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HIGH-SULFUR PITTSBURGH COAL:

UPGRADING IN SOUTHWESTERN PENNSYLVANIA AND NORTHERN WEST VIRGINIA

By Thomas Fraser, W. L. Crentz, and A. L. Bailey

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HIGH-SULFUR PITTSBURGH COAL:
UPGRADING IN SOUTHWESTERN PENNSYLVANIA AND NORTHERN WEST VIRGINIA[1]

By

Thomas Fraser,[2] W. L. Crentz,[3] and A. L. Bailey[4]

Introduction

IN a Nation-wide appraisal of coking-coal reserves and of the feasibility of expanding them by upgrading marginal coals, it is natural that the Pittsburgh region of Pennsylvania should be considered first. Here, where the American iron and steel industry started, the Pittsburgh coal bed is of paramount importance. The use of coke in iron blast furnaces is said to have begun with the discovery that good blast-furnace fuel could readily be made by a simple method of coking Pittsburgh coal. To the present time, the prosperity of the steel industry has depended largely on utilization of this great coal reserve and the cheap transportation afforded by the Monongahela River system.

OBJECT AND SCOPE OF INVESTIGATION

The initial project in the study of upgrading marginal coking coals was laid out in this area, which contains large reserves of Pittsburgh coal contiguous to the Monongahela and its navigable tributaries. Much of the Pittsburgh coal remaining here is known to have a high sulfur content. The problem of reducing the sulfur to meet metallurgical requirements already has received much attention,[5] and it is considered to be one of the most difficult technologic problems in the field of coal washing.

The research project was limited geographically to the Pittsburgh bed in Allegheny, Fayette, Washington, and Greene Counties of southwestern Pennsylvania and Monongalia, Marion, Marshall, Ohio, Brooks, and Hancock Counties of northern West Virginia. The work consisted in sampling and examining samples from typical areas of Pittsburgh coal in this region, with principal emphasis on the problem of sulfur.

ACKNOWLEDGMENTS

Acknowledgment is made to the many coal-producing companies that extended the privilege of sampling and gave active help; to many engineers and consultants in the region who offered suggestions; and to other sections of the Bureau of Mines that furnished services. A great many data on sulfur in samples of the Pittsburgh coal in West Virginia were furnished by the West Virginia Geological Survey, Morgantown, W. Va.

The laboratory separations and chemical analyses were furnished by the Coal Analysis Section. The cooperation of H. M. Cooper and R. F. Abernethy, of that section, was appreciated. Miss Fern Steele made the mechanical computations and tabulations.

PRODUCTION OF COKING COAL IN THE REGION

The production of coke from Pittsburgh coal was begun in 1841,[6] when two 10-foot beehive ovens were erected in the Connellsville region to make coke for shipment by river to the Cincinnati market.

Eavenson[7] reports that after the successful

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[5] Fraser, Thomas, and Crentz, William L., Washing Characteristics of the Pittsburgh Coal in a High-Sulfur Area in Greene County, Pa.: Bureau of Mines Tech. Paper 689, 1946, 85 pp.

Davis, D. H., and Griffen, John, The Pittsburgh Coal Seam in Pennsylvania—Its Reserves, Qualities, and Beneficiation: Trans. Am. Inst. Min. and Met. Eng., vol. 157, Coal Division, 1944, pp. 22–58.

[6] Fulton, John, Coke: International Text Book Co., Scranton, Pa., 1905, p. 133.

[7] Eavenson, Howard N., The Pittsburgh Coal Bed—Its Early History and Development: Trans. Am. Inst. Min. and Met. Eng., vol. 130, Coal Division, 1938, pp. 1–55.

use of Connellsville coke had been demonstrated in the Clinton furnaces in 1857, production of metallurgical coke in beehive ovens in that region increased very rapidly—all based on the use of straight Pittsburgh coal.

The statistical record shows that by 1880 the quantity of Pittsburgh coal used for producing coke amounted to 4,326,918 tons a year. The industry grew steadily to the peak year 1918, when 43,120,149 tons was used. In 1936 the total consumption for coke making was 24,680,298 tons. These totals include the coal used in byproduct plants in making gas and domestic coke; but such operations account for a relatively small percentage of the total coking business in the Pittsburgh area.

During these years, most of the coking coal has been obtained from the area of low-sulfur Pittsburgh coal east of the Monongahela River in Fayette and Westmoreland Counties, which is known as the coke region. With declining production in that area, however, it has become necessary to supplement the supply with increasing quantities of coal from adjacent areas, and this is forcing coking-coal operations into the higher-sulfur reserves west of the Monongahela River.

In the industrial expansion that took place during and after the First World War, several captive mines on the west side of the river in Greene County were opened to supplement supplies of high-volatile coking coal from the Connellsville region. The Youngstown Sheet & Tube Co. expanded development of a property at Nemacolin, and Pickands, Mather & Co. started their operation at Mather, in the northeast part of the Greene County field. Washeries and blending bins were erected at both these mines to reduce the sulfur content and insure uniformity of the product. These were the beginnings of the extension of coking-coal production into the higher-sulfur reserves, and this extension is increasing as the reserves in the old coke region diminish.

Table 1 gives the shipments of coking coal in January 1947, the last month for which records of coal shipments were required to be filed with the Solid Fuels Administration for War. In this period, 50.6 percent of the coking coal that originated in the Pittsburgh bed in the Pittsburgh area was supplied by producers in the coke region of Fayette and Westmoreland Counties. The rest was distributed as indicated. The general area in which coking coal is produced is indicated in figure 1. Mines that shipped byproduct coal in January 1947 are indicated by appropriate symbols.

TABLE 1.—*Shipments of byproduct coal from mines in the Pittsburgh bed in January 1947*

State and County	Number of mines	Mechanically cleaned coal, tons	Raw coal, tons	Total byproduct produced, tons	Total production, tons [1]
Pennsylvania:					
Allegheny County	8	3, 522	13, 578	17, 100	140, 235
Fayette County	28	[2] 1, 603, 355	125, 298	1, 728, 753	1, 931, 125
Greene County	6	307, 627	115, 611	423, 238	501, 093
Washington County	19	645, 084	347, 945	993, 029	1, 108, 161
Westmoreland County	12	88, 107	34, 262	122, 369	277, 173
West Virginia:					
Marion County	8	7, 402	329, 995	337, 397	734, 739
Monongalia County	3	----------	33, 875	33, 875	35, 461
Total	84	2, 655, 197	1, 000, 564	3, 655, 761	4, 727, 987

[1] Total production of mines that shipped byproduct coal.
[2] Includes 1, 387, 822 tons of byproduct coal shipped as raw coal but cleaned at coke ovens.

CURRENT PREPARATION PRACTICE

Washing.—Table 2 is a summary of current coal-cleaning practice in the Pittsburgh area. The coal is washed at virtually all the captive mines and large commercial operations that ship coking coal. In the coke region, where the raw coal generally has a low sulfur content, it is nevertheless advisable to wash the coal to maintain uniform quality and also to eliminate particles of slate, which are thought to cause fracture lines in the coke and increase the proportion of breeze.

In the higher-sulfur areas, where operations for the production of coking coal are on the increase, sulfur reduction is the major objective in washing. Table 3 gives the performance of five typical plants in the area that work on raw coals containing 1.31 to 2.72 percent sulfur. The data on sulfur reduction in these plants disclose in a general way the baffling nature of the problem.

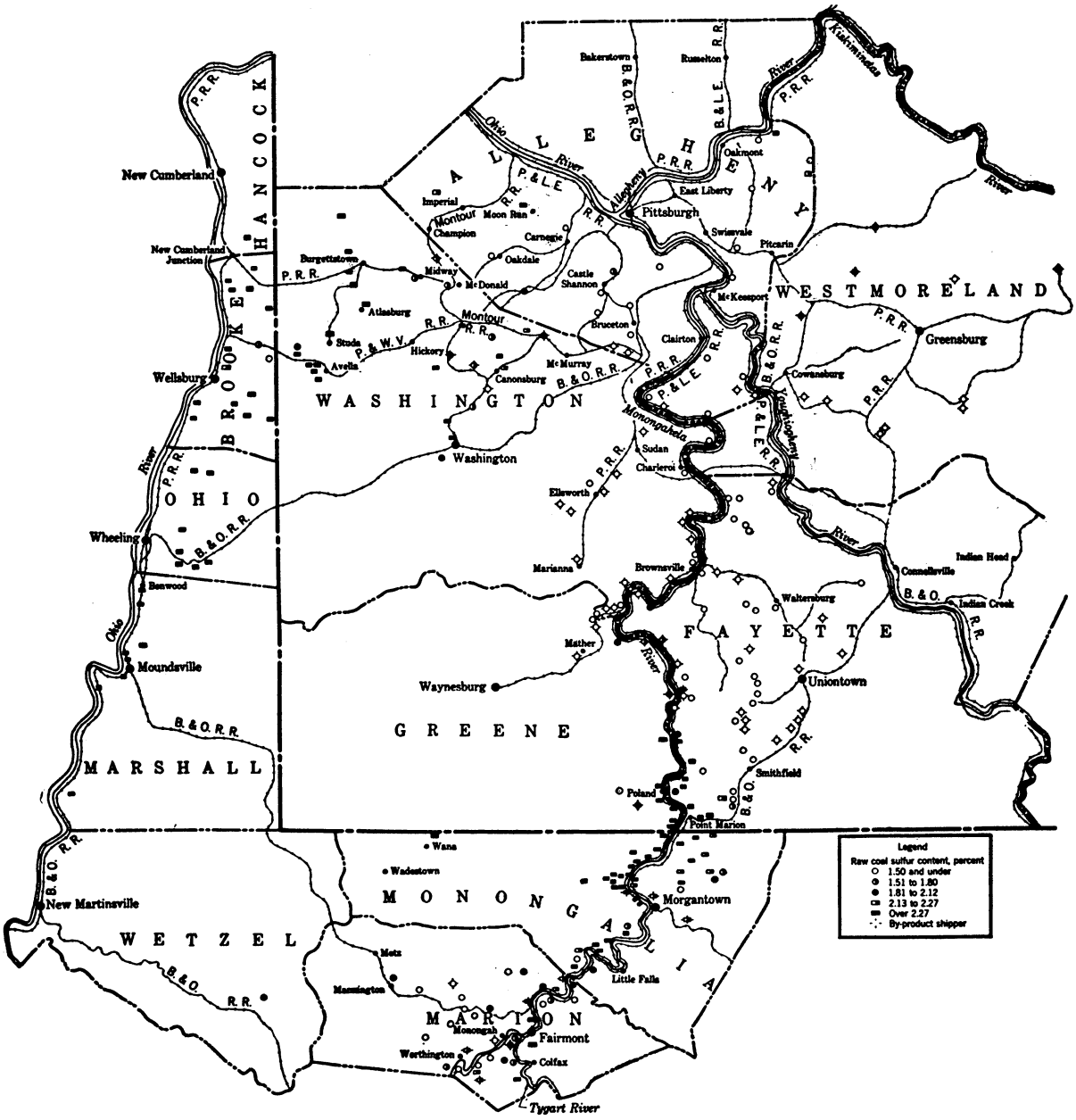


FIGURE 1.—GENERAL SULFUR-DISTRIBUTION MAP OF AREA UNDER INVESTIGATION, SHOWING MINES THAT SHIPPED BYPRODUCT COAL DURING JANUARY 1947.

TABLE 2.—*Current coal-cleaning practice in the Pittsburgh area*

State and County	Byproduct		Fuel only	
	Number of plants	Cleaned coal, tons	Number of plants	Cleaned coal, tons
Pennsylvania:				
Allegheny County:				
Baum jigs			2	1, 015, 850
Launders	2	254, 070	2	1, 856, 519
Dense-media			1	587, 302
Pneumatic method	1	833, 889	(1)	268, 938
Total Allegheny County	3	1, 978, 959	5	3, 728, 609
Fayette County:				
Baum jigs	1	1, 546, 408		
Launders	1	658, 636		
Pneumatic method			1	57, 900
Total Fayette County	2	2, 205, 044	1	57, 900
Greene County:				
Launders	2	3, 588, 875	1	676, 440
Pneumatic method	1	277, 064		
Total Greene County	3	3, 865, 939	1	676, 440
Washington County:				
Launders	4	2, 723, 580	2	839, 366
Dense-media			2	363, 905
Pneumatic method	1	318, 757		
Total Washington County	5	3, 042, 337	4	1, 203, 271
Westmoreland County:				
Baum jigs	1	65, 000	2	154, 326
Launders	1	193, 321		
Dense-media	1	162, 236	1	190, 242
Pneumatic method	(1)	400, 000	2	156, 977
Total Westmoreland County	3	820, 557	5	501, 545
West Virginia:				
Marshall County:				
Baum jigs			1	32, 607
Total Marshall County			1	32, 607
Marion County:				
Baum jigs	1	298, 720		
Total Marion County	1	298, 720		
Monongalia County:				
Baum jigs			4	2, 036, 189
Launders			1	173, 520
Dense-media			3	1, 622, 303
Total Monongalia County			8	3, 832, 012

[1] Pneumatic cleaning equipment in same plants using wet-washing equipment.

TABLE 3.—*Some examples of current washing performance*

Example	Size, inches	Raw coal		Cleaned coal			Refuse	
		Ash	Sulfur	Yield	Ash	Sulfur	Ash	Sulfur
1	2 x 0	9. 1	1. 31	96. 6	7. 0	1. 10	60. 6	6. 97
2	1 x 0	12. 1	1. 68	92. 7	7. 2	1. 35	74. 1	5. 87
3	4 x 0	12. 8	1. 96	91. 7	7. 8	1. 57	68. 4	5. 73
4	4 x 0	12. 5	1. 73	91. 0	7. 3	1. 28	65. 0	5. 65
5	1¼ x ¾	20. 4	2. 72	76. 0	6. 9	2. 47	63. 2	3. 92

In many beds more responsive to washing, the coal can be reduced to fairly uniform sulfur content, because the peaks of sulfur in the high-sulfur lots are mainly in the form of coarse pyrite bands; in the Pittsburgh bed, however, fluctuations in raw-coal sulfur are generally accompanied by almost equal fluctuations in organic and finely disseminated pyritic sulfur. This peculiarity of the Pittsburgh bed, which makes it unusually difficult to wash, is shown graphically in figure 2, which shows the sulfur forms in 37 mine samples collected in a relatively small area of Pittsburgh coal in Greene County.[8]

Blending.—Variability in sulfur content is characteristic of the Pittsburgh bed, even in the areas nominally low in sulfur. To smooth out the peaks, some producers have provided mixing bins and set up controls[9] to direct disposition of the R. O. M. coal from various mining sections so as to minimize the fluctuations in sulfur and ash.

Mixing and washing are expedients that have been used widely to cope with the problem of increasing sulfur in the coking coal delivered in the region. Conventional coal-washing methods that will reduce the sulfur content by about 0.30 percent have been used for many years, and this practice is now almost universal. As shown in table 1, only about a million tons was used in the raw state out of a total of 3,655,761 tons of byproduct coal produced in the district in January 1947. Washing and blending together constitute the preferred method of preparing coking coal in current practice.

The most general practice is to adjust the washers to make a separation at about 1.55 specific gravity. Blending before washing and blending after washing are practiced; and where two or more coals are used in the coke-oven charge, blending is done at the coke plants.

CHARACTERISTICS OF THE COALS

Sulfur forms.—The most perplexing problem in upgrading marginal coals of the Pittsburgh bed is how to reduce the sulfur content to acceptable amounts. Sulfur reduction overshadows ash reduction as a technical problem.

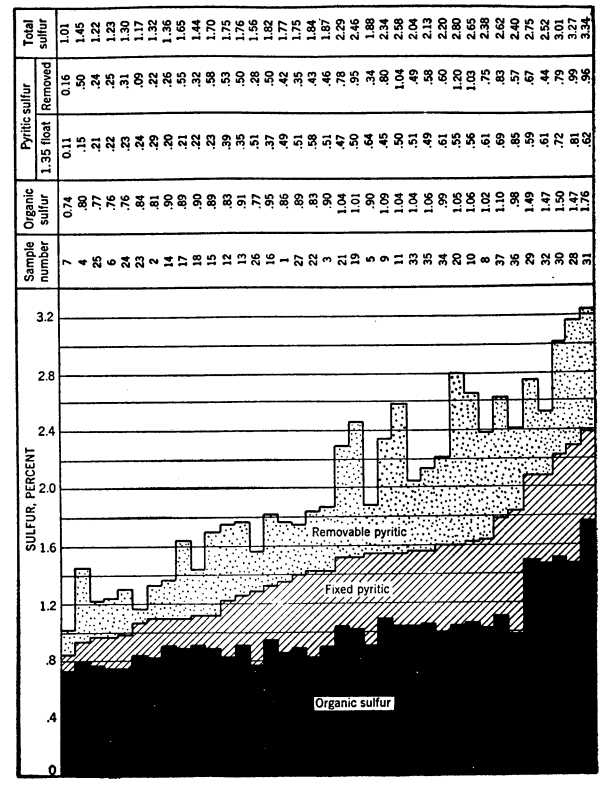


FIGURE 2.—VARIATIONS IN SULFUR CONTENT OF FACE SAMPLES ⅜ INCH BY 48 MESH.

The minimum ash content of the coal particles, beyond which further reduction is impossible by mechanical means, is the inherent ash of the coal matter. This inherent ash is usually a small percentage of the total ash content of the coal bed. On the other hand, the reduc-

[8] Fraser, Thomas, and Crentz, William L., Washing Characteristics of the Pittsburgh Coal in a High-Sulfur Area in Greene County, Pa.: Bureau of Mines Tech. Paper 689, 1946, 85 pp.

[9] DeKay, H. E., Turnbull, L. A., Scudder, J. N., and Toenges, A. L., Control of Sulfur and Ash in Mine-Run Metallurgical Coal: Bureau of Mines Rept. of Investigations 3742, 1943, 28 pp.

tion in sulfur content is definitely limited to the bed quantity of organic sulfur plus that part of the pyritic sulfur that is in the finely divided state. In the Pittsburgh bed these two forms usually comprise a considerable part of the total sulfur. Only the very light fractions of the coal approach the sulfur limit fixed by the organic sulfur value.

Earlier investigations [10] into the relationship between specific gravity and the forms of sulfur in the coal matter indicate that variations in organic-sulfur content of the various fractions fall largely within the range of experimental error, but there is substantially a straight-line relationship between specific gravity and pyritic-sulfur content. However, the fractions between 1.60 specific gravity and 1.35 specific gravity are so small in proportion to the total coal mass (fig. 3) that the sulfur in these fractions is insignificant; the average sulfur in coal product is determined almost entirely by the sulfur in the large fractions below 1.35 in specific gravity. The straight-line relationship is shown quantitatively in figure 4, in which pyritic-sulfur content is plotted against specific gravity of the coal particles.

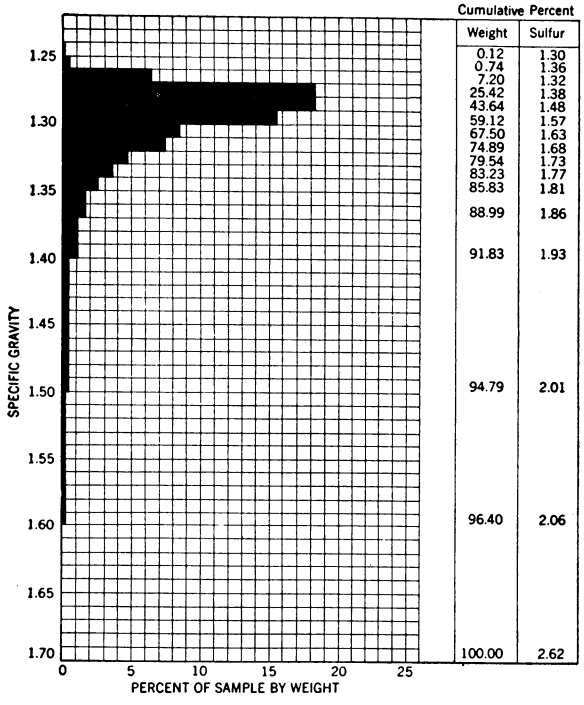


FIGURE 3.—SPECIFIC-GRAVITY CONSIST CHART OF COAL SAMPLE FROM THE SHANNOPIN MINE.

[10] Fraser, Thomas, and Crentz, W. L., Sulfur in Low-Gravity Fractions of Some Bituminous Coals: Bureau of Mines Rept. of Investigations 4167, 1947, 6 pp.

The most serious difficulty met with in producing low-sulfur coal is posed by the extreme variability of the Pittsburgh bed in respect to sulfur content. Geographically, there are areas of low-sulfur coal, adaptable to metallurgical use without washing and areas of very high-sulfur coal, but within these general areas (indicated in fig. 5) there are local variations in sulfur content. Especially in the intermediate or marginal areas (ranging between 1.5 and 2.5 percent in nominal sulfur content) there is a complex pattern of local variations in sulfur content that seems to offer some opportunity for selective mining but is so intricately varying and unpredictable in pattern that the practicability of such a plan is doubtful. All the mine-sample information that could be obtained is entered on the map (fig. 5) to show any general trend that may be discernible with respect to geographical distribution of the low-sulfur and marginal coals.

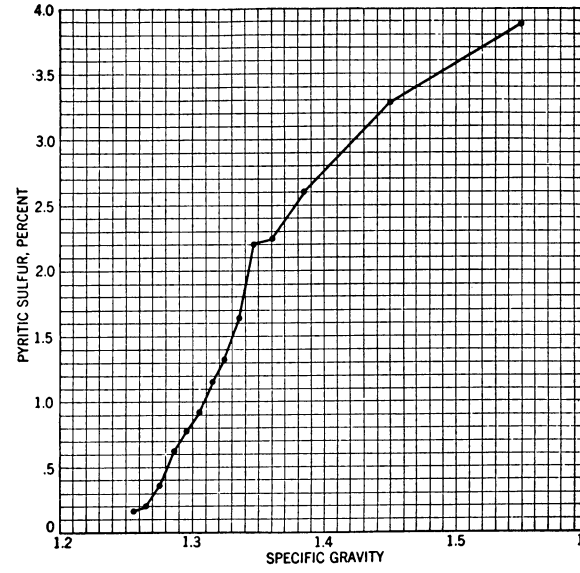


FIGURE 4.—PYRITIC-SULFUR CONTENT OF VARIOUS SPECIFIC-GRAVITY FRACTIONS OF A SAMPLE OF PITTSBURGH BED FROM GREENE COUNTY, PA.

