental event. Such an undertaking had never been attempted, let alone implemented, before.

TEC and its team of world-renowned experts devised a novel strategy utilizing well intervention and created new patented technologies to accomplish successful interventions. MMS accepted and authorized TEC's proposal, through appropriate alternative procedures or departures under the regulations, to pursue this innovative intervention well concept and strategy. Some of these innovations developed by Taylor for MC-20 were later utilized successfully by BP to address the Macondo spill.

After intensive studies and analyses, the final well classifications included 9 wells targeted for intervention and 16 wells targeted for a departure request (non-intervention based upon an absence of environmental risk).

Taylor's interventions on the first four wells which presented a high (flow) environmental risk resulted in the disappearance of two of the three hydrocarbon plumes/seepage discharges entering the water column from the MC-20 site. One containment dome is still in operation although volumes collected from this site have dissipated to negligible levels.

Additional intervention wells have been extensively discussed and considered. It is the conclusion of every individual, group or organization considering the issue that further intervention activity poses greater environmental risk than any potential environmental gain a very real risk exists for an uncontrolled discharge in the event of further activity. Containment is the only viable environmental response.

To date, TEC has expended approximately $435 million addressing decommissioning operations, and other costs associated with final resolution to the MC20 response.

IV. **Containment Activities Performed to Date.**

In addition to decommissioning activities and well interventions, TEC also developed and deployed a subsea containment system to mitigate the hydrocarbon plumes releases that existed prior to the successful well interventions.

As directed by Unified Command, in Administrative Order Number 006-08 dated September 23, 2008, Taylor proceeded to design, fabricate and install a subsea containment and collection system over each of the three identifiable locations of hydrocarbons entering the water column (plume sites) and conducted twice-daily over-flights to monitor for sheens resulting from these plumes. The intervention effort combined with the construction and deployment of the current containment system resulted in a measurable decrease in the observed sheen. As intervention success eliminated individual plumes and containment capture diminished, UC granted TEC to disconnect specific containment domes from the system. Only one containment dome remains in operation at this time.

V. **Residual Risks for Remaining 16 Wells.**

Prior to Hurricane Ivan, most of the MC-20 wells were unable to flow under their own declining reservoir pressure, and had been producing only under enhanced recovery techniques. All nine wells that had the potential to flow significant rates of hydrocarbons were plugged as a result of well intervention operations.

Based upon numerous studies and assessments, most of these 16 wells are not only prevented from flowing as a result of the increased hydrostatic of the seawater bearing down on the reservoir, but most also have sealing plugs created by the sediment carried by the seawater that entered the wells and flowing into the depleted reservoirs.

The typical sediment content of seawater is extremely high at the MC-20 site.

The risks of intervening in the remaining 16 wells include inherently risky well interventions potentially resulting in well collisions, inadequately plugged perforations that are in communication with higher pressured reservoirs, cross-flow potential, breaches of near-surface seals, and other threats to well integrity. These issues present tremendous risks of triggering negative environmental events.

For the remaining 16 wells, as confirmed during the CERA workshop discussed below, the environmental risks of intervention outweigh the risks of non-intervention.

VI. **Further Environmental, Engineering and Technical Studies and Risk Assessments.**

Subsequent to the nine successful well interventions, Unified Command organized a series of technical working groups to assess all technical, environmental, and residual risk issues to further explore all potential options to resolve the MC-20 matter and conclude the federal response. These working groups have all completed their assigned tasks and, coupled with the response undertaken by Taylor, form the record in this matter and the basis for the current FRACE Workshop.

A. **Unified Command Workgroups.**

In early 2012, Unified Command established two technical committees with experts from TEC, BSEE, Coast Guard and the National Oceanic and Atmospheric Administration (NOAA) to: (1) review technical risks of further intervention on the remaining 16 wells; and (2) determine the source of the ongoing sheen at MC-20. These two committees met twice per month from April through October 2012.

1. Well Review Workgroup

For the Well Review Workgroup, the committee members completed a comprehensive assessment for each individual well, including: (1) reservoir parameters and a determination on the well's ability to flow; (2) historical production history, including present gas and oil contact depths; (3) the existing wellbore components and

safety devices; and, (4) a detailed review of all drilling-related risks involved with well intervention on that specific well.

Next, the workgroup arrived at a consensus position on probability and consequence of an environmental event from each respective well in its current state; versus the probability and consequence of an environmental event should well intervention be attempted.

For 15 of the 16 wells reviewed, the Workgroup concluded that additional well interventions would result in either a higher probability of an adverse environmental event or a worse consequential environmental event, or both.

