A Review of the Amount of Oil Recovered from Large Offshore Oils Spills between 1970-2010

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Extended Abstract

We reviewed data collected during 30 large offshore oil spills occurring between 1968 and 2010 to determine the volume of oil recovered relative to the amount spilled. The goal of our study was to assess the "rule of thumb" that 10–30% of the total oil spilled offshore can be recovered with mechanical recovery (booming and skimming). We defined large offshore spills as being more than 10 km from shore and over about 5,000 barrels or 795 m^3. The assessment was limited to 30 spills that occurred between 1968 and 2010 because of data availability. Eighteen of these spills reported no recovery because response was challenged by spill location or sea conditions. The limiting factors affecting mechanical recovery in offshore settings include environmental conditions, oil behavior, and logistics.

For the incidents in which at least some oil was recovered mechanically (12 of the 30), oil recovery ranged from 0.1% to 10% with an average of 5.9% based on the total oil spilled (i.e., not accounting for evaporation, natural dispersion, submergence, or adhesion to surfaces). The average recovery drops to 2.3% if all 30 incidents are included, i.e., including incidents even if no mechanical recovery was reported. Both the 5.9% recovery average (average recovery excluding 18 no recovery spills) and the 2.3% recovery average (average recovery for all 30 spills) are biased high, as the reporting of recovery amounts often included oil-water mixtures with no estimates of water content.

Recovery percentages only very weakly correlated with year of spill. That is, recovery percentages for spills between 1968 & 1989 were not significantly different than those between 1990 & 2010. Further, recovery did not depend on the distance from shore to the spill location.

Oil recovery percentages (including those of the 10–30% rule of thumb) are generally reported on the basis of the total amount of oil spilled. In actual response operations, the amount of oil that would be "available" for potential recovery is reduced by the amount of evaporation, natural dispersion, submergence, adhesion to surfaces, or other processes. The detailed mass balances of the 30 spill incidents analyzed were not available with the exception of the well-studied and documented 2010 Deepwater Horizon (Macondo MC252) spill. For that incident, we found that mechanical recovery accounted for 2.7% to 4.0% of the total spilled oil, depending on the estimated range of oil removal and amount released from the well. When the recovery was calculated based on oil available for recovery (total oil release minus evaporation, natural dispersion, and oil removed directly at the wellhead), recovery ranged from 5.4% to 7.9% of available oil. When only the direct wellhead removal was subtracted from the total oil amount, we calculated recovery that ranged from 3.0% to 4.8% of available oil.

For the Deepwater Horizon recovery calculations, we assumed that all of the "available oil" would have been accessible and theoretically recoverable for each of the three major response strategies (mechanical skimming, burning, and chemical dispersants). Depending on the prioritization of the response strategies employed, other than direct removal at the wellhead, the oil may not truly have been "available" to the other

strategies if some of it had been recovered or removed by another response operation. For example, theoretically, the oil that was burned was not available for mechanical recovery or chemical dispersion. We believe the Macondo 252 spill was the only offshore oil spill where all three response options were operational.

Although we found that mechanical recovery only collected a small fraction (2–6% on average) of the oil spilled in response operations for large offshore events, we recognize that it will always be the most common tool for spill response. There are good reasons for this. Mechanical recovery is the only response option that puts oil back into containment. In addition, most spills are located in nearshore and in-shore areas where mechanical recovery operations can be much more effective. Based on this analysis, however, its application to large offshore spills will generally result in very limited recovery of the spilled oil, and we recommend that the mechanical recovery "rule of thumb" should be reconsidered with respect to spill response planning.

Additional details on this study can be found in Etkin & Nedwed (2020).

Etkin DS, and Nedwed TJ. "Effectiveness of Mechanical Recovery for Large Offshore Oil Spills." *Marine pollution bulletin*, v. 163, pp. 111848. doi: 10.1016/j.marpolbul.2020.111848.