PLAINTIFF'S EXHIBIT

UC-4289

INTERNAL CORRESPONDENCE

MINING AND METALS DIVISION • P. O. BOX 579, NIAGARA FALLS, NEW YORK 14302

To (Name) Mr. P. J. Colpoys (4)
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R & D File

Date August 10, 1972

Originating Dept Research and Development Department

Answering letter date

Subject Magnetite-Asbestos Well Fluid Weighting Agents, Laboratory Evaluation of Performance and Constituent Analysis

Dear Mr. Colpoys:

The program has been completed for evaluating various combinations of magnetite and asbestos as weighting agents for well fluids. The program objectives were to determine the optimum magnetite-asbestos ratios to maximize the fluid weight and the acid solubility of the weighting agent and to minimize the fluid viscosity and the settled density of the weighting agent.

Magnetite was mixed with asbestos at 1, 2, 3, and 5 wt. % of the mix. Following is a summary of the results.

1. A weighting agent compounded from 99 wt. % King City tailings magnetite and 1 wt. % High Purity Opened asbestos appears to be optimum for very high-density fluids. This composition has acceptable rheological properties in fluids weighted to 15 to 18 pounds per gallon (dilute suspensions settle to a slurry density of 15 pounds per gallon).

2. Asbestos at 2 and 3 wt. % provides a weighting agent suitable for well fluid weights ranging from 13.5 to 16 pounds per gallon.

3. At 5% asbestos the maximum fluid weight is limited to 14 pounds per gallon and to 13 pounds per gallon minimum weight.

4. Fluids lighter than 13 pounds per gallon will require more than 5 wt. % asbestos to suspend the magnetite and limit the settled solids density.

The performance evaluation data, the compounded weighting agent specifications, and the constituent characteristics are listed in seven tables:

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I. Rheological properties of fluids weighted to 12, 14, 16, and 18 pounds per gallon with weighting agents containing 1, 2, 3, and 5 wt. % asbestos.

II. Settling rates and final settled solids volumes of the four weighting agent compositions.

III. Chemical and physical characteristics of the four weighting agent compositions.

IV., V. & VI. Chemical and physical characteristics of the magnetite.

VII. Typical product characteristics for High Purity asbestos.

Precautions should be taken to ensure that asbestos-magnetite weighted fluids are kept free of anionic surfactants which will disperse the asbestos and allow the magnetite to settle. If this will not be possible in the field, the use of RG-244 or RG-444 grades of asbestos should be investigated as a substitute for the High Purity grade.

Very truly yours,

J. E. Skvarla

J. E. Skvarla

JES:rvg
Attach.

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TABLE I

Rheological Properties of Magnetite-Asbestos-Weighted Well Fluids

1. Instrument - Fann Viscometer, Model 35 (Spring, Rotor, Bobbin - No. 1).
2. Standard API procedure.
3. Target specs.: AV 100 cps. max., 10 sec.gel <20 lb./100 ft.^{2}, 10 min. gel <50.

Well Fluid		Weighting Agent Compound No. 1	2	3	5
Wt.-12 lb./gal.	AV (cps.)	7	14	22	48
Sp.gr. 1.44	PV (cps.)	7	11	19	42
	YP (cps.)	0	7	5	11
*10 sec.gel(lb./100 ft.^{2})		6	4	2	8
Wt.-14 lb./gal.	AV	21	40	48	63
Sp.gr. 1.68	PV	9	13	25	24
	YP	24	55	45	78
*10 sec.gel		28	8	17	24
Wt.-16 lb./gal.	AV	50	75	70	(700 viscous for analysis)
Sp.gr. 1.92	PV	23	24	16	
	YP	55	102	108	
*10 sec.gel		N.D.	24	37	
Wt.-18 lb./gal.	AV	86			
Sp.gr. 2.16	PV	69			
	YP	34			
*10 sec.gel		34			

*10-second and 10-minute gel strength data are comparable for asbestos systems

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TABLE II

Settling Rate and Final Settled Volume of Magnetite-Asbestos Well Fluid Weighting Compounds

Time (Min.)		Weighting Compounds 1	2	3	5
0	Settled Vol.(ml)	1000	1000	1000	1000
5		760	815	815	890
10		640	690	725	850
15		590	655	690	805
20		570	625	665	785
25		560	605	650	760
30		545	595	640	740
35		530	585	630	720
40		520	575	625	705
45		515	570	620	-
50		-	565	615	-
55		500	560	610	-
60		495	555	605	-
18 Hours		475	520	560	575

Analysis of the Settled Solids From the 18-Hour Settling Test

1. Settled vol. (ml)	475	520	560	575
2. Contained solids (g.)	516	411	412	414
3. Contained solids (cc.)	111	89	90	92
4. Contained water (ml)	364	431	470	483
5. Total wt. in settled solids (g.)	880	842	882	897
6. Sp.gr. of settled solids volume	1.85	1.62	1.58	1.56
7. Lb./gal. wt. of settled solids volume	15.4	13.5	13.2	13.0

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TABLE III

Chemical and Physical Characteristics of Magnetite-Asbestos Well Fluid Weighting Compounds

Weighting Compound	Composition, Parts/100 by Wt. Asbestos	Fe_3O_4	Compound* Sp. Gravity (g./cc.)	Compound** Solubilities (Wt. %) Acid	Acid Mud
1	1	99	4.66	92.4	97.3
2	2	98	4.62	92.4	94.6
3	3	97	4.58	92.0	95.4
5	5	95	4.50	90.0	94.3

*Constituent Sp.Gr.

Asbestos	2.5
Fe_3O_4	4.7

**By Gulf Res. procedure, target spec. > 50% sol.

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TABLE IV

Chemical and Physical Characteristics of the Magnetite

Magnetite Constituent

From King City, California asbestos mill tailings. Physically beneficiated to 4.7 minimum specific gravity. X-ray diffraction pattern identical to that of magnetite standard.

TABLE V

Magnetite Analysis by Emission Spectrograph

Element	% Contained
Al	0.08 - 0.8
Ca	0.008 - 0.08
Co	0.02 - 0.2
Cr	0.1 - 1.0
Cu	0.002 - 0.02
Fe	Major
Mg	0.8 - 8.0
Mn	0.02 - 0.2
Mo	0.008 - 0.08
Ni	0.1 - 1.0
Si	0.1 - 1.0
Ti	0.008 - 0.08
V	0.002 - 0.02

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TABLE VI

Magnetite Particle Size Distribution by Sharples Micromerograph

Diameter (Microns)	Wt. % Finer
50	100
30	70
20	41
10	29
9	28
8	26
7	22
6	17
5	15
4	14
3	10
2	4
1	1
0.5	0

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TABLE VII

Typical Product Characteristics for
High-Purity Pellets (HPP)

Property	Typical Value
Moisture Content, %	2.0
Magnetite, %	0.6
+65 Mesh, Wet Screen % (after repulping)	1.0
pH	9.5
Specific Gravity	2.45
Surface Area of Fibrous Product, m^2/gm	60
Refractive Index, $n_d 25°C$	1.54-1.56
Reflectance, GE Brightness, %	74
Nature of Surface Charge	Electropositive (Cationic)
Bulking Value, gal./100 lb.	4.8
Aspect Ratio of Fibers (Average L/D)	200/1
Shipping Density, $lb./ft.^3$	40

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