2. Sheen Source Workgroup

The Sheen Source Workgroup examined the potential source of the sheen, the environmental impact of the continuing release at the site, and the options available for mitigation. After extensive review of existing data and studies, and follow-up investigations to obtain additional information, of marine soil cores with forensic chemical analysis from the USCG Marine Safety Lab, the Sheen Source Workgroup concluded that there appears to be more than one source, and that releases occur on both an episodic and relatively continuous basis. The environmental impacts are thought to be negligible but that issue was left for further analysis in the Consensus Environmental Risk Assessment Workshop (discussed below).

B. **Consensus Ecological Risk Assessment.**

After reviewing all options available, Unified Command concluded that based on the observation that the current response actions were reaching a point of diminishing returns, it decided to convene a broadly-based group of federal and state stakeholders with applicable expertise to conduct a Consensus Ecological Risk Assessment (CERA) workshop.

Over a three day period in April, and again in June 2013, the CERA workshop was convened involving 45 people from 21 different federal and state agencies, as well as private sector expertise. The purpose of this CERA workshop was to evaluate the ecological trade-offs and potential environmental effects, both beneficial and adverse, of potential response options on

environmental resources that could be at risk. These response options included performing one or more additional well interventions and also various soil remediation options.

Regarding potential environmental impacts, the final CERA report found that "there is a low risk to resources in the general vicinity of the lease block and no exposure risk to resources outside the local area."

The CERA participants also made the following consensus recommendations:

- Expanded response capability could be a sound option;
- Utilization of the site for research and training purposes should be considered; and,
- Develop contingency preparedness capability to respond to a potential worst-case discharge scenario.

The CERA participants recommended that Unified Command: (1) "not pursue additional well intervention because the ecological risks outweigh the possible benefits;" and, (2) "not pursue dredge/dispose or dredge/cap options because the ecological risks outweigh the possible benefits."

VII. **Final Risk Assessment, Worst-Case Discharge Analyses, and Cost Estimates.**

As a result of the extensive work and analyses performed, Unified Command, acting through Coast Guard and BSEE, formally requested in December 2013 that two additional tasks be undertaken. The March 24-25, 2014 FRACE Workshop is being held to reach final conclusions on these two additional tasks.

A. **BSEE MC-20 Risk Analysis and Worst Case Discharge Working Group.**

On January 13, 2014, BSEE established a Working Group Charter to develop the risk analysis summary and potential discharge flow rates at MC-20. The charter explains that deliverables from this working group will be used by Unified Command to make decisions regarding future response operations and costs to cover current sheening and potential leaks at the MC-20 site. The charter also directed that the working group develop worst case discharge scenarios that accounts for all wells at the MC-20 site.

B. **Coast Guard's Response Cost Estimate Workgroup.**

Subsequent to the CERA workshop, on November 27, 2013, the Coast Guard developed a Working Group Charter to develop a cost estimate for incident response activities to address any residual risk posed by oil discharged at MC-20. This group is called the MC-20 Incident Response Cost Estimate Working Group.

The objective of this Working Group was to develop cost estimates for reasonably foreseeable response action necessary under the National Contingency Plan for future MC-20 oil discharges. The Workgroup was charged with delivering a written report of response cost estimates with complete justification for future potential costs associated with a worst-case discharge scenario at the MC-20 location.

At the request of Coast Guard Response Cost Estimate Workgroup, Environmental Research Consulting (ERC) developed cost estimates for reasonably foreseeable response actions for potential discharges at the MC-20 site. These cost estimates included: (1) maintenance and operation of the containment system; (2) all residual risks calculated based on location and duration of response; (3) potential shoreline and natural resource impacts; and (4) long term monitoring and surveillance.

ERC presented this information in a report titled "Analysis of Potential Response Costs and Impacts Associated with Hypothetical Future Releases from MC-20A Wells," (March 2014). ERC performed modeling and analyses for three different discharge scenarios: (1) Average Most-Probable Discharge of 3.8 barrels per day for 7 days, or 26.6 barrels; (2) Maximum Most-Probable Discharge of 3.8 barrels per day for 14 days, or 53.2 barrels; and, (3) Worst-Case Discharge of 3.8 barrels per day for 30 days, or 114 barrels.

In addition, for shoreline impacts, ERC also modeled an additional scenario at the request of TEC for Worst-Case Discharge of 10 barrels per day for 30 days, or 300 barrels, based upon the remote possibility that 6 wells would simultaneously leak 1.5 barrels per day, which was (at the time) the maximum proposed leakage rate due to corrosion. The modeling results revealed that the shore impacts and volume reaching shore with a 10 barrel release rate would be very similar to the Worst-Case Discharge of

3.8 barrels per day for 30 days (114 barrels), so additional cost modeling for this scenario was not performed.