Ash.—Unlike sulfur, the ash content in the float coals of the Pittsburgh bed shows much less variation, although the float ash is by no means constant on a particular gravity. Furthermore, the relationship between the ash and sulfur content of the Pittsburgh-bed coal is very irregular. The high-sulfur coals of the West Virginia panhandle have not a significantly higher ash content than the northern West Virginia coals, the sulfur content of which is considerably lower. All the coal samples tested from the area under investigation showed that

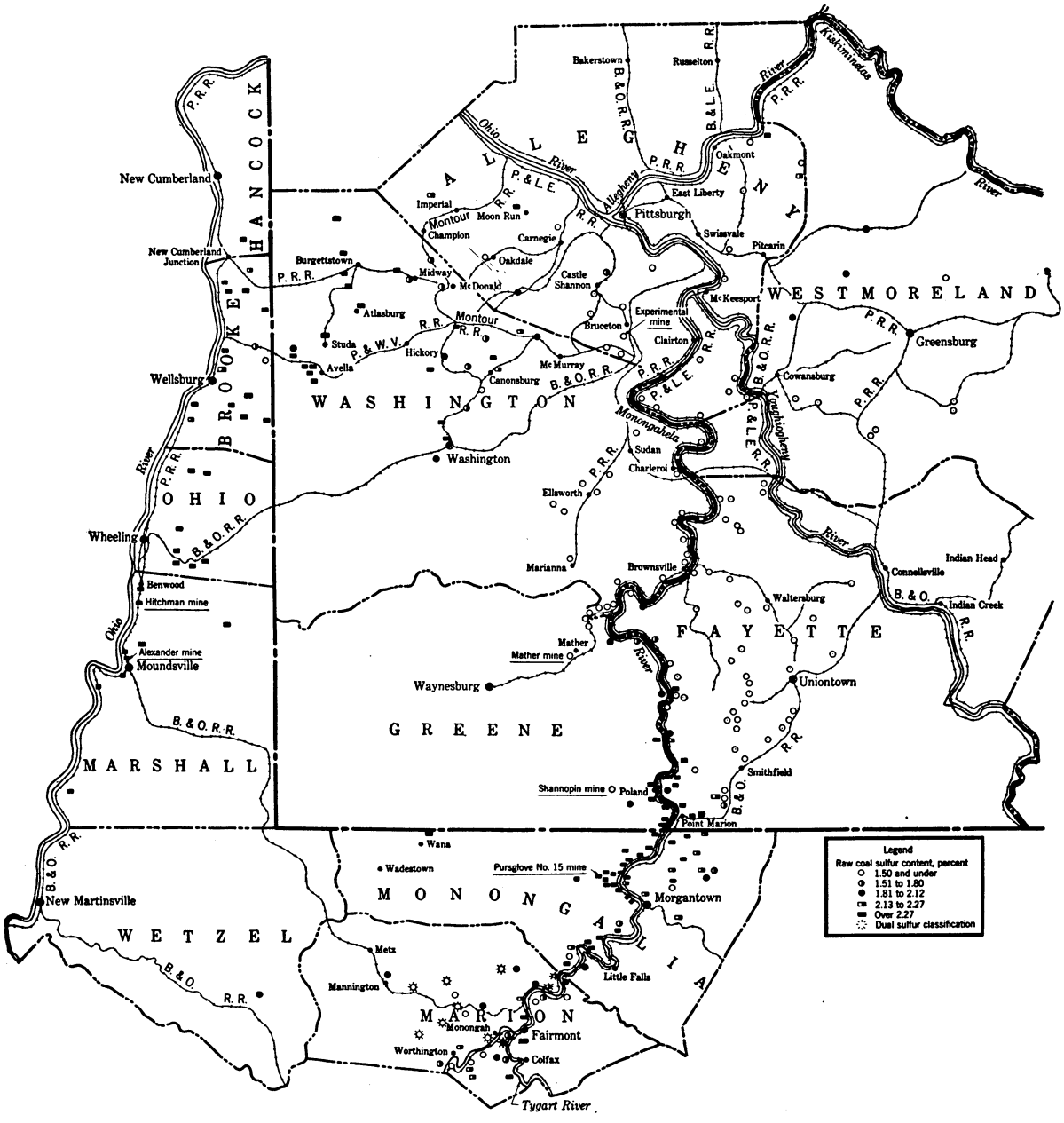


FIGURE 5.—SULFUR-DISTRIBUTION MAP OF AREA SHOWING LOCATION OF MINES SAMPLED AND WEST VIRGINIA MINES ASSIGNED DUAL SULFUR CLASSIFICATION UNDER THE BITUMINOUS COAL ACT OF 1937.

the ash content could easily be reduced by high gravity separation to meet current metallurgical requirements. The effect of washing is usually more pronounced in the small sizes. Crushing the coal to finer sizes has some effect upon the release of the high-ash impurities, but, like the reduction of the sulfurous compounds, material beneficiation is not noticed until the sample is crushed to about 14-mesh top size and smaller. In this size range, the problems of handling, washing, and drying become paramount.

In 1937, Davis and Griffen [11] reported that only about 10 percent of the Pittsburgh-bed coal reserves remaining in Pennsylvania are to be found in those areas that in the past have been the main sources of low-sulfur metallurgi-

[11] Davis, D. H., and Griffen, John, The Pittsburgh Coal Seam in Pennsylvania—Its Reserves, Qualities, and Beneficiation: Trans. Am. Inst. Min. and Met. Eng., vol. 157, Coal Division, 1944, pp. 22–58.

cal coal, namely Allegheny, Fayette, and Westmoreland Counties. Even this small percentage of the remaining reserves is not entirely of premium quality. Selective mining and mechanical cleaning must be utilized to upgrade at least part of this coal. In the past decade, any change in the remaining recoverable Pittsburgh-bed reserves in Pennsylvania undoubtedly would show more rapid depletion of the better grades. Therefore, evaluation of the preparation characteristics of Pittsburgh-bed coals, from both an economic and an operation standpoint, becomes a major problem. Fragmentary data concerning the sulfur pattern of this large nonhomogeneous coal reserve have been collected and supplemented, where needed, with field investigations conducted by the Bureau.

EXPERIMENTAL DATA

The object of the experimental-work data was to extend the intensive type of coal-sulfur study [12] to include typical samples throughout the geographical extent of the Pittsburgh bed that is economically accessible to the steel industry of the Pittsburgh region, and to include examples representing the range of sulfur problems throughout what might be called the marginal categories.

FIELD WORK

The location of samples is shown on the map of the region reproduced in figure 5 and listed in table 4. These samples are broadly representative of the type of coal that may be used in the raw state, the coals that require washing, and those that offer very little promise of upgrading to metallurgical standard even by intensive treatment. A comparison of these locations with the general map of sulfur distribution and byproduct-coal sources (figs. 1 and 5) will show the relationship of these samples to the pattern of geographical and quality distribution of the Pittsburgh coal in the region.

TABLE 4.—*Sample locations in the Pittsburgh region*

1. The Experimental mine, Bruceton, Allegheny County, Pa.
2. The Mather mine, Mather, Greene County, Pa.
3. The Shannopin mine, Bobtown, Greene County, Pa.
4. The Pursglove No. 15 mine, Pursglove, Monongalia County, W. Va.
5. The Alexander mine, Moundsville, Marshall County, W. Va.
6. The Hitchman mine, Benwood, Marshall County, W. Va.

[12] Fraser, Thomas, and Crentz, William L., Washing Characteristics of the Pittsburgh Coal in a High-Sulfur Area in Greene County, Pa.: Bureau of Mines Tech. Paper 689, 1946, 85 pp.

Mine samples and tipple samples were collected and shipped to the laboratory at Pittsburgh.

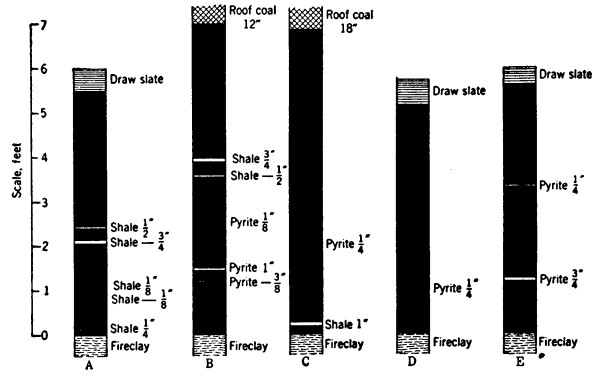


FIGURE 6.—CROSS SECTIONS OF PITTSBURGH BED AT FACE SAMPLE LOCATIONS.

A, EXPERIMENTAL MINE; *B*, SHANNOPIN MINE; *C*, PURSGLOVE NO. 15 MINE; *D*, ALEXANDER MINE; *E*, HITCHMAN MINE.

Bed sections at the face sample locations are shown in figure 6. At the Mather mine, only a tipple sample was obtained.

FLOAT-AND-SINK TESTS

The face samples were crushed to 1½-inch top size and then separated into three increments—one to be tested at 1½-inch×0 size, another to be crushed to ⅜-inch×0 size, and the third to be crushed to 14-mesh×0. All samples having a 14-mesh top size were dedusted at 100-mesh prior to the float-and-sink testing.

These samples were sized and float-and-sink tested according to the schedule indicated by figure 7, and all fractions were analyzed for ash

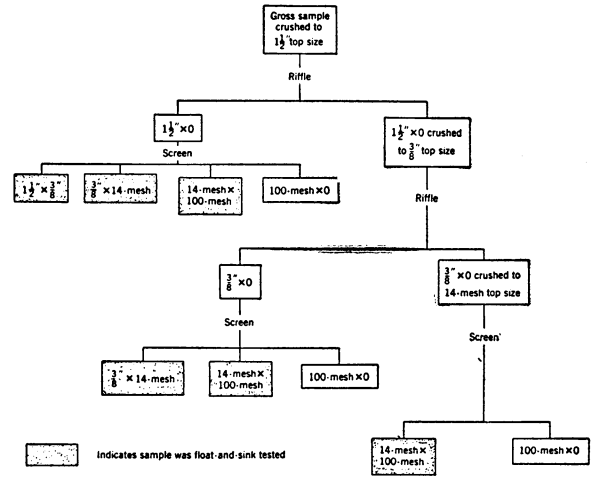


FIGURE 7.—FLOW DIAGRAM, SHOWING PREPARATION OF SAMPLES.

and sulfur content. This schedule of tests was calculated to explore the possibilities of sulfur reduction by low-gravity washing and fine crushing.

The test data are shown in data sheets 1 to 56 in the Appendix, and the principal findings and estimates of washing results are presented in the pages that follow. Data sheets 1, 5, 8, 9, 13, 17, 21, 25, 29, 33, 37, 41, 45, 49, and 53 are composites calculated from the washability data of the sized fractions.

EXPERIMENTAL RESULTS

POSSIBILITIES OF SULFUR REDUCTION

There are several procedures by which some coal of metallurgical grade can be obtained in those areas of the Pittsburgh bed that have a high average sulfur content, but all these methods are difficult to control in the practical operation of producing coal. Becker [13] has suggested four methods:

1. Mining high-sulfur and low-sulfur coals separately to produce two grades of coal, utilizing the better grade for special purposes.
2. Mining the entire quantity of coal as one fraction and crushing prior to washing in order to liberate greater quantities of the finely disseminated pyrite inclusions.
3. Separating the coal as mined at lower gravities and recovering the secondary coal for other uses.
4. Separating the coal roughly at lower gravities, followed by re-treatment of the secondary product for optimum beneficiation of such a fraction.
5. To these four procedures, a fifth may be added: Segregate the coal from low-sulfur and high-sulfur areas during mining and transporting of mine-run coal. Wash the two types separately and blend the two washed-coal products.

Selective mining.—The first procedure has been followed for many years in the Fairmount region of northern West Virginia, where the practice is peculiarly favored by the circumstance that the local areas of low-sulfur coal are relatively large, and the producers, being en-

[13] Becker, F. M., Reserves and Future of Coking Coals in the United States: Trans. Am. Inst. Min. and Met. Eng., Proc., Blast Furnace, Coke Oven, and Raw Materials Conference, 1947, pp. 3–22.

TABLE 5.—*Mines in northern West Virginia that were assigned dual classifications under the Coal Act of 1937*

Producer and mine	Sizes and classification [1]	
	Lump and R.O.M.	Screenings
Marion County:		
Davis Fork Coal Co.—Davis Fork	DE	DF
Blackburn Coal Co.—Blackburn No. 3	DE	DF
Colonial Trust Co.—Annabelle	DE	DF
Consolidation Coal Co.—Consolidation No. 22	DE	DF
Consolidation Coal Co.—Consolidation No. 63	DE	DF
Consolidation Coal Co.—Consolidation No. 86	DE	DF
Eastern Gas and Fuel Associates—Federal No. 1	DE	DF
Glenn, H. S.—Franklin	DE	DF
Hebb, H. R.—Kingmont Jr	DE	DF
Henderson, Rex—Henderson	DE	DF
Jackson, J. A.—Sunset	DE	DF
Jamison Coal & Coke Co.—Jamison No. 8	DE	DF
Jamison Coal & Coke Co.—Jamison No. 9	DE	DF
Jones Collieries, Inc.—Rachel	DE	DF
McCoy, Robert L.—Jaynes No. 1	DE	DF
Henry Coal Co. (Mitchell, F. H.)—Douglass	DE	DF
Morgan, Donald—Morgan Bros	DE	DF
Morgan, Donald—Morgan Bros. No. 2	DE	DF
Morgan, Joe—Joe Morgan	DE	DF
Scritchfield, D. L.—Scritchfield No. 1	DE	DF
Triplett, Mike—Clelland	DE	DF
Vincent Coal Co., c/o J. E. Vincent—Marion No. 1	DE	DF
Vincent Coal Co., c/o J. E. Vincent—Marion	DE	DF
Virginia & Pittsburgh Coal & Coke Co.—Kingmont	DE	DF
Virginia & Pittsburgh Coal & Coke Co.—Kingmont Jr. No. 2	DE	DF
Consolidation Coal Co.—Consolidation No. 93	DF	DF
Harrison County:		
Pinnell, J. R.—Shinn Run	DE	DF

[1] Where mines are classified "DE" or "DF" in any size group, the "D" classification shall apply to all coals having a sulfur content of 1.35 percent or under, irrespective of the use for which they are sold. If the sulfur content of the coals from such mines in any particular size group is in excess of 1.35 percent, the "E" or "F" classification indicated for that particular size group shall apply. The minimum price difference between classifications D and E was 5 cents per ton, whereas between classifications D and F the minimum price difference was 10 cents per ton.

gaged in the general coal trade, are in a position to dispose of fuel coal as well as coking coal. The extent of this practice is indicated by the dual classifications [14] established for computing minimum prices under the Bituminous Coal Act of 1937. The mines listed in table 5 were given dual classification, indicating that both grades of coal are sometimes shipped. Location of the area in which these mines operate is indicated in figure 5.

The current survey has shown that this practice would be feasible, in a measure, throughout the area of marginal reserves, as the bed appears to be everywhere characterized by local areas of low-sulfur coal and high-sulfur coal. However, the practicability of this expedient will vary greatly, depending on the size and definiteness of the low-sulfur areas.

Some early operations in the high-sulfur areas in Pennsylvania followed the practice of mining only selected areas of lower-sulfur coal and leaving intervening areas of high-sulfur coal; but this policy can be followed for only a limited time—until the mine-development program becomes too complicated.

[14] Bituminous Coal Division, U. S. Department of the Interior, Schedule of Effective Minimum Prices for District No. 3 as of September 1, 1942.

Fine grinding.—Procedure No. 2 is an attractive solution in theory, but in application to the Pittsburgh coal it is ineffective, unless the coal is crushed very fine which would greatly increase the cost of handling. Data on the effect of fine crushing in the release of sulfur are given in table 6. These data were obtained by float-and-sink tests of samples of the raw coal, in which separate increments were crushed to various sizes before separation.

These data indicate that it is necessary to grind the coal down to flotation size in order to effect any substantial reduction in float-coal sulfur content compared to that at 1½-inch size. The higher-sulfur samples obtained in northern West Virginia appear to respond to crushing for sulfur release slightly better than do the two Pennsylvania coal samples.

Notwithstanding the necessity for very fine crushing, this procedure is still worthy of consideration when it becomes necessary to use these high-sulfur coals. Although the release of sulfur may suffice to add only 2 to 4 tenths of 1 percent to the over-all sulfur reduction, as in the Pursglove and Hitchman samples, this may add substantially to the reserves of marginal coals that might be made suitable for metallurgical use.

TABLE 6.—*Effect of crushing on sulfur reduction*

Sample identification	Float at 80 percent yield						Float sulfur at 80 percent yield		
	1½ inches x 100 mesh		⅜ inch x 100 mesh		14 mesh x 100 mesh		I	II	III
	Sulfur	Ash	Sulfur	Ash	Sulfur	Ash			
1. Experimental mine	0. 93	4. 0	0. 93	3. 9	--------	--------	0. 97	0. 95	--------
2. Shannopin mine	1. 31	6. 8	1. 17	6. 7	1. 17	6. 4	1. 65	1. 61	--------
3. Pursglove mine:									
(a) 10 feet north of station 9987	1. 80	5. 5	1. 75	5. 4	1. 46	4. 9	1. 82	1. 55	1. 46
(b) 50 feet north of station 9985	1. 84	5. 3	1. 62	5. 0	1. 44	4. 6	1. 62	1. 48	1. 44
4. Hitchman mine:									
(a) 2 break-through 6 and 7	3. 03	5. 3	2. 84	5. 1	2. 74	4. 4	2. 81	2. 78	2. 74
(b) 1 break-through inby 6 and 7	3. 19	5. 5	3. 09	5. 0	2. 75	4. 5	3. 00	2. 91	2. 75
5. Alexander mine:									
(a) Inby 25 north face, 8 east butt	4. 08	5. 6	3. 86	5. 2	3. 67	4. 5	3. 76	3. 73	3. 67
(b) 40 feet inby 25 north face	4. 18	5. 8	3. 94	5. 4	3. 72	5. 1	4. 06	3. 87	3. 72

I—14 mesh x 100 mesh screened out of 1½ inches x 0 sample.
II—14 mesh x 100 mesh screened out of ⅜-inch x 0 sample.
III—Crushed to 14-mesh top size and dedusted over 100-mesh sieve.

Low-gravity washing.—The third procedure, washing at low gravity, appears to be more practicable under present conditions for the treatment of moderately high-sulfur coals

such as those represented by the Shannopin and Pursglove samples. Table 7A summarizes the data and indicates what might be accomplished by complete separation at low gravities, if that were possible. In this scheme, the disposal of the secondary fuel product (middlings) is critical. It may be assumed that in practical operation this product would be substantially larger than indicated by the float-and-sink data of the tabulation because of mechanical loss of premium coal into the middling product. This would make the yield of premium coal smaller, but it would mean that the secondary coal is lower in ash and thus more salable as fuel. Thus, assuming that the secondary-coal products of the washery would really contain substantially all the middlings plus an equal quantity of the No. 1 clean coal, the result may be reconstructed as shown in table 7B. Such an operation would be feasible for a commercial producer interested in the sale of both fuel coal and metallurgical coal. It would be interesting in the captive type of coal-mining organization only if some change in marketing practice were adopted to enable the captive producer to dispose of fuel coal.

TABLE 7.—*Part A: Possible yields of premium coals of 1.75 percent sulfur and 1.50 percent sulfur*

Sample identification	Raw coal sulfur	To get 1.75 percent sulfur				To get 1.50 percent sulfur			
		Washing gravity	Yield percent	Middlings [3]		Washing gravity	Yield percent	Middlings [3]	
				Weight, percent	Ash, percent			Weight, percent	Ash, percent
Pursglove: [1]									
1½ inch x 0	2.71	1.32	74.6	18.1	13.2				
⅜ inch x 0	2.68	1.34	79.8	12.8	15.0	1.26	2.6	90.0	6.8
14 mesh x 0	2.39	1.60+	93.2			1.36	83.7	9.0	16.8
Pursglove: [2]									
1½ inch x 0	2.72	1.30+	69.3	25.7	11.3	1.27+	24.3	70.7	7.5
⅜ inch x 0	2.61	1.38+	88.9	5.5	18.7	1.30—	64.2	30.2	10.7
14 mesh x 0	2.46	1.60+	94.7			1.37+	86.6	7.7	17.0
Shannopin:									
1½ inch x 0	2.62	1.32+	76.4	20.3	14.3	1.29+	44.7	52.0	9.6
⅜ inch x 0	2.63	1.34	83.0	13.3	16.7	1.29+	51.2	45.1	9.9

[1] Sample taken at 10 feet north of station 9987.
[2] Sample taken at 50 feet north of station 9985.
[3] Middlings is the fraction between the washing gravity and 1.60 specific gravity.

TABLE 7.—*Part B: Possible yields of premium coals of 1.75 percent sulfur and 1.50 percent sulfur, with estimate of practical middling product*

Sample identification	Raw coal sulfur	To get 1.75 percent sulfur				To get 1.50 percent sulfur			
		Washing gravity	Yield, percent	Middlings [3]		Washing gravity	Yield, percent	Middlings [3]	
				Weight, percent	Ash, percent			Weight, percent	Ash, percent
Pursglove: [1]									
1½ inches x 0	2.71	1.32	56.5	36.2	9.2				
⅜ inch x 0	2.68	1.34	67.0	25.6	10.2				
14 mesh x 0	2.39	1.60+	93.2			1.36	74.7	18.0	11.0
Pursglove: [2]									
1½ inches x 0	2.72	1.30+	43.6	51.4	8.1				
⅜ inch x 0	2.61	1.38+	83.4	11.0	12.1	1.30—	34.0	60.4	7.5
14 mesh x 0	2.46	1.60+	94.7			1.37+	78.9	15.4	11.0
Shannopin:									
1½ inches x 0	2.62	1.32+	56.1	40.6	9.8				
⅜ inch x 0	2.63	1.34	69.7	26.6	11.1	1.29+	6.1	90.2	7.1

[1] Sample taken at 10 feet north of station 9987.
[2] Sample taken at 50 feet north of station 9985.
[3] Middlings is the fraction between the washing gravity and 1.60 specific gravity.

Re-treatment of middle products. — The fourth procedure is in effect a refinement of the third aimed at improving the economic return by reclaiming some of the middlings to be added to the first-grade coal. Success in this feature of the treatment will involve grinding the intermediate gravity fractions and recovering low-sulfur float coal released by grinding. In view of the very unfavorable response to fine-crushing of the raw coal, it is hardly to be expected that recrushing the middlings will be very effective. However, even a small additional yield of metallurgical grade that might thus be wrung from the intermediate fraction, might suffice to push the borderline case over into the classification of economically feasible operations in the treatment of these marginal coals. This procedure is most interesting in the operation of captive mines, where it is imperative to obtain the maximum yield of metallurgical coal and eliminate the problem of using secondary fuel coal. However, it is not to be expected that the middling product can be eliminated entirely. That would necessitate raising the average sulfur content of the resulting blended metallurgical coal almost to that of a high-gravity float, or rejecting a large refuse product rich in bony coal. Hence, the final operation must be a compromise between these two alternatives.

Dual washing.—The fifth procedure suggested above is a refinement of No. 1. If the two classes of coal are washed separately in plants adapted to handle them, it may be expected to yield a better over-all result than Nos. 3 or 4, in which the two classes of coal are washed together. This follows logically from the fundamental fact that there is no difference in specific gravity between the high-sulfur float coal and the low-sulfur float coal. Once mixed together, these two classes of coal cannot be reseparated. The preferred treatment of the high-sulfur part of the R. O. M. cannot be accomplished in the mixture with the low-sulfur part without entailing an uneconomical loss in the low-sulfur class.

