ACCESS NUMBER: **M11PC00013**

STUDY TITLE: Updates to the Fault Tree for Oil-Spill Occurrence Estimators Needed Under the Forthcoming BOEM 2012-2017, 5-Year Program

REPORT TITLE: Updates to Fault Tree Methodology and Technology for Risk Analysis Chukchi Sea Sale 193 Leased Area

CONTRACT NUMBER: M11PC00013

SPONSORING OCS REGION: Alaska

APPLICABLE PLANNING AREA: Chukchi Sea

FISCAL YEARS OF PROJECT FUNDING: FY 2011-2016

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CUMULATIVE PROJECT COST: $229,840

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KEY WORDS: Lease Sale 193, Chukchi Sea, Oil spills, Offshore drilling and production, Subsea pipelines, Arctic hazards.

BACKGROUND:

The United States Department of the Interior, Bureau of Ocean Energy Management (BOEM) Alaska Outer Continental Shelf (OCS) Region uses oil spill occurrence estimates for National Environmental Policy Act assessments for all parts of their area of assessment, ranging from nearshore through shallow water, to deeper water. Although land to 3 nautical miles is not within BOEM jurisdiction, it is included in the BOEM environmental impact analysis; hence it is also included in the study area here. In this study, methodologies based on fault tree analysis developed earlier for the assessment of oil spill rates associated with exploration and production facilities and operations in OCS Arctic waters are applied to a specific Scenario; namely the Sale 193 Leased Area, termed the Anchor-A and Satellite A-2 development, hereinafter called the Project.

OBJECTIVES:

The objectives of this study are as follows:

- Assimilate U.S. OCS oil spill statistics and evaluate their applicability to leased tracts which were offered in the Chukchi Sea Sale 193.
- Develop the fault trees for estimating oil spill occurrences from hypothetical Chukchi Sea OCS developments associated with spills of different size categories.
- Using the fault tree approach, develop oil spill indicators and assess their variability, including effect of variability of both the historical data and the future development scenario parameters.
- Evaluate the variability of the non-Arctic factors, and include this in the Monte Carlo analysis.

DESCRIPTION:

Oil spill occurrence estimates were generated for the future hypothetical oil and gas development scenario, the Anchor A and Satellite A-2 (the Project), in the Chukchi Sea Outer Continental Shelf (OCS) Sale 193 Leased Area. Because sufficient historical data on offshore oil spills for this region do not exist, an oil spill occurrence model based on fault tree methodology was developed and applied. Using the fault trees, base data from the Gulf of Mexico and Pacific OCS including the variability of the data, were modified and augmented to represent expected Arctic offshore oil spillage frequencies.

SIGNIFICANT CONCLUSIONS:

Principal conclusions on the variation of spill indicators for the Project scenario and for its non-Arctic counterpart by spill size and region can be summarized as follows:

- Spill frequency per 10^3 years and per 10^9 barrels produced decreases with increasing spill size for all Arctic and non-Arctic scenarios.
- The spill index increases with spill size for all Arctic and non-Arctic scenarios.
- All non-Arctic scenario spill indicators are greater than their Arctic counterparts.

The variation of spill indicators by facility type for representative scenarios was found to be as follows:

- Platforms contribute the most (69%) to the two Arctic spill frequency indicators.
- Pipelines are next in relative contribution to spill frequencies (30%) and most in contribution to spill index (51%).
- Wells are the lowest contributors to spill index (16%) and spill frequency (1%). Among wells, production wells are the highest contributor to all 3 well spill indicators
- It can be concluded that platforms are likely to have the most, but smaller spills, while wells will have the least number but larger spills. Pipelines will be in between, with more spills than wells.

STUDY RESULTS:

Three principal spill occurrence indicators, as follows, were quantified for each year of each scenario, as well as scenario life of field averages:

- Spill frequency per 1,000 years
- Spill frequency per 10^9 barrels produced
- Spill index, the product of spill size and spill frequency

These indicators were quantified for the following spill sizes:

- Small (S): 50 - 99 bbl
- Medium (M): 100 - 999 bbl
- Large (L): 1,000 - 9,999 bbl
- Huge (H): >= 10,000 bbl

Quantification was carried out for each future year for the Project scenario, with a range of development parameters, in duration up to 51 years. In addition, a comparative scenario for non-Arctic locations was formulated and analyzed for oil spill occurrence. Generally, it was found that the non-Arctic spill indicators were likely to be higher than those for similar scenarios in the Arctic. The computations were carried out using a Monte Carlo process to permit the inclusion of uncertainties in the base and scenario data and Arctic effects. A wide range of details for each scenario was generated

STUDY PRODUCTS:

- Bercha International Inc., “Updates to Fault Tree for Oil Spill Occurrence Estimators, ~ Update of GOM and PAC OCS Statistics to 2012”, OCS Study BOEM 2013-0116, Final Task 2 Report to BOEM, US Department of the Interior, Alaska Outer Continental Shelf Region, July 2013.
- Bercha, F.G., Smith, C., and Crowley, H., “Current Offshore Oil spill Statistics,” Proceedings of the 11th International Conference and Exhibition on Performance of Ships and Structures in Ice (ICETECH 2014), Banff, Alberta, Canada, 28-31 July 2014
- Bercha International Inc., “Updates to Fault Tree Methodology and Technology for Risk Analysis Chukchi Sea Sale 193 Leased Area”, OCS Study BOEM 2014-774, Final Report to BOEM, US Department of the Interior, Alaska Outer Continental Shelf Region, October 2014.