The trajectory and fate of oil during a worst-case discharge were modelled and compared to threshold values for potential impacts to ecological (shoreline invertebrates, bird mortality, and water column) and socioeconomic (amenity beach cleanup, closed fishing) resources. Given a worst-case discharge, none of the simulations predicted mortality to sensitive water column organisms, shoreline invertebrates, or birds. The models did predict shoreline oiling that would conservatively trigger cleanup of amenity beaches (visible sheening and/or scattered tar balls). Given a worst-case discharge the probability of shoreline impacts was 0.175.

Table 12: Probability of MC-20A WCD with Shoreline Impact

Time Period	Annual Probability of Discharge[1]	Probability of Shore Impact	Annual Probability of Discharge that Impacts Shore
Total per Year	0.000574	0.175	0.00010045
Total in 50 Years	-	-	0.0050225

(Corrected Table 12 from Dr. Dagmar Etkins. Received by Taylor Energy 3/20/2014 from "Analysis of Potential Response Costs and Impacts Associated with Hypothetical Future Releases from MC20-A Wells"

ERC's modelling calculated the probability of a worst-case discharge of 0.000574 per year. Combined with the probability of shoreline impacts (0.175), there is a 1 in 10,000 chance of worst-case discharge that impacts the shoreline in one year.

Costs for natural resource damages (NRDA) for a Worst-Case Discharge were estimated to be $2,500, with a potential additional $100,000 for assessment studies and analyses.

ERC's total response cost estimates for a Worst-Case Discharge for containment system operation and maintenance were approximately $5.1 million; long term monitoring costs would total $1 to $12 million depending upon one of four monitoring methods (daily aerial, bi-monthly aerial, wave glider system, or slick sleuth system).

ERC calculated total response costs based on a 50 year window, and ultimately estimated total future response costs for MC-20 to range from $6.1 million to $17 million.

The ERC report also determined that based upon a Worst-Case Discharge of 114 barrels, there would generally be a 0.00003 to 0.05 chance of resulting in a Natural Resource Damage Assessment (NRDA) case. Furthermore, the chances that there would be any environmental impacts that might be deemed of sufficient magnitude and type to merit a NRDA process for a spill of this size are 0.0000054 to 0.009.

The ERC report is consistent with prior analyses and demonstrates that prior cost and risk estimates were over-estimated.

C. Analysis of Well Leak Rate for All Wells and Zones; Cumulative Oil Rate Exposure

In 2014, Platt Sparks performed an analysis of all wells and all zones above the current completed interval that had the potential for oil flow and calculated the cumulative oil release based upon a release from every zone in every well simultaneously.

This analysis identified 36 zones in the 28 MC-20 wells that had the potential to flow oil into the wellbore. Based upon the presence of surface cement plugs or good cement bonding across oil-bearing zones, the number of possible oil zones is reduced to 26. For all zones, Platts Sparks calculated the Adjusted Fluid Rate to be 0.35 to 1.29 barrels per day, and the Net Flow Oil Rate value to be 0.15 to 0.59 barrels per day for all zones behind pipe.

For the 26 zones without surface plugs or good cement bonding across all oil-bearing zones, Platts Sparks calculated the total Cumulative Oil Rate exposure to be 3.0 barrels per day for a small orifice size, and 10.7 barrels per day for the larger orifice size. These values reflect the total oil release rate from every zone in every well flowing through corrosion-induced leaks, all at the same time.

As detailed in ERC's discharge probability analysis and report, discussed below, the chances of a release from every zone in every well, at the same time, is "nearly infinitesimal."

D. **Analysis of Discharge Scenarios and Probabilities Report.**

In addition to the ERC cost analyses above, TEC commissioned ERC to perform an analysis of discharge scenario probabilities (flow rate, flow duration, and total release). ERC presented the results of these analyses in a report titled "Analysis of Discharge Scenario Risks from Offshore Wells; Perspectives on Taylor Energy MC-20A Discharge Scenarios" (March 2014).

This ERC report provides the following conclusions:

- Of the original 28 wells, there are two MC-20 wells that could theoretically have a flow event, and there are 19 wells that could theoretically have a corrosion-caused leakage event from a hydrocarbon zone.

- The annual probability that there will be a flow or leak event from any of the wells is estimated to be 0.000574. An incident would be expected once in 1,742 years. Over the course of 100 years, there is a 5.7% chance that there will be an oil release event from one of the wells.

