Oil Spill Liability Modeling: Helping to Manage Existential Risks

Introduction

Corporate risk managers are concerned with liabilities of all kinds, but there is an extra and obvious layer of concern within the oil industry that stems from the total and immense potential liability associated with catastrophic oil spills, should they occur. Liability stems from numerous components—from spill response to environmental damages. The liability for just the environmental components of the Deepwater Horizon oil spill in the Gulf of Mexico in 2010 will exceed $18 billion USD when the settlement is finalized. Given the magnitude of potential liability and new regulations in the EU that require licensees to understand their total potential liability and demonstrate a financial plan for such an accident, understanding these liabilities is particularly important. To address regulatory requirements and satisfy corporate risk management needs, companies need a reliable oil spill liability estimation model that includes costs associated with all potential liability sources. The collective learnings from historical claims associated with past oil spills, in addition to the wealth of available yet often obscure data, means that comprehensive oil spill liability estimation is possible.

Discussion

A small number of statistical models have been developed previously to predict the cost of response and cleanup related to oil spills around the world, but only a small subset of these have also considered the liabilities related to environmental damages and third-party claims. All of these models, however, are either passive (meaning that they do not actively update the predicted results) or restricted to a specific region, which limits their predictive ability at a broader scale. Exponent believes that a Bayesian network approach is a better solution.

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The Exponent Oil Spill Liability Assessment Model (EOSLEM) (Figure 1) is a user-friendly graphical model that represents the interactions and relationships among many variables in a system. It includes “Cost Elements” (at a minimum: cleanup and response, environmental damages, and third-party claims) and “Scaling Elements.” The model allows a user to select discrete scenarios to model by choosing values for the various Scaling Elements (e.g., region of operation, type of operation, size of spill, product spilled, etc.). These selections provide the initial non-economic inputs needed to estimate the most likely costs of both individual Cost Elements and the total liability for the scenario. The output of the Bayesian network model is a summation, or single estimate, of the most likely value from each Cost Element. Uncertainty is incorporated into the most likely estimate for each Cost Element by computing a weighted average cost that reflects the probability of each cost level within the Cost Element. In this way, a Bayesian network model for oil spill liability explicitly incorporates uncertainty in the final estimate, which is not provided in other, non-Bayesian models that have been developed to date.

Figure 1. Simplified Bayesian network structure of EOSLEM
Summary

Given the high uncertainty and high financial consequences of oil spills, companies have realized the need for and value of technical and data-driven models to circumscribe the nature of potential liabilities. As active and well-known practitioners in oil spill response, environmental damage assessment, and environmental economics, Exponent works closely with both U.S. and multinational companies to provide expert consulting to assist risk managers in the complex process of protecting a company’s assets through rigorous risk management and, in turn, planning.

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