Estimate of Annual Metric Tons of Mercury Discharged with Barite

The following is an estimate of the amount of mercury discharged with barite during drilling activities in the Gulf of Mexico. Conservative assumptions from publicly available documents are used for the amount of mercury in barite and the amount of barite discharged per foot of well drilled. Where more than one source of data was available, the more conservative (i.e. tending to increase the estimated amount of mercury discharged) source was used. The MMS data sources provide an estimate of the total number of wells drilled per year and the total average footage per well. Based on a conservative set of assumptions, it is estimated that 0.8 metric tons of mercury are discharged in drilling fluid barite per year.

This estimation was peer-reviewed by MMS staff experts.

Amount of Mercury in Barite

The concentration of mercury in barite is assumed to be **1 part per million**, the maximum allowed in barite discharged during drilling activities (58 FR 12454), however, there is industry data available that indicates that the average concentration of mercury in barite discharged is closer to 0.5 parts per million. The suppliers of barite used during drilling activities assay the material and provide a certificate of analysis with the barite.

Barite Discharged Per Foot of Well Drilled

The amount of barite in the drilling fluid varies from well to well. Data used by the EPA for the effluent limitation guidelines selected an 11 pound per gallon mud and a barite concentration of 98 pounds per barrel (USEPA, 1993) as an average. For this calculation, a **14 pounds per gallon** mud with a barite concentration of 147 pounds per barrel is used. This estimate is based on communications with drilling mud experts.

Data from Avanti (1997) for water based drilling muds (WBM):

Average WBM directly discharged: 3,766 bbl
Average WBM with cuttings discharged: 551 bbl
Average footage drilled: 4,454 ft.

Assuming an average mud weight of 14 lb/gal and a barite content of 25% in mud gives:

(3,766+551) bbl x 42 gal/bbl x 14 lb/gal x 0.25 = 634,599 lbs barite per well, or

in terms of pounds of barite per foot drilled for an average well of 4,454 feet = **140 lbs barite per foot drilled**.

Alternately:

A presentation at an SPE Meeting (Candler and Primeaux, 2003) gave data on 38 wells, with an average depth of 14,580 feet, with an average amount of barite discharged of 429 tons. This is equivalent to a smaller discharge of 60 lbs per foot drilled.

Drilling Activity

Well data from MMS database indicates that 5,457 wells were drilled with an average depth of **12,038 feet** over the past five years. Therefore, the average annual number of wells drilled is **1,091 per year**. The average well depth can also be considered an upper limit because some wells are recorded in the database with the entire depth, which may include sections that were previously drilled and not newly drilled.

Calculation of Mercury Discharged with Barite

Using the MMS data as an estimate of the total footage drilled, and assuming 1 ppm Hg in barite, we have,

1,091 wells/yr x 12,038 ft/well x 140 lbs barite / ft x $1x10^{-6}$ g Hg/ g Barite = 1,839 lb Hg/yr = **0.8 metric ton of mercury per year**.

References:

Avanti Corporation. 1997. *Assessment and Comparison of Available Drilling Waste Data from Wells Drilled using Water Based Fluids and Synthetic Based Fluids*. EPA Contract No. 68-C5-0035.

Candler, J.E. and R.J. Primeaux. 2003. *Field Measurements of Barite Discharges in the Gulf of Mexico*. Presentation to the Society of Petroleum Engineers' Exploration and Production Environmental Conference, March 10-12, 2003, San Antonio, Texas.

U.S. Environmental Protection Agency. 1993. *Development Document for Effluent Limitation Guidelines and New Source Performance Standards for the Offshore Subcategory of the Oil and Gas Extraction Point Source Category*. EPA 821-R-93-003.