- The annual probability of a corrosion-caused leakage incident from one or more of the 19 leak-capable wells is 0.0000418. A corrosion-caused leak event would be expected once in 23,923 years.

- The median predicted total spill volume is 7.3 barrels. There is a 95% chance that the spill will involve less than 45 barrels, and a 99% chance that it will involve 80 barrels or less. The maximum spill volume would be about 400 barrels.

- The probability that there will be leakage of more than 100 barrels is 0.0000017%.

- The probability of a well flow event from one or both of the two flow-capable MC-20 wells is estimated to be 0.000532 per year. Over the course of 100 years, the probability increases to 0.0532.

- The probability of a simultaneous spill from all wells is "nearly infinitesimal."

- Regarding duration of flow, the study determined that 14 days would be the likely maximum based upon deployment of pre-constructed and pre-positioned containment equipment. For the Worst-Case Discharge scenario, ERC assumed a continuous flow for 30 days until containment.

- Under the Worst-Case Discharge scenario, a hypothetical spill would contribute a maximum of 0.02% of the annual natural seepage of hydrocarbons into the Gulf of Mexico. The estimated daily release represents 0.005% to 0.01% of natural seepage rates.

- Overall, the Worst-Case Discharge scenario comprises 0.04% to 0.07% of total oil inputs into the Gulf of Mexico from all other sources.

This ERC report underscores that the future residual risks from the MC-20 site are extremely small and that timely containment deployment will further minimize and mitigation against potential environmental impacts.

VIII. **Conclusion.**

There are already three important findings and recommendations that have been reached by group consensus, confirmed by independent experts, endorsed by the participants in the Consensus Ecological Risk Assessment Workshop, and reconfirmed by Unified Command Task Forces and Workgroups. These three findings and recommendations, taken together, provide the basis for all further recommendations from the FRACE Workshop.

The three findings and recommendations that should no longer be at issue are:

1. **Undertaking any further intervention activity on any well or producing zone in which a well bore currently exists would create far more environmental risk than any potential environmental gain. For that reason no further intervention activity is recommended.**

2. **Undertaking any soil remediation option would likely result in far more environmental harm than benefit. It is not possible to excavate the contaminated soil and disposal of this material would pose unjustifiable environmental risk. From a net environmental benefits perspective, the residual oil/mud mixture**

should be left undisturbed. The natural attenuation process will consist of burial due to sediment inputs from the Mississippi River, and biodegradation.

3. **Unified Command believes and a Consensus Ecological Risk Assessment Workshop with broad participation concurs that there are no quantifiable adverse environmental impacts associated with the current status of the MC-20 site. The environmental impact is best described as "negligible."**

The FRACE Workshop on March 25-26, 2014 is the degree of risk, on a well by well basis, in the short term and in the long term. Assessing that risk, Unified Command must then decide: (1) whether containment is worthwhile and satisfactory mitigation measure requiring further action; and, (2) whether future risks require any additional precautionary or mitigation measures. There are two important reasons as to why consensus on these issues is achievable.

First, Unified Command has repeatedly demonstrated the ability to find common ground. There has consistently been a mutual respect for the roles and positions of the respective members of Unified Command and the experts and consultants who have been engaged. The ability to reach agreement on the three important findings and recommendations referenced above demonstrates the ability to reach agreement. The situation involving the erroneous acoustical image from the Okeanos Explorer is also exemplary of the spirit of cooperation and consensus. From the start, there was no intransigence or conflict, but rather a mutual desire to learn the truth and to be governed by the best science available. There is no reason to believe that attitude will not characterize the FRACE Workshop.

Second, there has been mutual agreement as to the goal of this Workshop. Everyone agrees that subsequent negotiations will be required at the highest levels of USCG and BSEE to reach a final agreement. The FRACE Workshop is neither the time nor the place for the negotiation of a final agreement. It is, however, the place to reach agreement as to all the facts, conclusions and recommendations necessary to conduct that final negotiation and decision-making. In this respect it is important to number the three steps to final recommendation.

First, we must review and discuss the facts as determined by scientific research, field testing, side scan/sonar surveys, core samples and other technical and academic efforts.

Second, based on these facts, we must determine what these facts suggest is occurring and whether there is any basis for a contrary conclusion.

Third, based upon the research and what we determine those facts suggest is occurring, we should make recommendations we believe should be followed in reaching a final agreement.

It is the obligation of each participant to study the facts and cumulative research of almost of decade of hard work, to assess those facts in reaching conclusions as to what is likely occurring at the MC-20 site and, wherever possible, reach consensus on recommendations to be considered in negotiating a final agreement.