TABLE 8.—*Combination No. 5 low-sulfur coal washed at high gravity and blended with high-sulfur coal washed at low gravity*

Type of raw coal	Percent of ROM	Washed-coal product, percent			Washing gravity
		Raw coal	Sulfur	Ash	
Low-sulfur	59	56.62	1.30	8.3	1.60
High-sulfur	41	33.34	1.84	6.2	1.35
Total average	100	89.96	1.49	7.5	

Computations based upon the two classes of samples obtained at the Shannopin mine [15] gave the comparative data shown in table 8, in which examples of the two operations are evaluated.

Examination of the detailed data of all the samples (data sheets 1 to 56) makes it obvious that none of these five treatment procedures constitute a satisfying solution of the problem of upgrading the high-sulfur Pittsburgh coal. There is no doubt that the search for a better method will go on indefinitely, and improvements in coal-preparation techniques will be matched by improvements in blast-furnace operation to adapt the metallurgical practices to more effective use of these coals.

In view of the tremendous economic importance of the Pittsburgh coal bed, it is disconcerting to note the small improvements, in respect to sulfur, that can be attained even when such expedients are resorted to as pulverizing to powder or washing at such low gravities as to yield only 50 percent float coal. However, even a small improvement in washing practice would be of great importance. Lifting of the tolerance for sulfur in the raw coal by as much as even 0.5 percent may be expected to add extensively to potential reserves of coking coal in the region. An additional gain by easing of the specifications for sulfur in furnace coke would extend reserves by hundreds of millions of tons.

CLASSIFICATION OF RESERVES AS TO WASHABILITY

Intensive study of the washability data in the light of these possible treatment procedures suggests the attempt to define classes of raw coal with respect to washability, so that these classifications may be applied to remaining reserves to arrive at some appraisal of reserves with respect to their potential adaptability to metallurgical use.

It seems most useful to base such a classification on washing facility and to define the limits of each class in terms of raw-coal sulfur content, so that any given area of coal reserves may be appraised tentatively by reference to simple analytical data such as are widely available.

The logical class distinctions would be: (1) coals usable for metallurgical fuel in the raw state, (2) coals made suitable by conventional washing, (3) coals that would yield an economic proportion of suitable coal by separation at very low gravity (3, 4, or 5 of above methods), and (4) coals that would yield an economical pro-

[15] Fraser, Thomas, and Crentz, William L., Washing Characteristics of the Pittsburgh Coal in a High-Sulfur Area in Greene County, Pa.: Bureau of Mines Tech. Paper 689, 1946, 85 pp.

portion of suitable coal by fine grinding and froth flotation (method 2).

Of these four classes of coal, the first two are now regularly used for metallurgical fuel and constitute no extraordinary technological problem; classes 3 and 4 constitute the marginal group that offers possibilities of upgrading into the coking-coal class by the development and application of intensive preparatory treatments. Beyond these classes are those reserves of coal that are so high in sulfur that there is no recoverable fraction of low-sulfur material adaptable to metallurgical use.

To arrive at a tentative definition of these coal classes (in reference to the Pittsburgh bed in the Pittsburgh area only), a statistical study was made of the relationship of raw-coal sulfur to float-coal sulfur and to particle-size float-sulfur combinations, using the float-and-sink data of the samples reported in this paper.

These relationships are best shown by the simple line graphs of figures 8 to 10, in which float-coal sulfur content is plotted against raw-coal sulfur content.

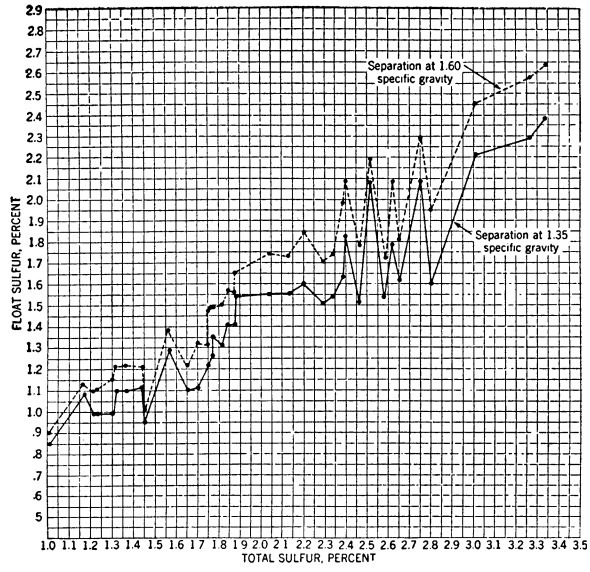


FIGURE 8.—RELATION OF RAW-COAL SULFUR TO FLOAT-COAL SULFUR IN THE PITTSBURGH BED (37 INDIVIDUAL SAMPLES ⅜ INCH BY 48 MESH).

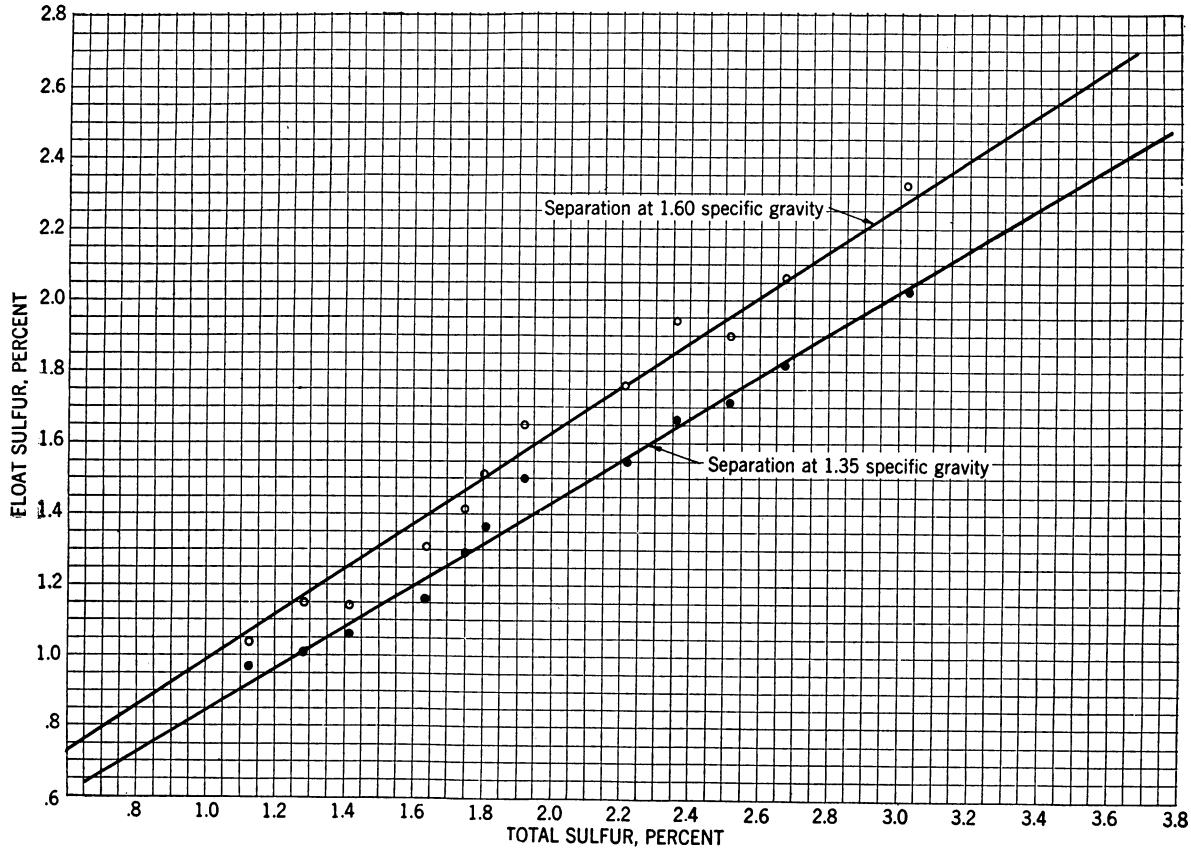


FIGURE 9.—RELATION OF RAW-COAL SULFUR TO FLOAT-COAL SULFUR IN THE PITTSBURGH BED (AVERAGES OF GROUPS OF THREE SAMPLES ⅜ INCH BY 48 MESH).

864010°—50——3

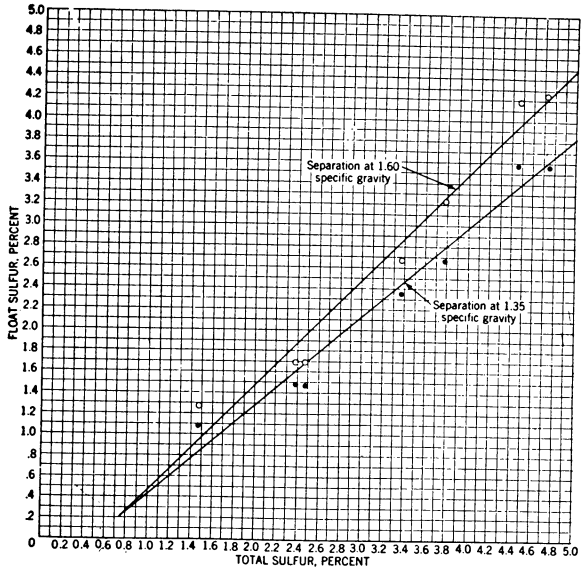


FIGURE 10.—RELATION OF RAW-COAL SULFUR TO FLOAT-COAL SULFUR IN THE PITTSBURGH BED AFTER CRUSHING TO 14-MESH TOP SIZE.

This statistical treatment shows a rather erratic pattern for single samples, but when averaged in groups of three, the graph (fig. 9) shows a value that closely follows the relationship between raw sulfur and float sulfur that is disclosed by actual analyses. Even in groups of two, the agreement is relatively close. In groups of two samples, the tolerance is ±0.07 in 78 samples out of 100.

Use of this statistical method for estimating the 1.35 specific gravity float-sulfur content shows even greater precision than the 1.60 specific gravity float-sulfur line. In groups of 3 samples a tolerance of ±0.06 percent sulfur can be expected in 92 out of 100 examples, whereas in groups of 2 samples 78 out of 100 samples have a tolerance of ±0.06 percent sulfur.

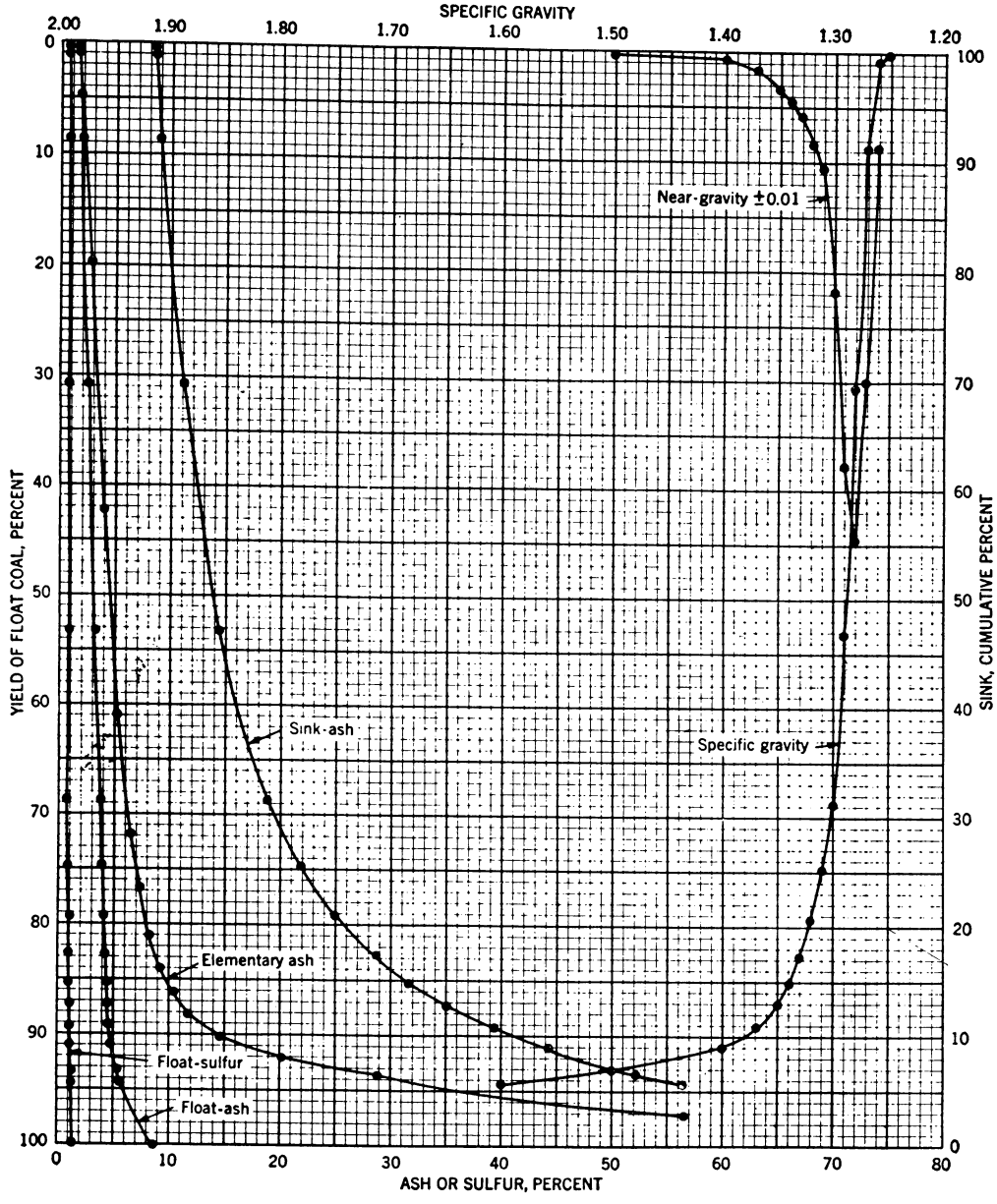
In view of these statistical tests, it is believed that the chart may be useful for tentatively classifying raw coals when data on the sulfur content are available.

Thus, on the assumption that a washed coal of 1.50 percent sulfur content is suitable for metallurgical use, we may place reserves containing up to 1.50 percent sulfur in class 1, the coals that are suitable for use in the raw state. Figure 9 shows that coals of 1.50 to 1.80 percent sulfur may be placed in class 2 (coals that may be made suitable by conventional washing). The lower line of the same chart indicates that coals of 1.81 to 2.12 percent sulfur may be placed in class 3 (coals that may be made suitable by washing at low gravity). As indicated by figure 10, which shows the relationship of raw-coal sulfur to float-coal sulfur after crushing to 14-mesh, we may place coals containing up to 2.27 percent in sulfur in class 4; these may be made suitable by fine grinding followed by froth flotation. A froth-flotation separation comparable to a 1.60 specific-gravity separation would permit coals having up to 2.03 percent sulfur in the raw state to be cleaned to a 1.50 percent sulfur float product. This would place these coals in class 3 and would offer two approaches to the cleaning problem—one a low-gravity separation of the coal without fine crushing, and the other a high specific gravity separation of the product after first crushing to 14-mesh top size.

SUMMARY AND CONCLUSIONS

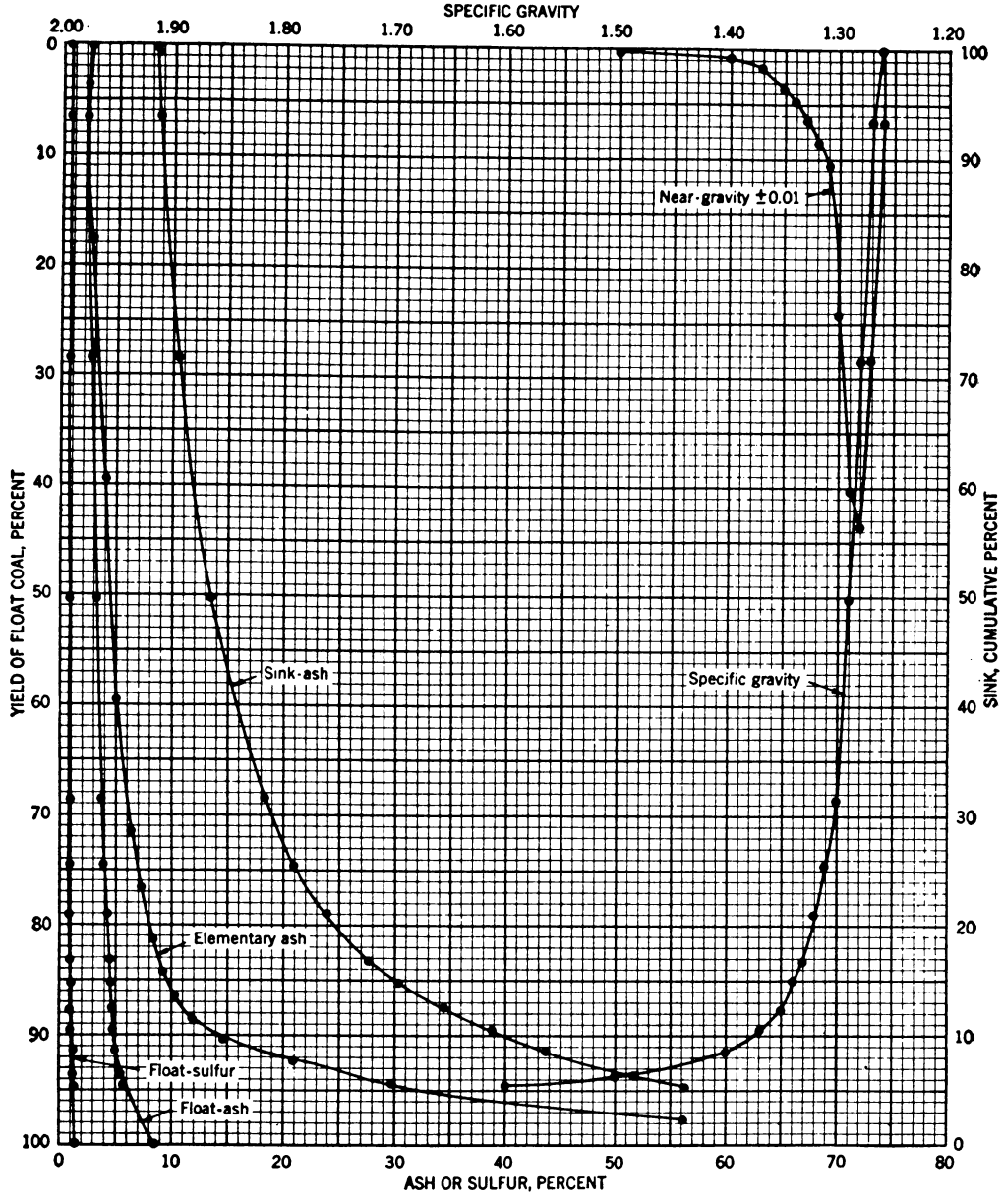
This report deals with upgrading to metallurgical standards of the large reserves of high-sulfur Pittsburgh coal remaining in southwestern Pennsylvania and northern West Virginia. The principal results and conclusions are:

1. The main washing problem concerns the release of sulfur, ash removal being relatively easy.
2. The sulfur problem is increased by the wide variations of sulfur content not only in the raw coal but in the float product.
3. Within the area studied, there are areas of low-sulfur coal adaptable to metallurgical use without washing and areas of very high-sulfur coal, but within these extremes are intermediate or marginal areas that contain some coal matter of metallurgical quality.
4. A study of the washing characteristics of these coals show that no one method of cleaning will result in a satisfactory solution of the problem of up-grading these high-sulfur coals.
5. Selective mining, low-gravity separation, fine crushing and froth flotation, and combinations of the three must be employed before sulfur can be reduced significantly.
6. All these methods are difficult to control in the practical operation of producing and washing coal.
7. Study of the washability data shows that the raw coal may be classified with respect to ease of cleaning.
8. Coals containing 1.80 percent sulfur in the raw product present no extraordinary technological problem.
9. Coals containing 1.81 to 2.27 percent sulfur in the raw state may be upgraded to metallurgical standard by the development and application of intensive preparatory treatment.
10. Coals of the Pittsburgh bed that contain more than 2.27 percent sulfur in the raw state cannot be considered as a metallurgical fuel.



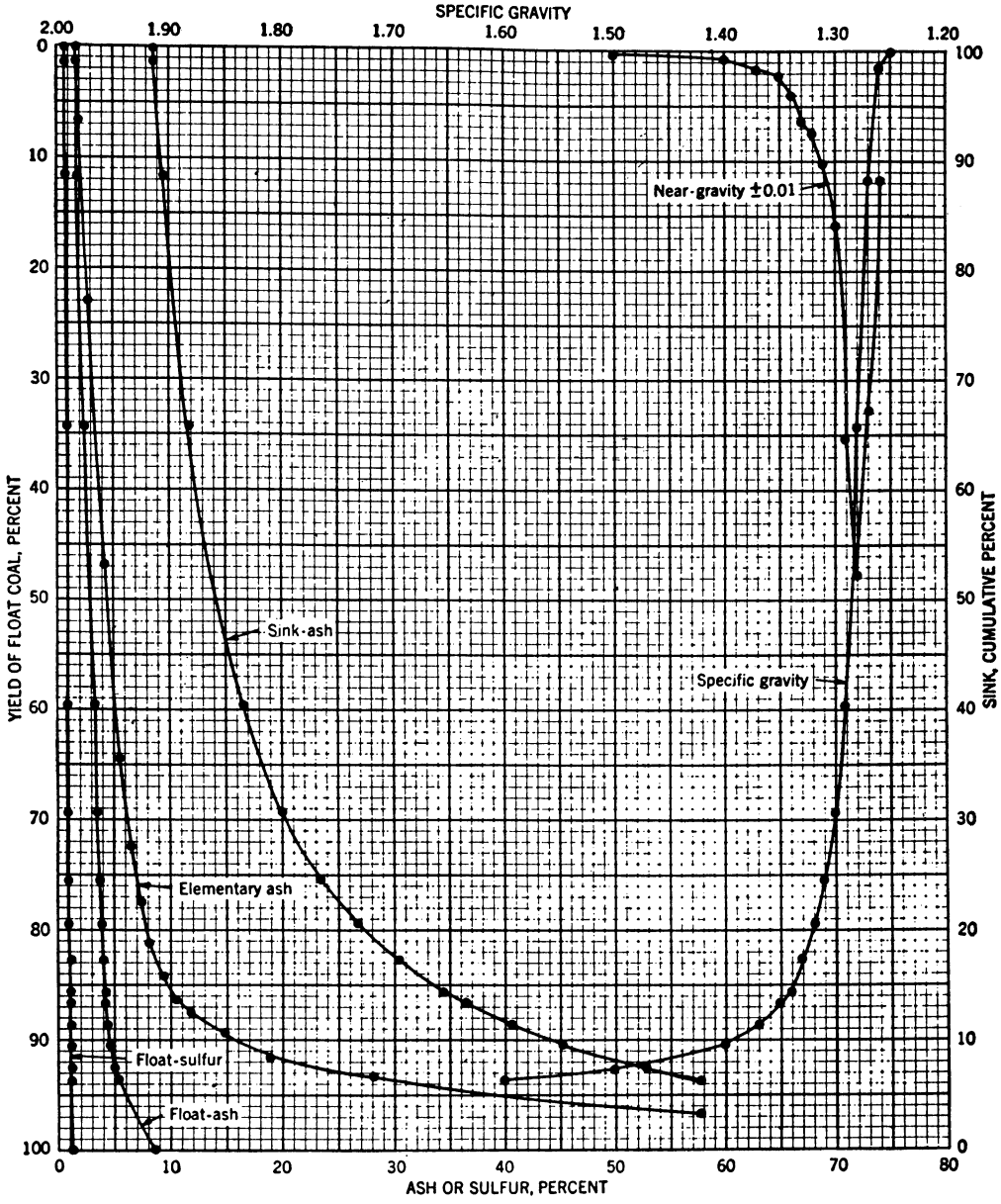
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.01 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.25	55	0.1	1.4	0.73	0.1	1.4	.73	100.0	8.3	1.20	
1.25 - 1.26	742	0.8	1.6	0.77	0.9	1.6	.77	99.9	8.3	1.20	8.7
1.26 - 1.27	8,811	7.9	1.9	0.82	8.8	1.9	.81	99.1	8.4	1.20	30.0
1.27 - 1.28	25,409	22.1	2.7	0.90	30.9	2.5	.88	91.2	9.0	1.24	44.4
1.28 - 1.29	25,899	22.3	4.0	0.92	53.2	3.1	.89	69.1	11.0	1.34	37.9
1.29 - 1.30	18,205	15.6	5.1	0.92	68.8	3.6	.90	46.8	14.3	1.54	21.6
1.30 - 1.31	6,887	6.0	6.3	1.09	74.8	3.8	.92	31.2	18.9	1.86	10.4
1.31 - 1.32	5,100	4.4	7.2	1.12	79.2	4.0	.93	25.2	21.9	2.04	8.1
1.32 - 1.33	4,382	3.7	8.2	1.36	82.9	4.2	.95	20.8	25.0	2.23	5.9
1.33 - 1.34	2,578	2.2	9.2	1.50	85.1	4.3	.96	17.1	28.6	2.42	4.3
1.34 - 1.35	2,373	2.1	10.3	1.70	87.2	4.4	.98	14.9	31.5	2.56	3.1
1.35 - 1.37	2,225	2.0	11.7	1.98	89.2	4.6	1.00	12.8	35.0	2.70	1.6
1.37 - 1.40	1,999	1.8	14.5	2.46	91.0	4.8	1.03	10.8	39.3	2.83	.8
1.40 - 1.50	2,594	2.2	20.1	1.79	93.2	5.2	1.05	9.0	44.2	2.90	.3
1.50 - 1.60	1,318	1.1	29.0	1.31	94.3	5.4	1.05	6.8	52.1	3.26	
Sink - 1.60	6,435	5.7	56.5	3.64	100.0	8.3	1.20	5.7	56.5	3.64	
Totals	115,012	100.0									

DATA SHEET 1.—BRUCETON MINE (A-3-8, 9, AND 10). SIZE, 1½ INCHES BY 100 MESH.



