Estimation of the Oil Released from Deepwater Horizon Incident (26 April 2010, 1200hrs PDT)

1) Surface Oil volume Estimation

Estimating oil volume by the visual appearance of the slick is a highly unreliable process. At best, one can calculate an answer to only an order of magnitude. Other estimation methods, if available, are likely to give more accurate answers

Oil spills separate into thick portions that can be as thick as an inch or more and thin sheen that are only as thick as a few visible light wavelengths. Most of the oil volume in a typical crude oil spill is in the thick part (but most of the area is sheen

Much of the oil from the light crude that is being released will evaporate or disperse in the water column. We would expect at least half of the oil released to be accounted for by these mechanisms

The oil that makes it to the surface is showing signs of emulsification. Emulsified oil can contain up to 90% water.

Weathered oil that has formed tar balls are not detectable by satellites or overflights.

Based upon past experiments, published standards, and actual spills, NOAA/ERD defines the range of thickness of slicks as

Sheen thickness – $(10^{-8}m \leftrightarrow 10^{-5}m)$
Dark oil thickness- $(10^{-5}m \leftrightarrow 10^{-2}m)$

Area coverage of slick (4/26/10), based upon satellite images $(1500km^2 \leftrightarrow 3000km^2)$

Sheen volume, using average thickness of 0.1 micron, area of 2000 sq. km and 100% coverage yields oil volume of 200 cu. m = 1200 bbl= 50,000 gal

Thick oil volume, using average thickness of 100 microns, 1% average coverage and 50% water content yields an oil volume of 1000 cu. m = 6000 bbl. = 0.25 million gal

To an order of magnitude, we estimate that there are around 10,000 bbl of oil on the water surface, or around a half million gallons

2) Estimated Present Volume Release Rate

The following assumptions are used to make a release rate calculation. If any of them are changed, the answer could be significantly different.

The oil is leaking, in a vertical plume from a hole approximately 40 cm. in diameter.

The velocity of the material in the plume is estimated by visual observation to be between 7 cm/sec and 30 cm/sec.

The plume itself contains gas bubbles, oil droplets, and entrained seawater.

Assuming that 50% of the plume volume is oil and a rise velocity of 15 cm/sec, the oil released from this source would be roughly 5000 bbl/day. (approximately 200,000 gal/day) Other sources would contribute additional oil. This answer will be refined as additional information becomes available.