ACCESS NUMBER: **M11PC00021**

STUDY TITLE: Oil Spill Occurrence Estimators for Onshore Alaska North Slope Crude and Refined Oil Spills

REPORT TITLE: Oil Spill Occurence Rates for Alaska North Slope Crude & Refined Oil Spills

CONTRACT NUMBER: M11PC00021

SPONSORING OCS REGION: Alaska

APPLICABLE PLANNING AREA: Beaufort Sea, Chukchi Sea

FISCAL YEARS OF PROJECT FUNDING: FY 2011-2015

COMPLETION DATE OF REPORT:

COSTS BY FY: FY 2011: $210,000

CUMULATIVE PROJECT COST: $210,000

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KEY WORDS: pipeline, oil field, oil spills, North Slope, occurrence estimators

BACKGROUND:

BOEM is charged with ensuring the environmentally and economically sound management of offshore resources on the U.S. Outer Continental Shelf (OCS). Estimates of oil spill occurrence rates are useful for analyzing potential oil spill impacts and contingency planning. This analysis will provide BOEM with a tool based on Alaska-specific data to estimate oil spills from future onshore oil and gas operations on the North Slope to inform environmental analyses of future project proposals required under the National Environmental Policy Act (NEPA).

OBJECTIVES:

- Update and collate crude and refined oil spill records for the North Slope of Alaska;
- Provide general information about the nature of oil spills on the North Slope of Alaska;
- Apply statistical procedures to develop occurrence rates for crude and refined oil spills < 500 bbl;
- Apply statistical procedures to develop occurrence rates for crude and refined oil spills ≥ 500 bbl by pipeline and facility;
- Apply statistical procedures to develop occurrence rates for crude and refined oil spills ≥1,000 bbl; and
- Develop appropriate confidence interval estimates.

DESCRIPTION:

A dataset was compiled from 7 existing datasets of spills resulting from oil and gas operations on the North Slope of Alaska resulting in a dataset of 1,577 oil spill greater than one barrel reported in the time

period from 1971 to 2011. After combining and reviewing the data, Nuka Research used a subset of 1,492 spills larger than one barrel from 1980-2010 as the basis for the occurrence rate analysis. The dataset included variables describing spill date, minimum and maximum spill volume, substance, cause, facility, and oil field. The data were characterized for each of these variables. Data for independent variables were also assembled and included: oil production (crude oil, natural gas liquids, natural gas, produced water, and number of wells), age of the oil field, and length of cross-country pipelines. A variety of regression techniques were applied to explore the most accurate predictive approaches that could be used to estimate the number and volume of spills based on various independent variables.

SIGNIFICANT CONCLUSIONS:

- Monthly spill reports are cyclic with the greatest number of spills in June and the least in October. This cyclic behavior and the large variation in monthly spill reports required the study to focus on annual spill rates.
- No statistically significant differences in spill rates were found between oil fields. Meaning that the results of this study can be generalized across fields. There were significant differences in spill rates between product type, cause, and facility type.
- The best method for predicting the annual number of spills was a mixed regression model based upon volume of oil produced and total length of pipe for a given oil field.
- Developing a satisfactory model for predicting spill volume was not possible, partly due to the presence of a few outlier spills in the dataset. Annual spill volume is not dependent on oil production volume.
- Spills larger than 500 bbl are rare and appear to be random events with respect to oil production volume. The best approach to estimating their occurrence was a simple return rate that predicts between zero and two spills of more than 500 bbl will occur for every one billion barrels of production.

STUDY RESULTS:

A total of 32,618 bbl of oil was reported spilled in the North Slope oil fields from June 1971 – September 2011. The largest spill was a 5,054 bbl crude oil spill from the GC-2 pipeline in 2006. This single spill accounted for 15% of the total and was one of two spills greater than 1,000 bbl during the 40 year study period. Over 80% of the spills were less than 10 bbl and these spills accounted for 13% of the total volume spilled.

Linear, multiple, and mixed effect regression techniques all produced satisfactory models to predict annual spill numbers from production and oil field data. No technique was found to predict annual volume of oil spills.

The same regression techniques were used to explore a subset of data broken out by substance (crude vs. refined oil) and spill size class.

STUDY PRODUCTS:

Robertson, T.L., Campbell, L. K., Pearson, L., and Higman, B. (2013). Oil spill occurrence rates for Alaska North Slope crude and refined oil spills. Report to Bureau of Ocean and Energy Management. Contract M11PS00021.