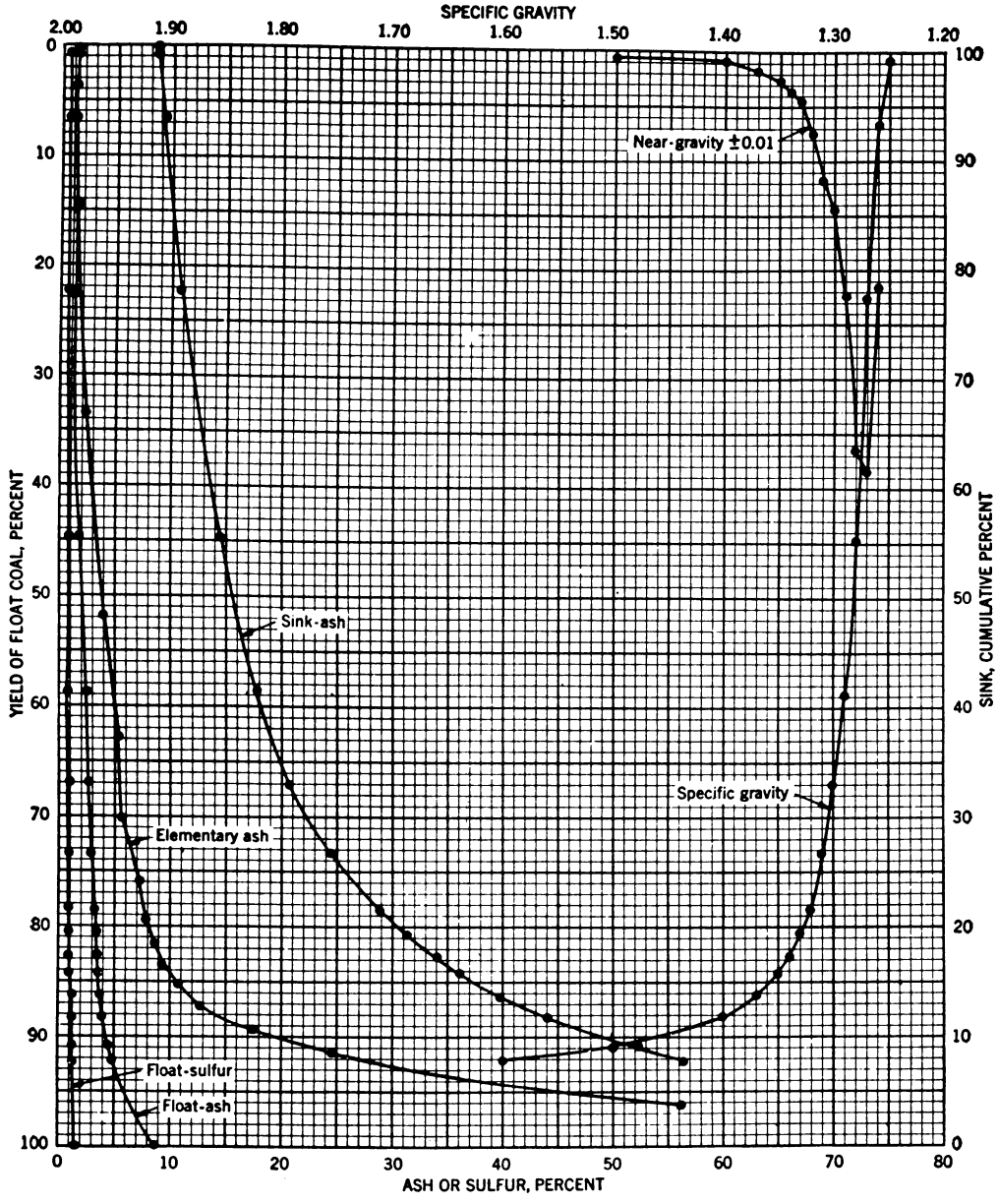
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.01 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.25	—	—	—	—	—	—	—	—	—	—	—
1.25 - 1.26	141	0.2	2.5	.65	.2	2.5	0.65	100.0	8.3	1.16	6.5
1.26 - 1.27	5,103	6.3	2.1	.79	6.5	2.1	0.79	99.8	8.3	1.16	28.2
1.27 - 1.28	17,805	21.9	2.8	.88	28.4	2.6	0.86	93.5	8.7	1.18	43.7
1.28 - 1.29	17,691	21.8	4.0	.89	50.2	3.2	0.87	71.6	10.5	1.28	40.2
1.29 - 1.30	14,969	18.4	5.0	.89	68.6	3.7	0.88	49.8	13.4	1.45	24.3
1.30 - 1.31	4,790	5.9	6.3	1.07	74.5	3.9	0.89	31.4	18.3	1.77	10.4
1.31 - 1.32	3,688	4.5	7.2	1.06	79.0	4.1	0.90	25.5	21.0	1.93	8.6
1.32 - 1.33	3,289	4.1	8.3	1.37	83.1	4.3	0.92	21.0	24.0	2.12	6.1
1.33 - 1.34	1,647	2.0	9.1	1.50	85.1	4.4	0.94	16.9	27.8	2.30	4.5
1.34 - 1.35	1,987	2.5	10.3	1.73	87.6	4.6	0.96	14.9	30.3	2.41	3.5
1.35 - 1.37	1,588	2.0	11.8	2.09	89.6	4.7	0.99	12.4	34.3	2.55	1.6
1.37 - 1.40	1,420	1.8	14.5	2.57	91.4	4.9	1.02	10.4	38.7	2.64	.8
1.40 - 1.50	1,814	2.2	20.8	1.48	93.6	5.3	1.03	8.6	43.7	2.65	.3
1.50 - 1.60	907	1.1	29.8	.95	94.7	5.6	1.03	6.4	51.6	3.05	
Sink - 1.60	4,282	5.3	56.1	3.49	100.0	8.3	1.16	5.3	56.1	3.49	
Totals	81,121	100.0									

DATA SHEET 2.—BRUCETON MINE (A–3–8). SIZE, 1½ BY ⅜ INCHES.



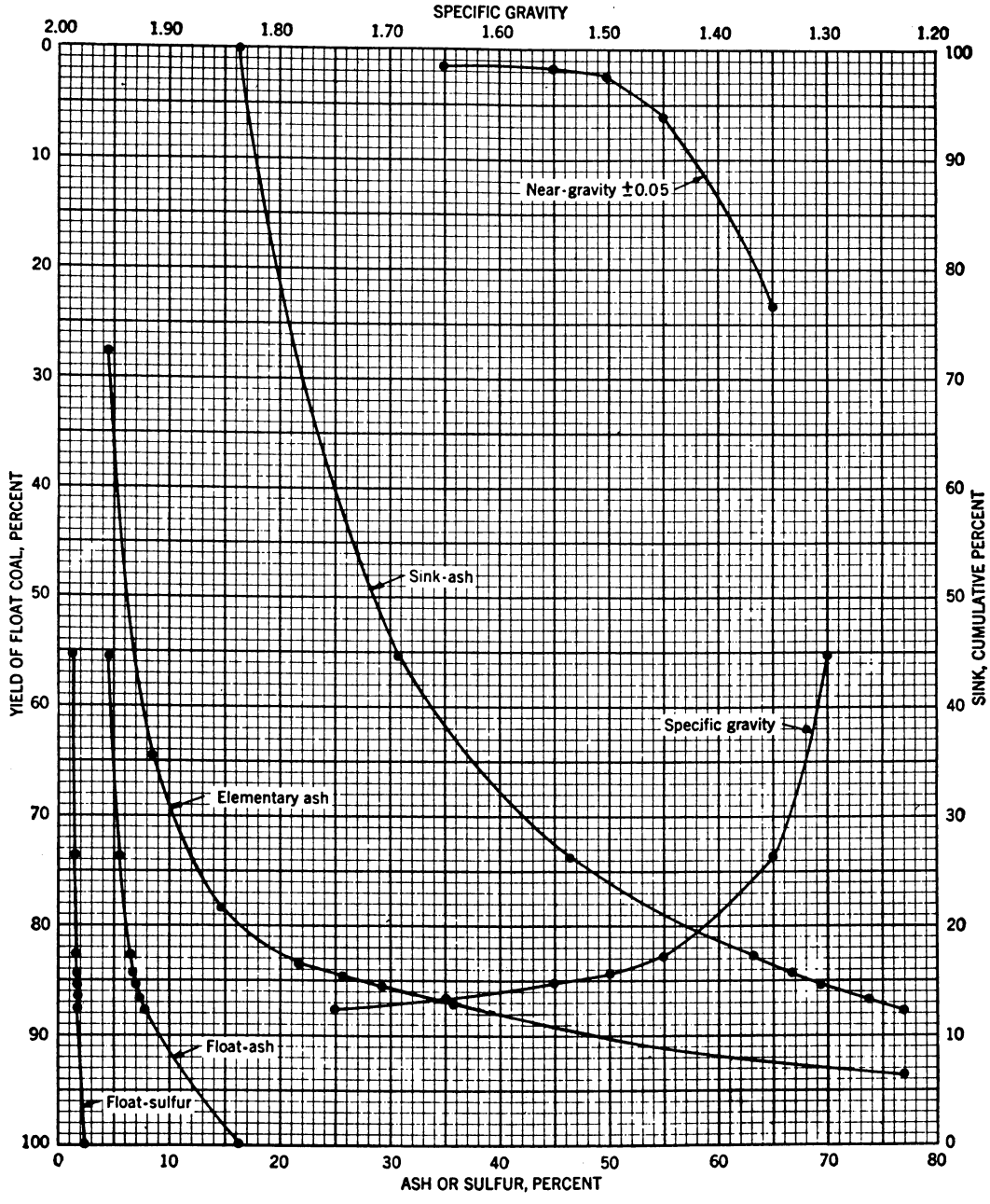
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.01 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.25	27	0.1	1.7	.73	0.1	1.7	.73	100.0	8.5	1.26	
1.25 - 1.26	399	1.3	1.6	.78	1.4	1.6	.78	99.9	8.5	1.26	11.7
1.26 - 1.27	3,148	10.4	1.8	.86	11.8	1.8	.85	98.6	8.6	1.27	32.8
1.27 - 1.28	6,804	22.4	2.6	.97	34.2	2.3	.93	88.2	9.4	1.31	47.8
1.28 - 1.29	7,712	25.4	4.1	.98	59.6	3.1	.95	65.8	11.7	1.43	35.1
1.29 - 1.30	2,949	9.7	5.4	1.04	69.3	3.4	.96	40.4	16.5	1.71	15.9
1.30 - 1.31	1,873	6.2	6.5	1.15	75.5	3.7	.98	30.7	20.0	1.93	10.2
1.31 - 1.32	1,220	4.0	7.4	1.26	79.5	3.8	.99	24.5	23.5	2.12	7.4
1.32 - 1.33	1,021	3.4	8.0	1.34	82.9	4.0	1.01	20.5	26.6	2.29	6.2
1.33 - 1.34	853	2.8	9.4	1.51	85.7	4.2	1.02	17.1	30.3	2.48	3.9
1.34 - 1.35	340	1.1	10.3	1.58	86.8	4.3	1.03	14.3	34.4	2.67	2.1
1.35 - 1.37	567	1.9	11.7	1.78	88.7	4.4	1.05	13.2	36.4	2.76	1.5
1.37 - 1.40	513	1.7	14.8	2.34	90.4	4.6	1.07	11.3	40.5	2.92	.8
1.40 - 1.50	680	2.2	19.0	2.55	92.6	5.0	1.11	9.6	45.1	3.03	.3
1.50 - 1.60	367	1.2	28.2	1.98	93.8	5.3	1.12	7.4	52.8	3.17	
Sink - 1.60	1,873	6.2	57.6	3.40	100.0	8.5	1.26	6.2	57.6	3.40	
Totals	30,346	100.0									

DATA SHEET 3.—BRUCETON MINE (A-3-9). SIZE, ⅜ INCH BY 14 MESH,



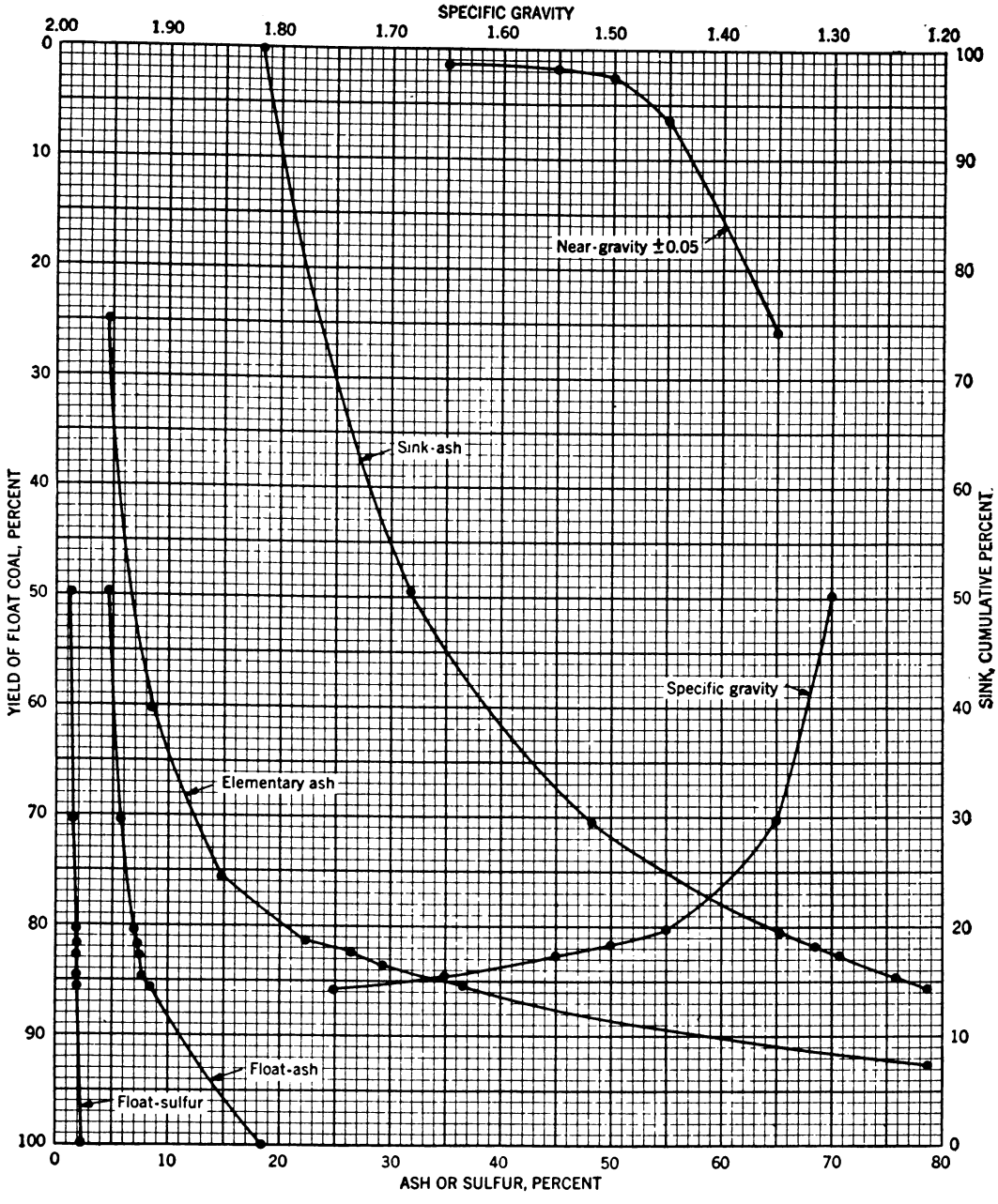
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.01 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.25	28	0.8	1.3	.73	0.8	1.3	0.73	100.0	8.7	1.43	
1.25 - 1.26	202	5.7	1.2	.81	6.5	1.2	.80	99.2	8.7	1.44	21.5
1.26 - 1.27	560	15.8	1.4	.84	22.3	1.3	.83	93.5	9.2	1.48	38.4
1.27 - 1.28	800	22.6	2.2	.90	44.9	1.8	.86	77.7	10.8	1.61	36.6
1.28 - 1.29	496	14.0	3.9	.99	58.9	2.3	.89	55.1	14.3	1.89	22.1
1.29 - 1.30	287	8.1	5.3	1.11	67.0	2.6	.92	41.1	17.8	2.20	14.4
1.30 - 1.31	224	6.3	5.5	1.13	73.3	2.9	.94	33.0	20.9	2.47	11.7
1.31 - 1.32	192	5.4	7.2	1.28	78.7	3.2	.96	26.7	24.5	2.79	7.4
1.32 - 1.33	72	2.0	7.7	1.33	80.7	3.3	.97	21.3	28.9	3.17	4.2
1.33 - 1.34	78	2.2	8.7	1.43	82.9	3.4	.98	19.3	31.1	3.36	3.5
1.34 - 1.35	46	1.3	9.3	1.50	84.2	3.5	.99	17.1	34.0	3.61	2.3
1.35 - 1.37	70	2.0	10.6	1.61	86.2	3.7	1.01	15.8	36.0	3.78	1.6
1.37 - 1.40	66	1.9	12.8	1.76	88.1	3.9	1.02	13.8	39.7	4.10	.9
1.40 - 1.50	100	2.8	17.4	2.06	90.9	4.3	1.05	11.9	44.0	4.47	.4
1.50 - 1.60	44	1.2	24.6	2.14	92.1	4.6	1.07	9.1	52.1	5.21	
Sink - 1.60	280	7.9	56.3	5.68	100.0	8.7	1.43	7.9	56.3	5.68	
Totals	3,545	100.0									

DATA SHEET 4.—BRUCETON MINE (A-3-10). B BUTT, 150 FEET INBY NO. 7 ROOM. SIZE, 14 BY 100 MESH.



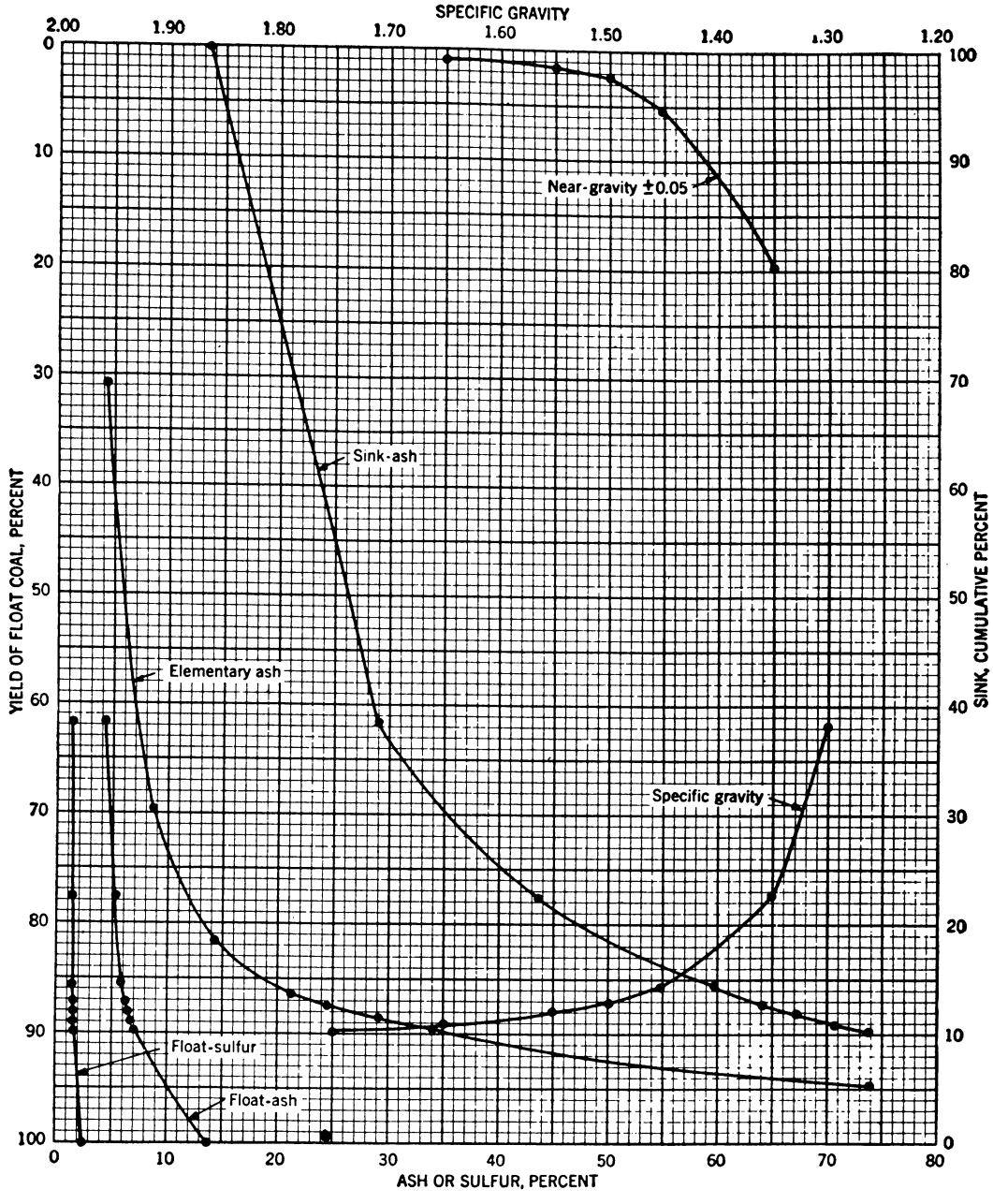
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.05 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.30	—	55.3	4.4	1.21	55.3	4.4	1.21	100.0	16.1	2.22	—
1.30 - 1.35	—	18.5	8.5	2.06	73.8	5.4	1.42	44.7	30.6	3.46	23.1
1.35 - 1.45	—	9.1	14.7	3.29	82.9	6.4	1.63	26.2	46.3	4.45	6.0
1.45 - 1.50	—	1.4	21.7	4.48	84.3	6.7	1.68	17.1	63.1	5.07	2.3
1.50 - 1.55	—	.9	25.7	4.91	85.2	6.9	1.71	15.7	66.8	5.13	1.7
1.55 - 1.65	—	1.5	29.2	5.29	86.7	7.3	1.77	14.8	69.3	5.14	1.3
1.65 - 1.75	—	1.0	35.6	5.17	87.7	7.6	1.81	13.3	73.8	5.12	
Sink - 1.75	—	12.3	76.9	5.12	100.0	16.1	2.22	12.3	76.9	5.12	
Totals	—	100.0									

DATA SHEET 5.—MATHER NO. 1 MINE. SIZE, 1 INCH BY 48 MESH.



Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.05 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.30	—	49.9	4.7	1.23	49.9	4.7	1.23	100.0	18.3	2.22	—
1.30 - 1.35	—	20.6	8.5	2.16	70.5	5.8	1.50	50.1	31.8	3.21	25.6
1.35 - 1.45	—	10.0	15.0	3.39	80.5	7.0	1.74	29.5	48.1	3.94	6.4
1.45 - 1.50	—	1.4	22.1	4.49	81.9	7.2	1.78	19.5	65.1	4.22	2.4
1.50 - 1.55	—	1.0	26.4	4.94	82.9	7.4	1.82	18.1	68.4	4.20	1.9
1.55 - 1.65	—	1.8	29.2	5.25	84.7	7.9	1.89	17.1	70.9	4.16	1.5
1.65 - 1.75	—	1.1	36.6	5.05	85.8	8.3	1.93	15.3	75.8	4.03	
Sink - 1.75	—	14.2	78.8	3.95	100.0	18.3	2.22	14.2	78.8	3.95	
Totals	—	100.0									

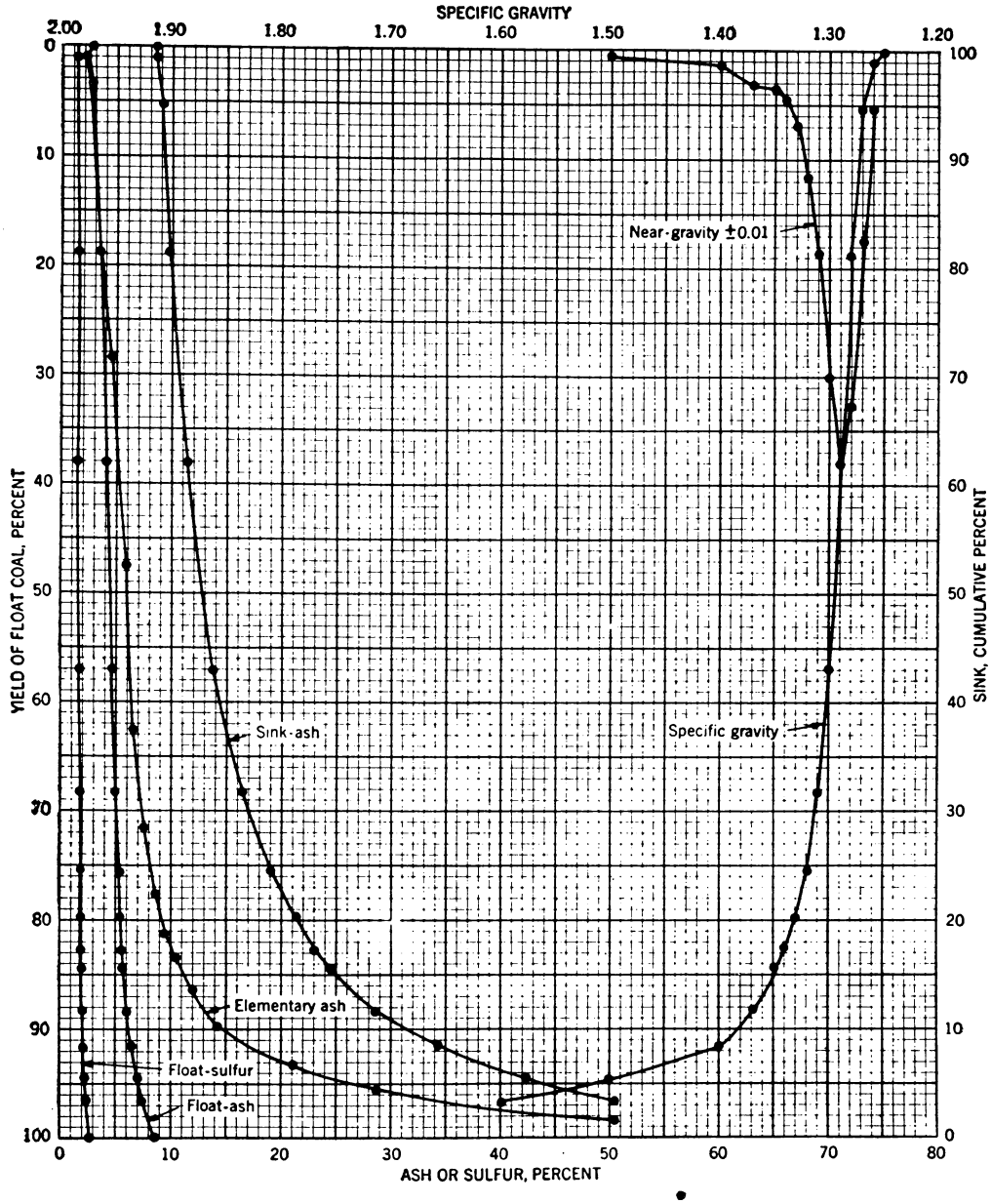
DATA SHEET 6.—MATHER NO. 1 MINE. SIZE, 1 BY ⅜ INCH.



Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.05 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.30	—	61.8	4.2	1.19	61.8	4.2	1.19	100.0	13.7	2.21	—
1.30 - 1.35	—	15.9	8.6	1.90	77.7	5.1	1.34	38.2	29.0	3.87	19.9
1.35 - 1.45	—	8.0	14.2	3.15	85.7	5.9	1.50	22.3	43.5	5.27	5.4
1.45 - 1.50	—	1.4	21.2	4.47	87.1	6.2	1.55	14.3	59.9	6.46	2.3
1.50 - 1.55	—	.9	24.8	4.87	88.0	6.4	1.59	12.9	64.1	6.68	1.5
1.55 - 1.65	—	1.1	29.2	5.38	89.1	6.7	1.63	12.0	67.1	6.81	1.0
1.65 - 1.75	—	.8	34.0	5.38	89.9	6.9	1.67	10.9	70.9	6.96	
Sink - 1.75	—	10.1	73.8	7.08	100.0	13.7	2.21	10.1	73.8	7.08	
Totals	—	100.0									

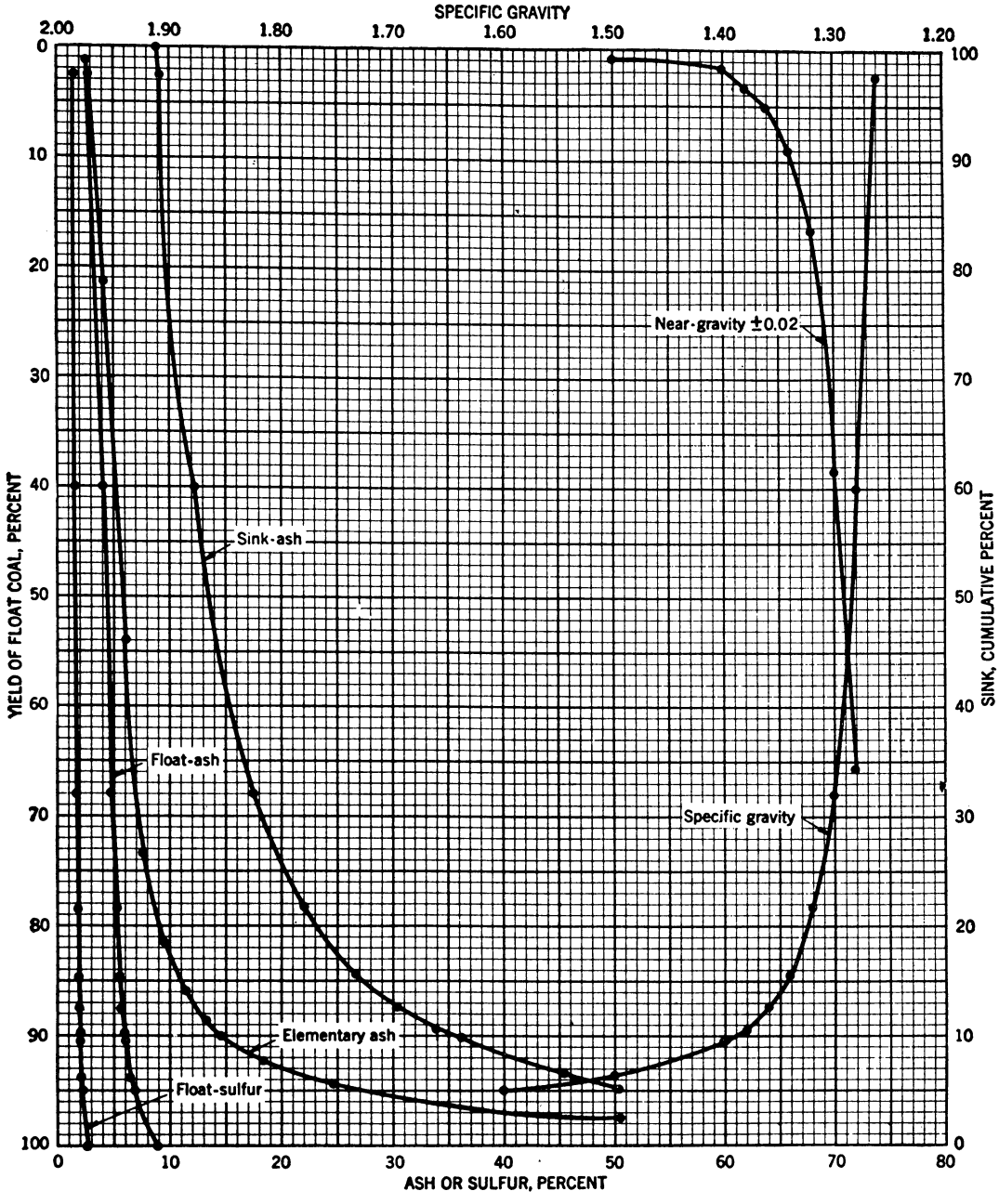
DATA SHEET 7.—MATHER NO. 1 MINE. SIZE, ⅜ INCH BY 48 MESH.

864010°—50——4



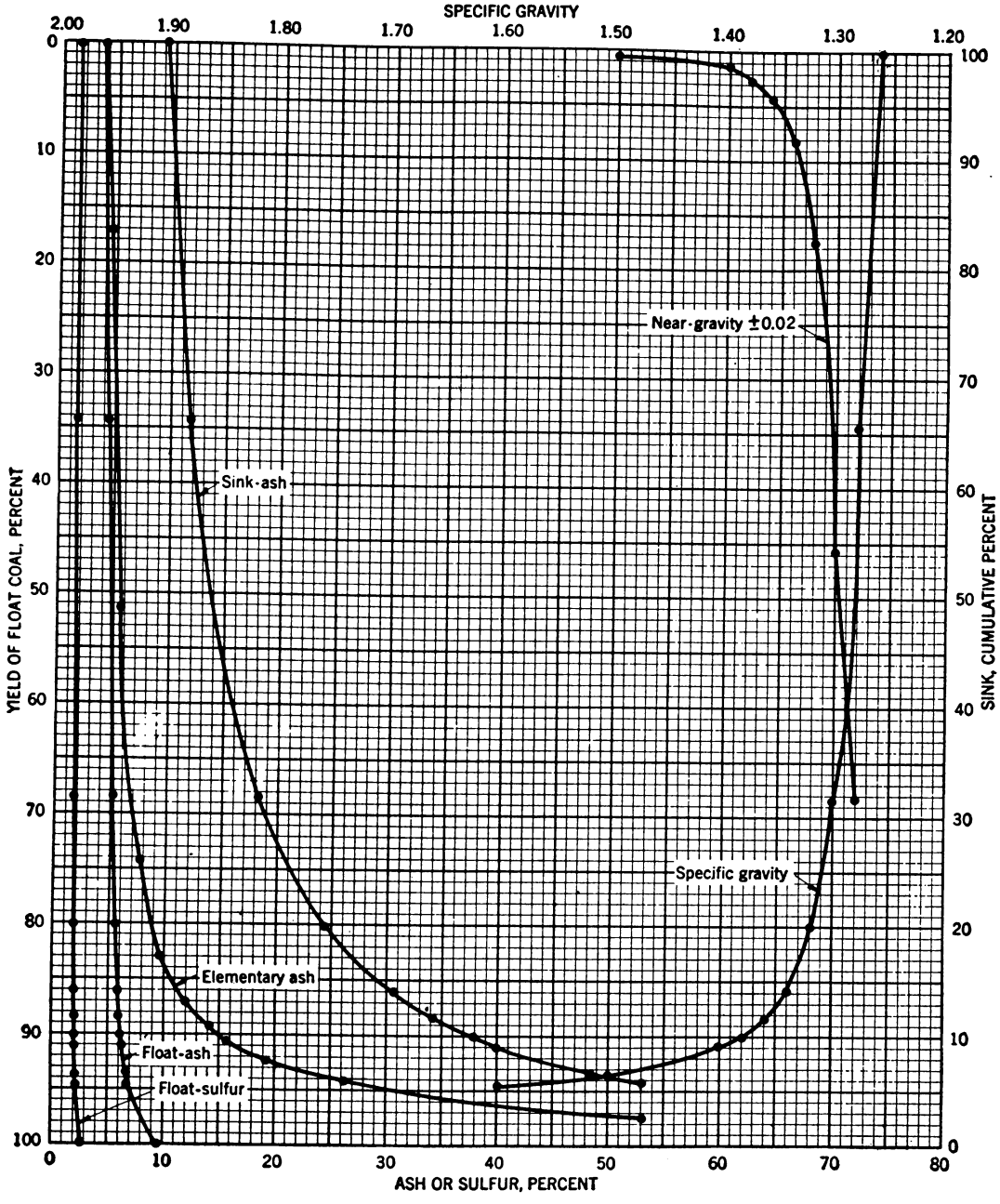
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.01 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.25	38	0.1	2.6	1.38	.1	2.6	1.38	100.0	8.6	2.62	
1.25 - 1.26	725	1.0	2.2	1.35	1.1	2.2	1.35	99.9	8.7	2.62	5.2
1.26 - 1.27	4,248	4.2	2.8	1.31	5.3	2.7	1.32	98.9	8.7	2.63	17.7
1.27 - 1.28	15,300	13.5	3.8	1.33	18.8	3.5	1.33	94.7	9.0	2.69	32.8
1.28 - 1.29	22,523	19.3	4.8	1.57	38.1	4.2	1.45	81.2	9.8	2.91	38.1
1.29 - 1.30	22,079	18.8	5.9	1.88	56.9	4.7	1.59	61.9	11.4	3.33	30.1
1.30 - 1.31	13,215	11.3	6.6	2.09	68.2	5.0	1.67	43.1	13.8	3.97	18.7
1.31 - 1.32	8,595	7.4	7.6	2.37	75.6	5.3	1.74	31.8	16.4	4.64	11.6
1.32 - 1.33	4,881	4.2	8.6	2.56	79.8	5.5	1.79	24.4	19.0	5.32	6.9
1.33 - 1.34	3,072	2.7	9.5	2.75	82.5	5.6	1.82	20.2	21.2	5.90	4.5
1.34 - 1.35	2,040	1.8	10.5	2.95	84.3	5.7	1.84	17.5	23.0	6.38	3.8
1.35 - 1.37	4,443	3.9	11.9	3.28	88.2	6.0	1.91	15.7	24.5	6.78	3.1
1.37 - 1.40	3,759	3.3	14.2	4.04	91.5	6.3	1.98	11.8	28.6	7.93	1.4
1.40 - 1.50	3,655	3.2	20.9	4.44	94.7	6.8	2.07	8.5	34.2	9.44	.5
1.50 - 1.60	2,287	2.0	28.7	6.14	96.7	7.2	2.15	5.3	42.2	12.47	
Sink - 1.60	3,767	3.3	50.4	16.30	100.0	8.6	2.62	3.3	50.4	16.30	
Totals	114,627	100.0									

DATA SHEET 8.—SHANNOPIN MINE SAMPLE, 1½-INCH CRUSHING. 31 ROOM SECTION OFF 16 BUTT, 60 FEET INBY NO. 3 ROOM. SIZE, 1½ INCHES BY 100 MESH.



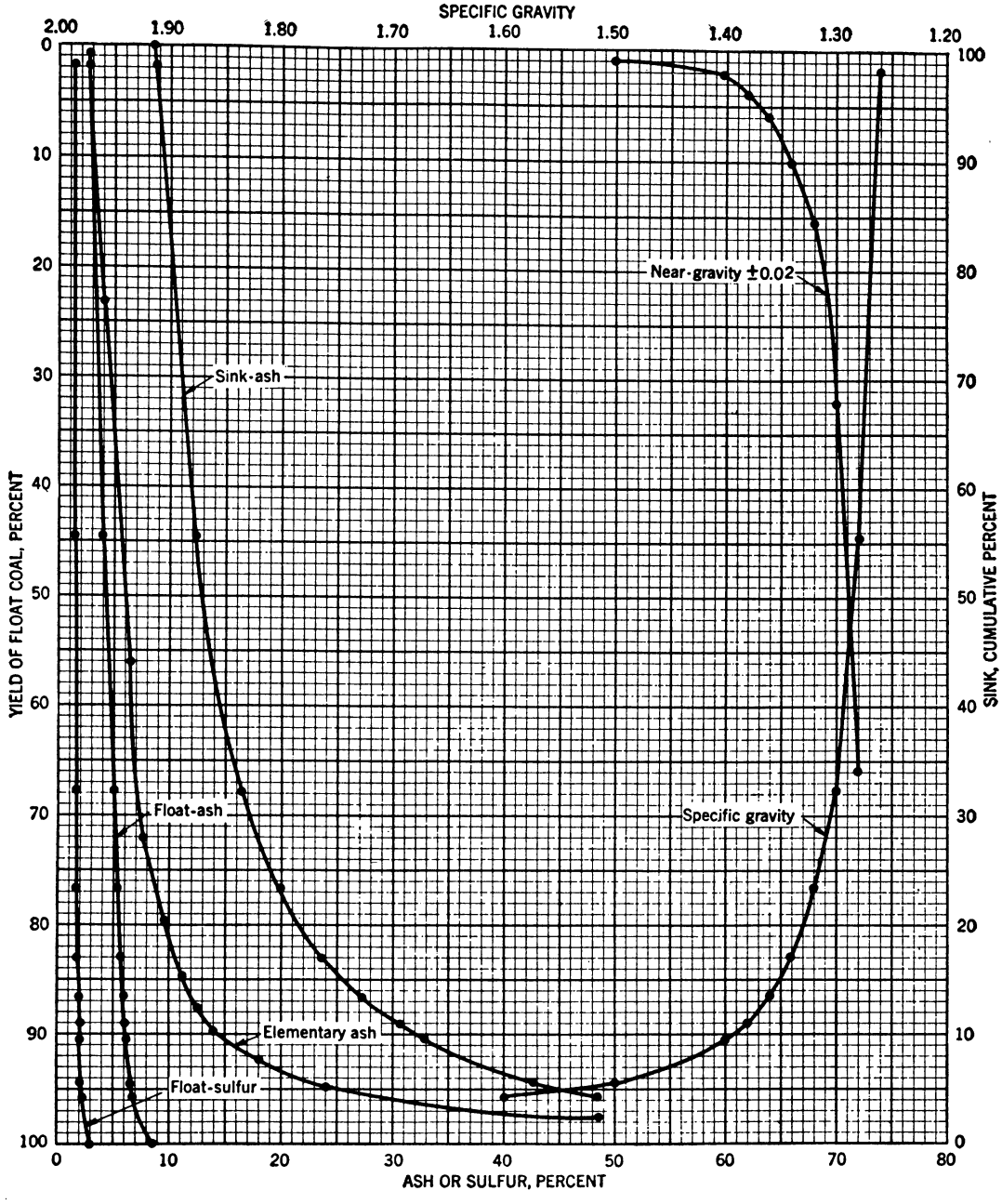
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	613.	2.3	2.7	1.43	2.3	2.7	1.43	100.0	8.9	2.72	
1.26 - 1.28	10061.	37.7	4.1	1.56	40.0	4.1	1.55	97.7	9.0	2.75	65.7
1.28 - 1.30	7475.	28.0	6.0	2.00	68.0	4.8	1.74	60.0	12.0	3.49	38.3
1.30 - 1.32	2750.	10.3	7.6	2.38	78.3	5.2	1.82	32.0	17.4	4.79	16.4
1.32 - 1.34	1618.	6.1	9.5	2.76	84.4	5.5	1.89	21.7	22.0	5.94	9.0
1.34 - 1.36	765.	2.9	11.3	3.15	87.3	5.7	1.93	15.6	26.8	7.16	5.1
1.36 - 1.38	595.	2.2	13.1	3.66	89.5	5.9	1.97	12.7	30.3	8.06	3.3
1.38 - 1.40	292.	1.1	14.5	4.30	90.6	6.0	2.00	10.5	33.9	8.98	1.7
1.40 - 1.50	858.	3.2	18.2	5.26	93.8	6.4	2.11	9.4	36.2	9.52	.9
1.50 - 1.60	334.	1.2	24.5	7.68	95.0	6.6	2.19	6.2	45.3	11.69	
Sink - 1.60	1352.	5.0	50.5	12.68	100.0	8.9	2.72	5.0	50.5	12.68	
Totals	26713.	100.0									

DATA SHEET 9.—PURSGLOVE MINE SAMPLE, 1½-INCH CRUSHING. 50 FEET NORTH OF STATION 9985. SIZE, 1½ INCHES BY 100 MESH.



