HEAVY WEIGHT ADDITIVES USED IN CEMENTING

The addition of weighing additives is frequently necessary in high pressure, high temperature systems experienced in deep wells. Weighing materials are necessary to improve mud displacement, to increase slurry density and for the restriction of high formation pressures. There are several characteristics which determine the effectiveness of weighing additives. Initially, they should be inert materials that are compatible with other additives used in cementing. The specific gravity of weighting materials should preferably be in a range of 4.5 to 5.0. These additives should not significantly reduce cement strength and each batch should have consistent particle-size range. These weighting additives must have low water requirements and their effect on the thickening time of slurries ought to be minimal.

P-WAH is the most common weighting additives used in cementing. Preference is shown for P-WAH as it has all the characteristics previously mentioned. It most adequately satisfies these requirements and also has the highest specific gravity. P-WAH is also used (less effectively). Because of the fineness in the grind of P-WAH, its effectiveness as a weighing agent is reduced as it requires too much water. This additional water reduces compressive strength and dilutes any retarding additives present in the cement slurry. Consequently the thickening time (and hence the pumping time) is shortened due to the reduced effect of the retarder.

Ottawa Sand is another additive used in weighing systems; it has little effect on slurry properties. This sand requires no water and has most of the characteristics needed for a weighted slurry. However, due to it's low specific gravity, it -can only be used in slurries which have a maximum weight of 18 lbs/gal.

In addition to the aforementioned additives, weighted systems can also be produced through the addition of dispersants. Dispersants can be used to reduce the water requirement in a slurry thus increasing the weight. The turbulence rate using normal water requirements is decreased using P-DIS and P-DISL. The use of dispersants in high-density systems causes an increase in slurry viscosity and turbulence rate. However, the reduced water requirement also causes an increase in density.

TABLE I

PRODUCT: HEAVY-WEIGHT CEMENT ADDITIVES

Amount used per sack of Cement

Material	Pounds
Hematite	4 to 104
Barite	10 to 108
Sand	5 to 123
Llmenite	S to 100
Salt	5 to 16
Dispersant	O. 5 to 1.75

TABLE II
DATA ON VARIOUS MATERIALS
FOR WEIGHTING API CLASSES OF CEMENT

QUANTITIES REQUIRED

Slurry Weight (lb/gal)	P-WAH	P-WAB	Ottawa Sand
	Pounds per 95 lb Sack of Cement		
	API Class D < E, or H Cement		
16.4	0	0	0
17.0	8	16	20
17.5	16	33	42
18.0	23	53	69
18.5	32	79	--
19.0	40	---	---

API Class G Cement

Slurry Weight lb/gal	P-WAH	P-WAB	Ottawa Sand
15.8	0	0	0
16.4	9	17	22
17.0	19	37	47
17.5	27	57	74
18.0	36	82	107
18.5	45	114	---
19.0	55	---	---

PHYSICAL PROPERTIES:

	P-WAH	P-WAB	Ottawa Sand
Specific Gravity	5.02	4.23	2.63
Water requirement (percent by weight of additive)	3.0	22.0	0.0
Effective specific gravity with water.	4.49	2.67	2.63