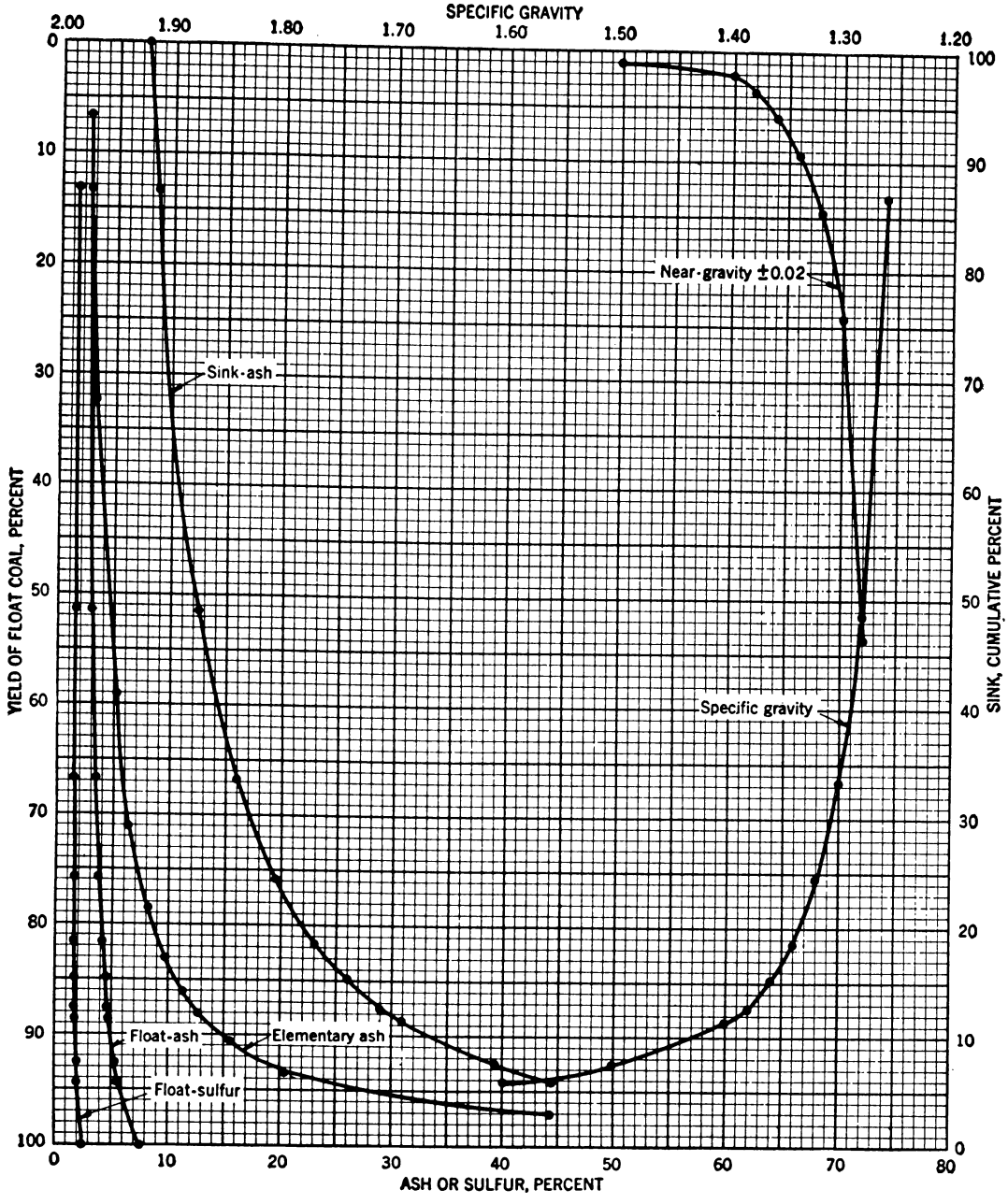
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	30.	.2	3.7	1.42	.2	3.7	1.42	100.0	9.3	2.73	
1.26 - 1.28	4720.	34.1	4.4	1.61	34.3	4.4	1.61	99.8	9.3	2.74	68.2
1.28 - 1.30	4720.	34.1	5.8	2.04	68.4	5.1	1.82	65.7	11.8	3.32	45.8
1.30 - 1.32	1618.	11.7	7.8	2.51	80.1	5.5	1.92	31.6	18.3	4.70	17.5
1.32 - 1.34	801.	5.8	9.7	2.96	85.9	5.8	1.99	19.9	24.5	5.99	8.1
1.34 - 1.36	311.	2.3	11.9	3.06	88.2	5.9	2.02	14.1	30.5	7.23	4.2
1.36 - 1.38	266.	1.9	14.1	3.46	90.1	6.1	2.05	11.8	34.1	8.02	2.8
1.38 - 1.40	117.	.9	15.6	3.92	91.0	6.2	2.07	9.9	37.9	8.91	1.4
1.40 - 1.50	365.	2.6	19.3	5.19	93.6	6.6	2.16	9.0	40.0	9.37	.7
1.50 - 1.60	152.	1.1	26.2	8.16	94.7	6.8	2.23	6.4	48.5	11.09	
Sink - 1.60	741.	5.3	53.1	11.69	100.0	9.3	2.73	5.3	53.1	11.69	
Totals	13841.	100.0									

DATA SHEET 10.—PURSGLOVE MINE SAMPLE, 1½-INCH CRUSHING. 50 FEET NORTH OF STATION 9985. SIZE, 1½ BY ⅜ INCH.



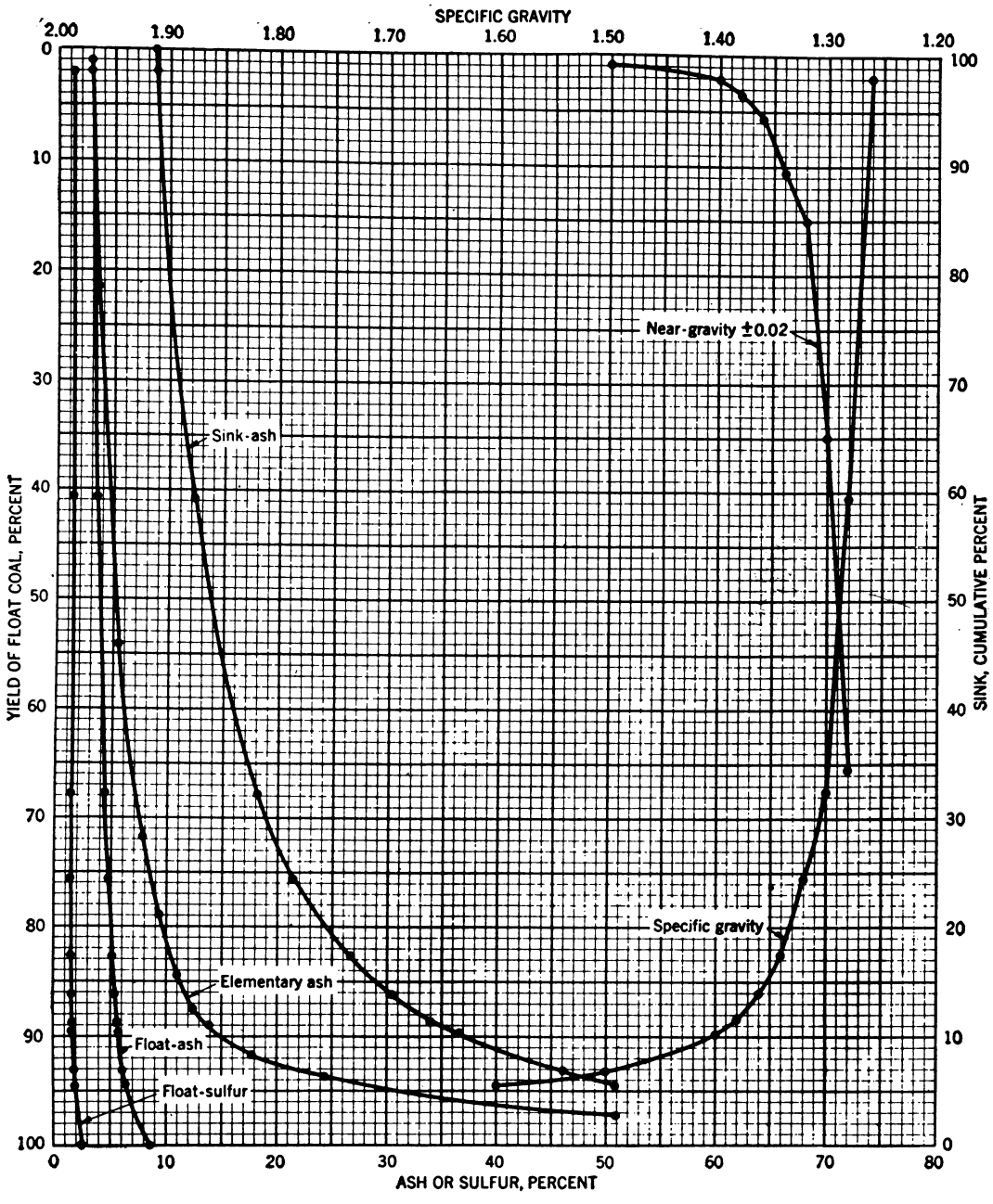
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	173.	1.8	2.7	1.40	1.8	2.7	1.40	100.0	8.6	2.78	
1.26 - 1.28	4160.	42.6	4.1	1.52	44.4	4.0	1.52	98.2	8.7	2.81	65.9
1.28 - 1.30	2275.	23.3	6.4	1.97	67.7	4.9	1.67	55.6	12.3	3.80	32.1
1.30 - 1.32	863.	8.8	7.6	2.27	76.5	5.2	1.74	32.3	16.5	5.11	15.3
1.32 - 1.34	637.	6.5	9.6	2.64	83.0	5.5	1.81	23.5	19.9	6.17	10.0
1.34 - 1.36	345.	3.5	11.2	3.32	86.5	5.8	1.87	17.0	23.8	7.53	6.0
1.36 - 1.38	250.	2.5	12.5	3.98	89.0	5.9	1.93	13.5	27.1	8.63	3.9
1.38 - 1.40	133.	1.4	14.0	4.80	90.4	6.1	1.98	11.0	30.6	9.72	2.2
1.40 - 1.50	369.	3.8	17.9	5.50	94.2	6.5	2.12	9.6	32.9	10.42	1.0
1.50 - 1.60	133.	1.4	24.0	7.85	95.6	6.8	2.20	5.8	42.7	13.64	
Sink - 1.60	432.	4.4	48.5	15.42	100.0	8.6	2.78	4.4	48.5	15.42	
Totals	9770.	100.0									

DATA SHEET 11.—PURSGLOVE MINE SAMPLE, 1½-INCH CRUSHING. 50 FEET NORTH OF STATION 9985. SIZE, ⅜ INCH BY 48 MESH.



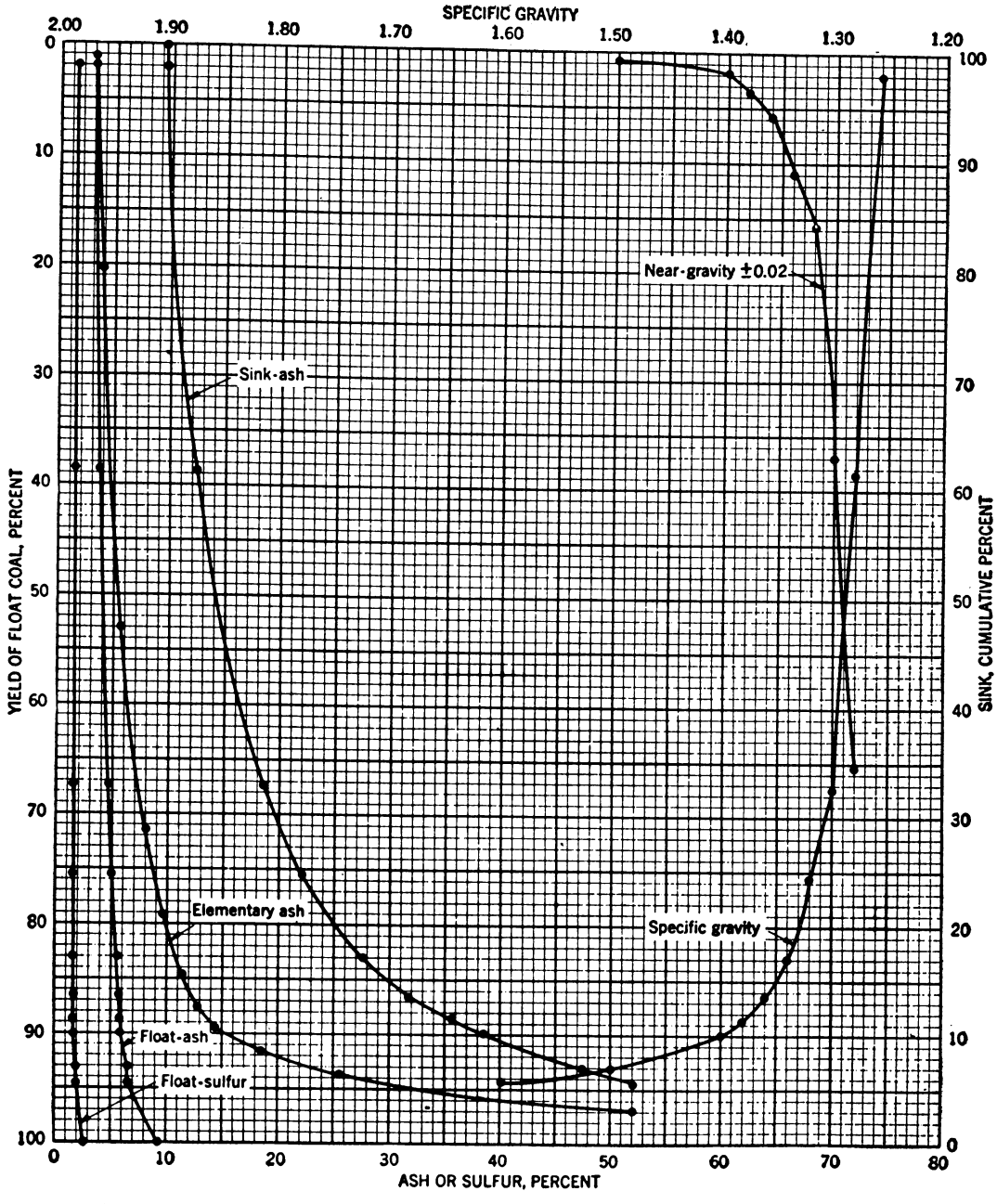
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	410.	13.2	2.6	1.45	13.2	2.6	1.45	100.0	7.7	2.42	
1.26 - 1.28	1181.	38.1	3.2	1.49	51.3	3.0	1.48	86.8	8.5	2.57	53.6
1.28 - 1.30	480.	15.5	5.2	1.70	66.8	3.5	1.53	48.7	12.6	3.41	24.2
1.30 - 1.32	269.	8.7	6.3	1.90	75.5	3.8	1.57	33.2	16.0	4.20	14.5
1.32 - 1.34	180.	5.8	8.2	2.30	81.3	4.1	1.63	24.5	19.5	5.01	9.3
1.34 - 1.36	109.	3.5	9.8	2.83	84.8	4.4	1.67	18.7	23.0	5.85	6.0
1.36 - 1.38	79.	2.5	11.4	3.28	87.3	4.6	1.72	15.2	26.0	6.55	3.8
1.38 - 1.40	42.	1.3	12.7	3.80	88.6	4.7	1.75	12.7	28.9	7.20	2.1
1.40 - 1.50	124.	4.0	15.6	4.74	92.6	5.2	1.88	11.4	30.9	7.61	1.1
1.50 - 1.60	49.	1.6	20.5	5.74	94.2	5.4	1.95	7.4	39.2	9.16	
Sink - 1.60	179.	5.8	44.3	10.10	100.0	7.7	2.42	5.8	44.3	10.10	
Totals	3102.	100.0									

DATA SHEET 12.—PURSGLOVE MINE SAMPLE, 1½-INCH CRUSHING. 50 FEET NORTH OF STATION 9985. SIZE, 14 BY 100 MESH.



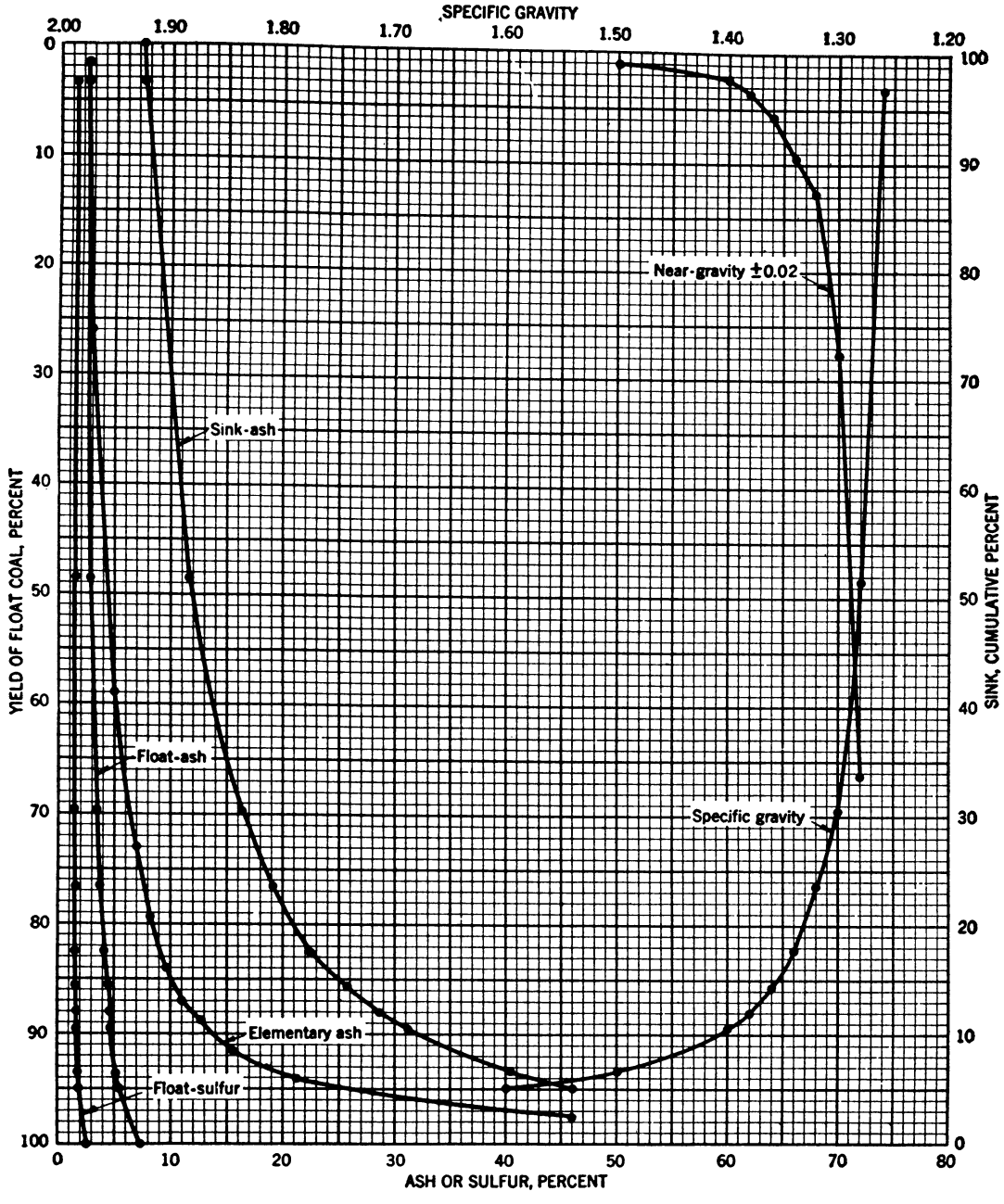
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	300.	2.2	2.9	1.48	2.2	2.9	1.48	100.0	8.8	2.61	
1.26 - 1.28	5137.	38.4	3.6	1.43	40.6	3.6	1.43	97.8	8.9	2.64	65.4
1.28 - 1.30	3612.	27.0	5.5	1.63	67.6	4.4	1.51	59.4	12.4	3.42	34.9
1.30 - 1.32	1060.	7.9	7.8	2.12	75.5	4.7	1.58	32.4	18.1	4.91	15.0
1.32 - 1.34	942.	7.1	9.2	2.34	82.6	5.1	1.64	24.5	21.5	5.82	10.6
1.34 - 1.36	469.	3.5	11.0	2.85	86.1	5.3	1.69	17.4	26.5	7.23	5.8
1.36 - 1.38	313.	2.3	12.4	3.54	88.4	5.5	1.74	13.9	30.4	8.35	3.7
1.38 - 1.40	180.	1.4	13.9	4.11	89.8	5.7	1.77	11.6	34.0	9.33	2.1
1.40 - 1.50	442.	3.3	17.7	5.01	93.1	6.1	1.89	10.2	36.7	10.03	.9
1.50 - 1.60	168.	1.3	24.4	6.12	94.4	6.3	1.95	6.9	46.0	12.46	
Sink - 1.60	743.	5.6	50.9	13.89	100.0	8.8	2.61	5.6	50.9	13.89	
Totals.	13366.	100.0									

DATA SHEET 13.—PURSGLOVE MINE SAMPLE, ⅜-INCH CRUSHING. 50 FEET NORTH OF STATION 9985. SIZE, ⅜ INCH BY 100 MESH.



Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	203.	2.0	3.1	1.53	2.0	3.1	1.53	100.0	9.2	2.66	
1.26 - 1.28	3792.	36.5	3.9	1.45	38.5	3.8	1.45	98.0	9.3	2.68	65.3
1.28 - 1.30	2989.	28.8	5.6	1.65	67.3	4.6	1.54	61.5	12.5	3.41	37.0
1.30 - 1.32	857.	8.2	8.0	2.22	75.5	5.0	1.61	32.7	18.6	4.95	15.6
1.32 - 1.34	767.	7.4	9.5	2.40	82.9	5.4	1.68	24.5	22.1	5.87	10.9
1.34 - 1.36	365.	3.5	11.4	2.95	86.4	5.6	1.73	17.1	27.6	7.37	5.8
1.36 - 1.38	243.	2.3	12.8	3.62	88.7	5.8	1.78	13.6	31.7	8.50	3.6
1.38 - 1.40	135.	1.3	14.4	4.31	90.0	5.9	1.82	11.3	35.6	9.51	1.9
1.40 - 1.50	327.	3.1	18.5	5.24	93.1	6.4	1.94	10.0	38.4	10.18	.9
1.50 - 1.60	124.	1.2	25.5	6.38	94.3	6.6	1.99	6.9	47.5	12.44	
Sink - 1.60	592.	5.7	52.1	13.71	100.0	9.2	2.66	5.7	52.1	13.71	
Totals	10394	100.0									

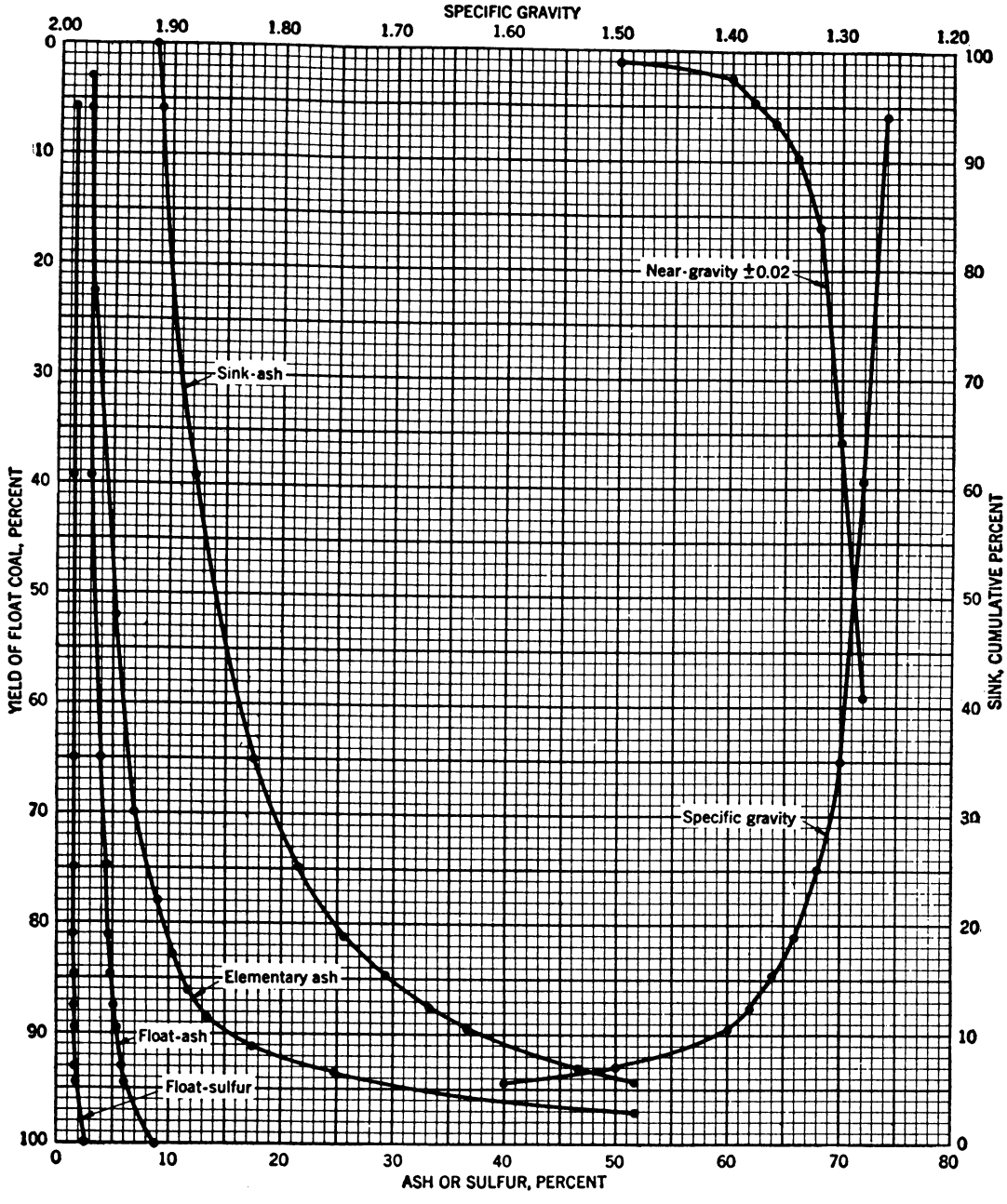
DATA SHEET 14.—PURSGLOVE MINE SAMPLE, ⅜-INCH CRUSHING. 50 FEET NORTH OF STATION 9985. SIZE, ⅜ INCH BY 14 MESH.



Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float - 1.26	97.	3.3	2.6	1.39	3.3	2.6	1.39	100.0	7.4	2.44	
1.26 - 1.28	1345.	45.2	2.9	1.38	48.5	2.9	1.38	96.7	7.6	2.47	66.2
1.28 - 1.30	623.	21.0	5.0	1.53	69.5	3.5	1.43	51.5	11.7	3.43	27.8
1.30 - 1.32	203.	6.8	6.9	1.72	76.3	3.8	1.45	30.5	16.3	4.73	12.7
1.32 - 1.34	175.	5.9	8.2	2.05	82.2	4.1	1.49	23.7	19.1	5.60	9.4
1.34 - 1.36	104.	3.5	9.8	2.51	85.7	4.4	1.54	17.8	22.6	6.78	5.8
1.36 - 1.38	70.	2.3	11.0	3.24	88.0	4.5	1.58	14.3	25.8	7.82	3.8
1.38 - 1.40	45.	1.5	12.1	3.50	89.5	4.7	1.61	12.0	28.7	8.73	2.3
1.40 - 1.50	115.	3.9	15.5	4.34	93.4	5.1	1.73	10.5	31.1	9.49	1.1
1.50 - 1.60	44.	1.5	21.0	5.40	94.9	5.4	1.78	6.6	40.4	12.52	
Sink - 1.60	151.	5.1	46.0	14.60	100.0	7.4	2.44	5.1	46.0	14.60	
Totals	2972.	100.0									

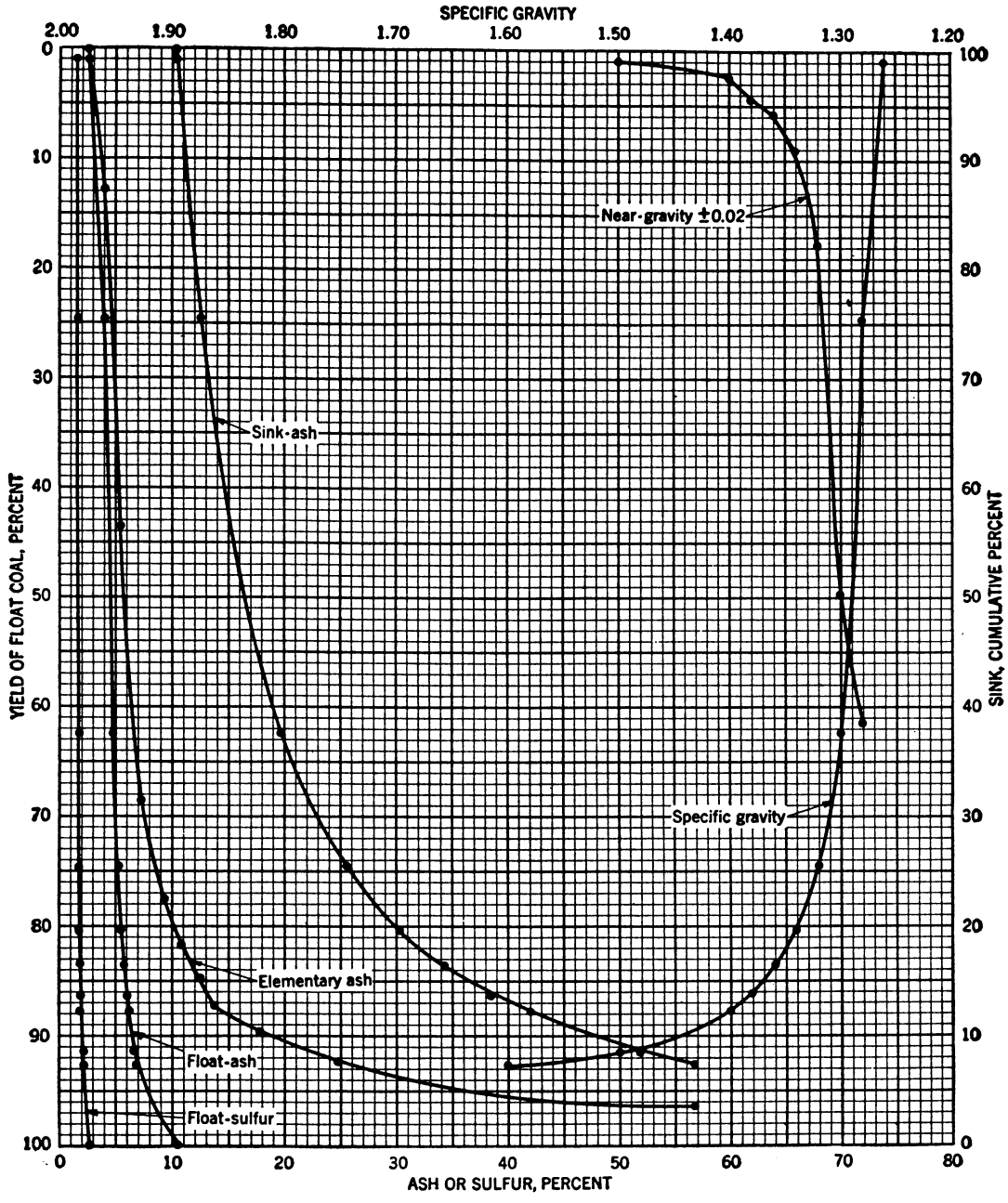
DATA SHEET 15.—PURSGLOVE MINE SAMPLE, ⅜-INCH CRUSHING. 50 FEET NORTH OF STATION 9985. SIZE, 14 BY 100 MESH.

864010°—50——5



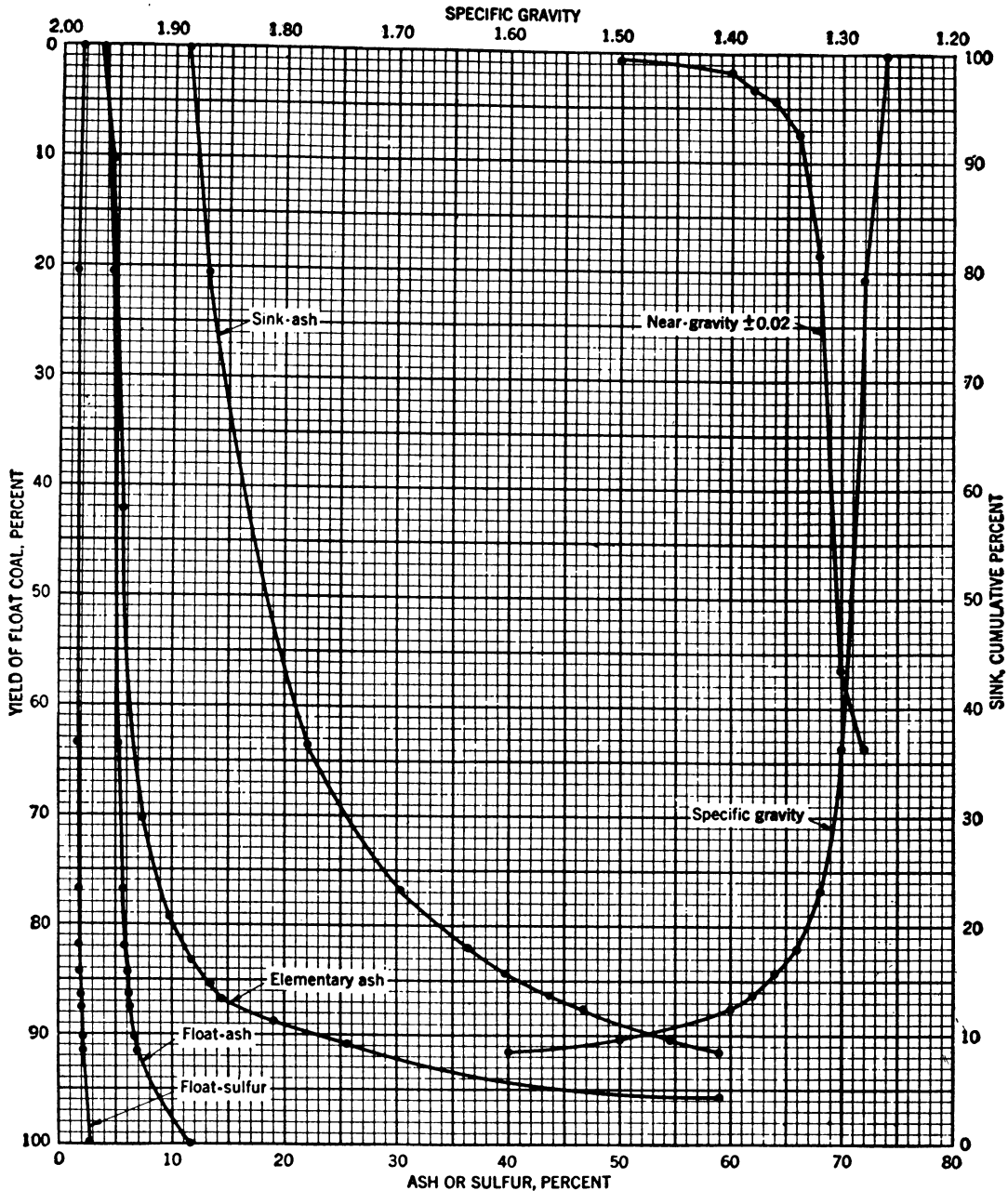
Specific gravity fractions	Weight grams	Elementary data: Percent Weight	Ash	Sulfur	Computed cumulative data: Float, cumulative percent Weight	Ash	Sulfur	Sink, cumulative percent Weight	Ash	Sulfur	Near-gravity ±0.02 percent
Float- 1.26	132.	5.9	2.8	1.30	5.9	2.8	1.30	100.0	8.7	2.46	
1.26 - 1.28	748.	33.3	3.1	1.34	39.2	3.0	1.33	94.1	9.0	2.54	59.1
1.28 - 1.30	580.	25.8	5.2	1.44	65.0	3.9	1.38	60.8	12.3	3.19	35.7
1.30 - 1.32	223.	9.9	6.9	1.60	74.9	4.3	1.41	35.0	17.5	4.48	16.1
1.32 - 1.34	140.	6.2	9.0	1.91	81.1	4.7	1.44	25.1	21.6	5.61	9.8
1.34 - 1.36	82.	3.6	10.4	2.21	84.7	4.9	1.48	18.9	25.7	6.82	6.4
1.36 - 1.38	62.	2.8	11.7	2.64	87.5	5.1	1.51	15.3	29.3	7.91	4.7
1.38 - 1.40	43.	1.9	13.4	3.01	89.4	5.3	1.55	12.5	33.2	9.07	2.6
1.40 - 1.50	82.	3.6	17.4	3.88	93.0	5.8	1.64	10.6	36.7	10.16	1.0
1.50 - 1.60	30.	1.3	24.8	5.03	94.3	6.0	1.69	7.0	46.7	13.41	
Sink - 1.60	128.	5.7	51.8	15.36	100.0	8.7	2.46	5.7	51.8	15.36	
Totals	2250.	100.0									

DATA SHEET 16.—PURSGLOVE MINE SAMPLE, 14-MESH CRUSHING. 50 FEET NORTH OF STATION 9985. SIZE, 14 BY 100 MESH.



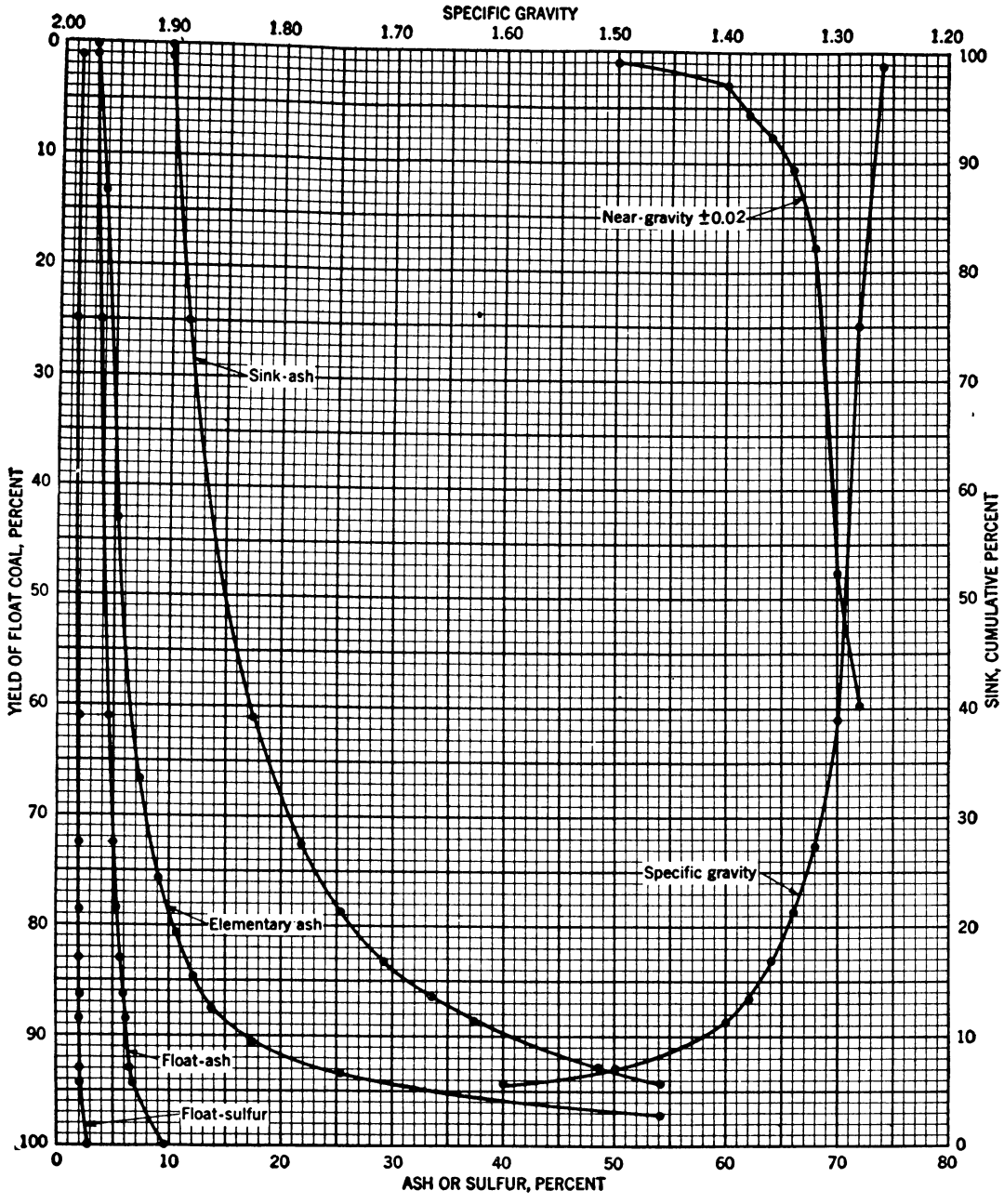
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	222.	1.0	2.5	1.54	1.0	2.5	1.54	100.0	10.4	2.71	
1.26 - 1.28	5569.	23.7	4.0	1.59	24.7	4.0	1.59	99.0	10.5	2.72	61.4
1.28 - 1.30	8861.	37.7	5.4	1.74	62.4	4.8	1.68	75.3	12.5	3.08	49.9
1.30 - 1.32	2862.	12.2	7.2	2.11	74.6	5.2	1.75	37.6	19.7	4.43	17.9
1.32 - 1.34	1329.	5.7	9.3	2.43	80.3	5.5	1.80	25.4	25.7	5.54	9.0
1.34 - 1.36	771.	3.3	10.9	3.01	83.6	5.7	1.85	19.7	30.4	6.44	5.9
1.36 - 1.38	622.	2.6	12.5	3.67	86.2	5.9	1.90	16.4	34.3	7.13	4.3
1.38 - 1.40	394.	1.7	13.9	4.04	87.9	6.1	1.94	13.8	38.5	7.79	2.4
1.40 - 1.50	819.	3.5	17.8	4.78	91.4	6.5	2.05	12.1	42.0	8.32	1.0
1.50 - 1.60	304.	1.3	24.9	6.62	92.7	6.8	2.12	8.6	51.8	9.75	
Sink - 1.60	1714.	7.3	56.6	10.31	100.0	10.4	2.71	7.3	56.6	10.31	
Totals	23467.	100.0									

DATA SHEET 17.—PURSGLOVE MINE SAMPLE, 1½-INCH CRUSHING. 10 FEET NORTH OF STATION 9987. SIZE, 1½ INCHES BY 100 MESH.



Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	9.	.1	3.6	1.63	.1	3.6	1.63	100.0	11.3	2.72	
1.26 - 1.28	2455.	20.5	4.5	1.59	20.6	4.5	1.59	99.9	11.3	2.72	63.5
1.28 - 1.30	5156.	43.0	5.5	1.79	63.6	5.2	1.73	79.4	13.1	3.01	56.3
1.30 - 1.32	1593.	13.3	7.3	2.17	76.9	5.5	1.80	36.4	22.0	4.45	18.4
1.32 - 1.34	617.	5.1	9.9	2.32	82.0	5.8	1.83	23.1	30.4	5.75	7.4
1.34 - 1.36	278.	2.3	11.7	2.93	84.3	6.0	1.86	18.0	36.3	6.73	4.3
1.36 - 1.38	239.	2.0	13.3	3.88	86.3	6.2	1.91	15.7	39.9	7.28	3.3
1.38 - 1.40	157.	1.3	14.4	3.90	87.6	6.3	1.94	13.7	43.7	7.78	1.8
1.40 - 1.50	328.	2.7	19.0	4.74	90.3	6.7	2.03	12.4	46.8	8.19	.8
1.50 - 1.60	152.	1.3	25.5	7.44	91.6	6.9	2.10	9.7	54.6	9.15	
Sink - 1.60	1015.	8.4	59.0	9.41	100.0	11.3	2.72	8.4	59.0	9.41	
Totals	11999.	100.0									

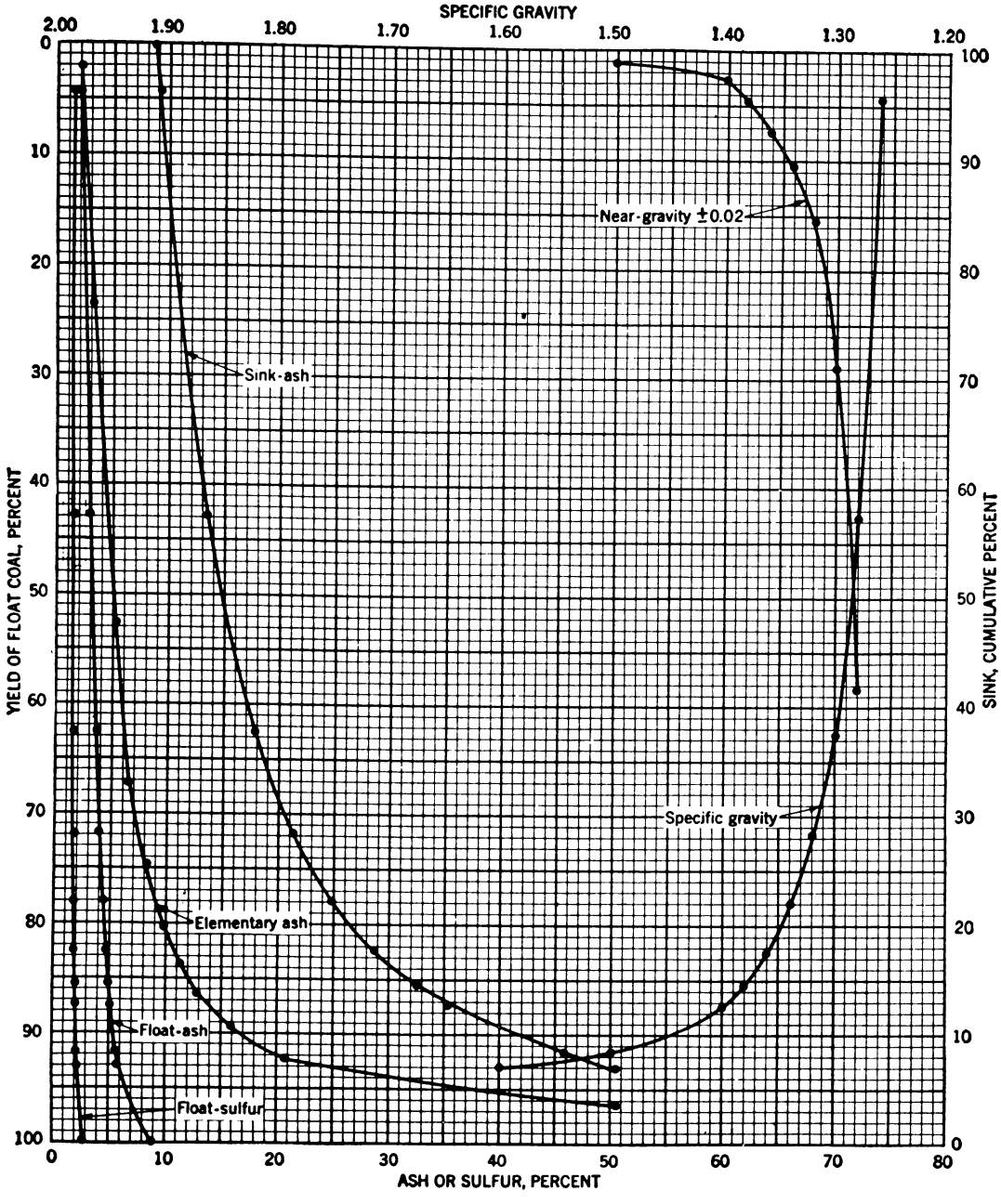
DATA SHEET 18.—PURSGLOVE MINE SAMPLE, 1½-INCH CRUSHING. 10 FEET NORTH OF STATION 9987. SIZE, 1½ BY ⅜ INCH.



Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	109.	1.2	2.8	1.49	1.2	2.8	1.49	100.0	9.6	2.72	
1.26 - 1.28	2119.	23.8	3.9	1.51	25.0	3.8	1.51	98.8	9.7	2.73	59.8
1.28 - 1.30	3203.	36.0	5.2	1.66	61.0	4.6	1.60	75.0	11.5	3.12	47.6
1.30 - 1.32	1029.	11.6	7.1	2.08	72.6	5.0	1.67	39.0	17.4	4.46	17.8
1.32 - 1.34	555.	6.2	9.0	2.57	78.8	5.3	1.75	27.4	21.7	5.47	10.5
1.34 - 1.36	380.	4.3	10.7	3.14	83.1	5.6	1.82	21.2	25.4	6.32	7.7
1.36 - 1.38	304.	3.4	12.2	3.65	86.5	5.9	1.89	16.9	29.1	7.12	5.6
1.38 - 1.40	193.	2.2	13.8	4.22	88.7	6.1	1.95	13.5	33.4	8.00	3.0
1.40 - 1.50	374.	4.2	17.3	4.91	92.9	6.6	2.08	11.3	37.1	8.72	1.1
1.50 - 1.60	118.	1.3	25.3	6.10	94.2	6.8	2.14	7.1	48.7	10.95	
Sink - 1.60	520.	5.8	54.1	12.05	100.0	9.6	2.72	5.8	54.1	12.05	
Totals	8904.	100.0									

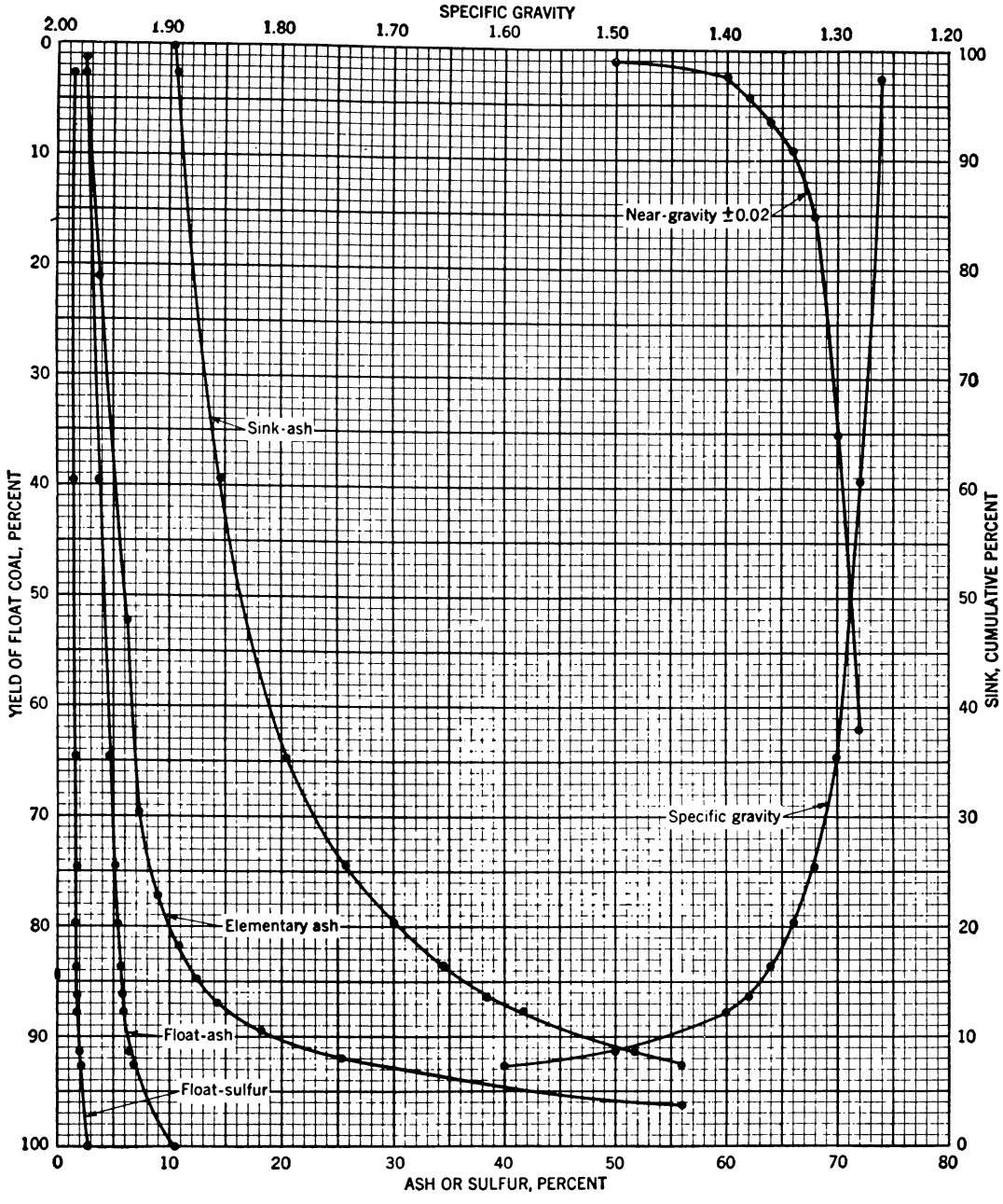
DATA SHEET 19.—PURSGLOVE MINE SAMPLE, 1½-INCH CRUSHING. 10 FEET NORTH OF STATION 9987. SIZE, ⅜ INCH BY 14 MESH.

864010°—50——6



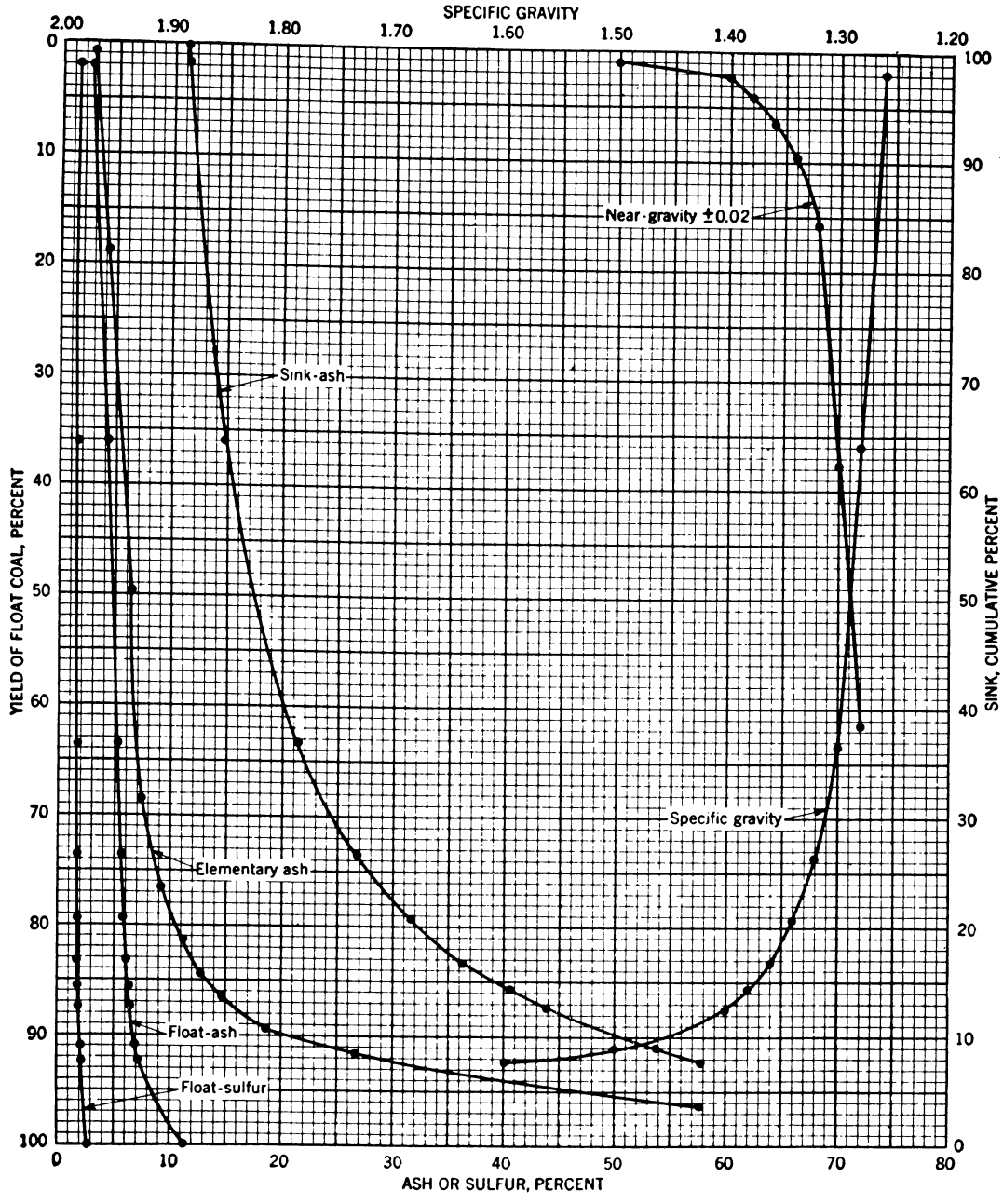
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	104.	4.1	2.1	1.58	4.1	2.1	1.58	100.0	8.9	2.66	
1.26 - 1.28	995.	38.8	3.1	1.74	42.9	3.0	1.72	95.9	9.2	2.71	58.4
1.28 - 1.30	502.	19.6	5.1	1.73	62.5	3.7	1.73	57.1	13.3	3.36	29.0
1.30 - 1.32	240.	9.4	6.5	1.88	71.9	4.0	1.75	37.5	17.6	4.22	15.5
1.32 - 1.34	157.	6.1	8.1	2.34	78.0	4.3	1.79	28.1	21.3	4.99	10.5
1.34 - 1.36	113.	4.4	9.7	2.76	82.4	4.6	1.84	22.0	24.9	5.73	7.5
1.36 - 1.38	79.	3.1	11.1	3.13	85.5	4.9	1.89	17.6	28.7	6.47	4.8
1.38 - 1.40	44.	1.7	12.6	3.70	87.2	5.0	1.93	14.5	32.5	7.17	2.6
1.40 - 1.50	117.	4.5	15.8	4.46	91.7	5.6	2.05	12.8	35.1	7.64	1.2
1.50 - 1.60	34.	1.3	20.7	4.85	93.0	5.8	2.09	8.3	45.7	9.38	
Sink - 1.60	179.	7.0	50.5	10.25	100.0	8.9	2.66	7.0	50.5	10.25	
Totals	2564.	100.0									

DATA SHEET 20.—PURSGLOVE MINE SAMPLE, 1½-INCH CRUSHING. 10 FEET NORTH OF STATION 9987. SIZE, 14 BY 100 MESH.



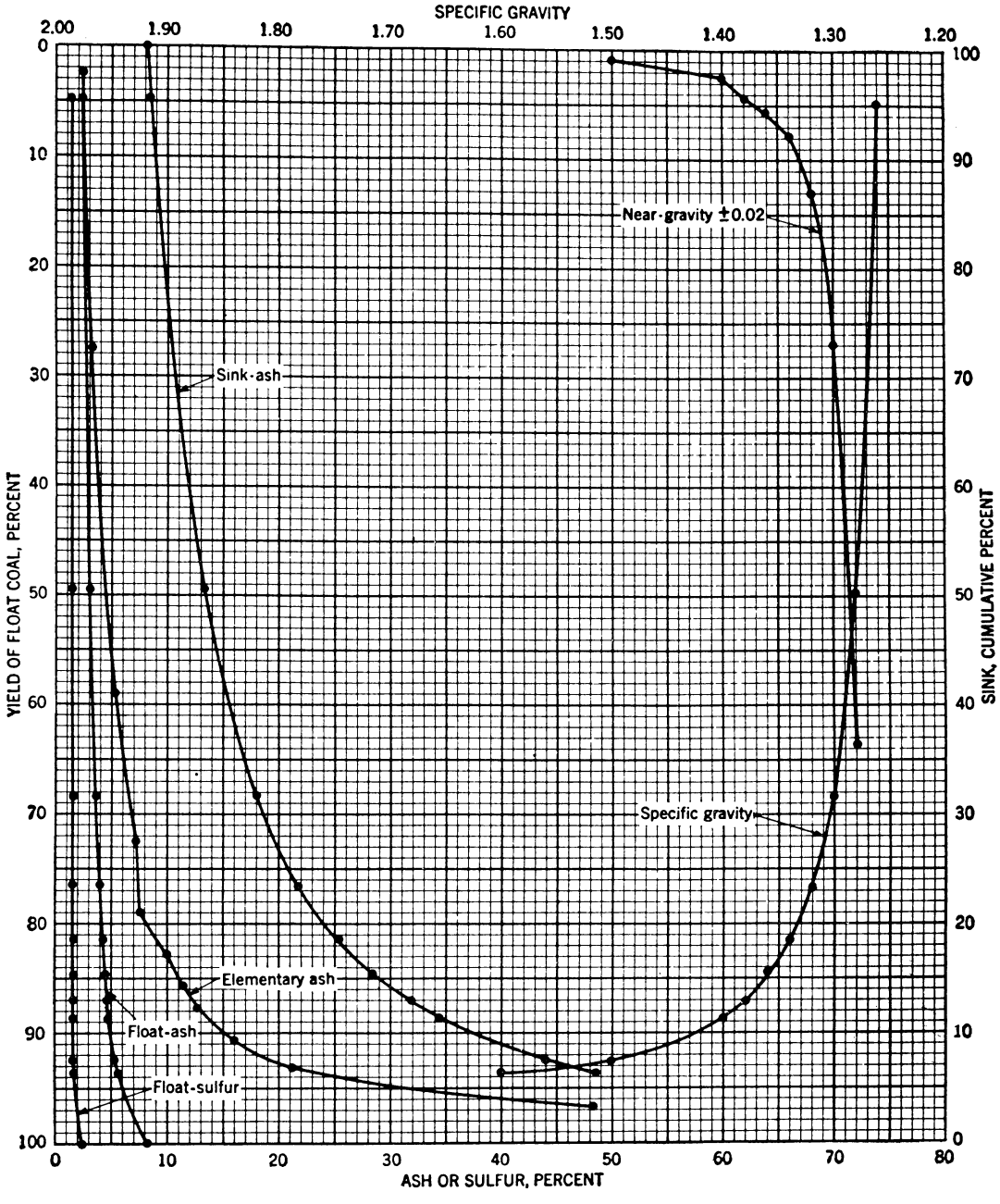
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	303.	2.6	2.5	1.50	2.6	2.5	1.50	100.0	10.3	2.68	
1.26 - 1.28	4240.	36.8	3.9	1.58	39.4	3.8	1.57	97.4	10.6	2.71	62.1
1.28 - 1.30	2920.	25.3	6.2	1.77	64.7	4.8	1.65	60.6	14.6	3.39	35.1
1.30 - 1.32	1133.	9.8	7.3	2.02	74.5	5.1	1.70	35.3	20.5	4.55	15.1
1.32 - 1.34	614.	5.3	8.8	2.42	79.8	5.4	1.75	25.5	25.6	5.52	9.1
1.34 - 1.36	437.	3.8	10.9	2.90	83.6	5.6	1.80	20.2	30.0	6.33	6.4
1.36 - 1.38	303.	2.6	12.4	3.53	86.2	5.8	1.85	16.4	34.4	7.12	4.2
1.38 - 1.40	184.	1.6	14.1	3.80	87.8	6.0	1.89	13.8	38.5	7.79	2.3
1.40 - 1.50	419.	3.6	18.1	4.41	91.4	6.4	1.99	12.2	41.7	8.31	1.0
1.50 - 1.60	142.	1.2	25.4	5.26	92.6	6.7	2.03	8.6	51.6	9.95	
Sink - 1.60	857.	7.4	56.0	10.73	100.0	10.3	2.68	7.4	56.0	10.73	
Totals	11552.	100.0									

DATA SHEET 21.—PURSGLOVE MINE SAMPLE, ⅜-INCH CRUSHING. 10 FEET NORTH OF STATION 9987. SIZE, ⅜ INCH BY 100 MESH.



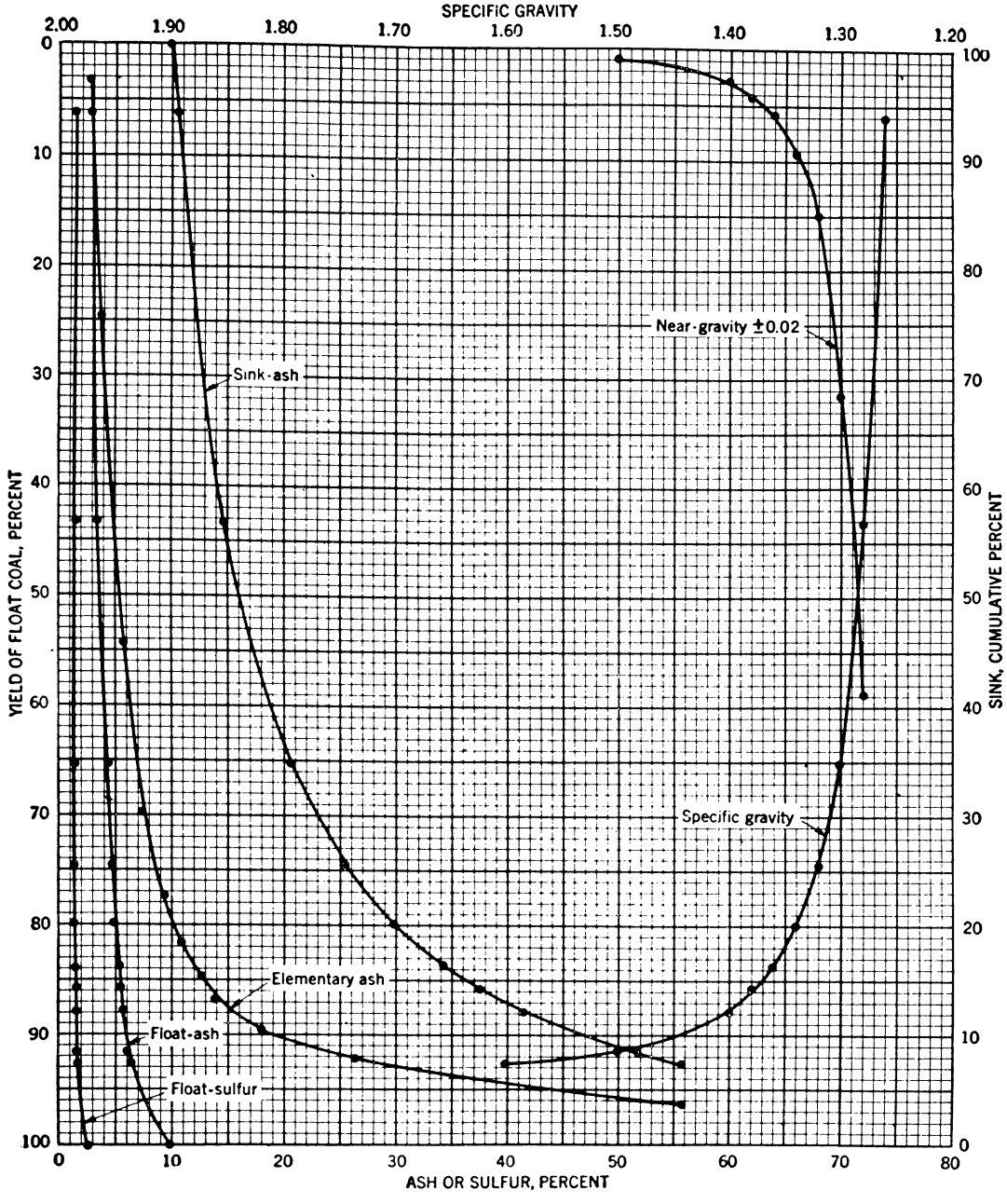
Specific gravity fractions	Elementary data				Computed cumulative data						Near gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	165.	1.9	2.7	1.58	1.9	2.7	1.58	100.0	11.1	2.77	
1.26 - 1.28	2980.	34.1	4.3	1.63	36.0	4.2	1.63	98.1	11.2	2.79	61.5
1.28 - 1.30	2390.	27.4	6.4	1.82	63.4	5.2	1.71	64.0	14.9	3.41	37.7
1.30 - 1.32	903.	10.3	7.4	2.07	73.7	5.5	1.76	36.6	21.3	4.60	15.8
1.32 - 1.34	478.	5.5	9.2	2.50	79.2	5.8	1.81	26.3	26.8	5.59	9.5
1.34 - 1.36	352.	4.0	11.1	2.98	83.2	6.0	1.87	20.8	31.4	6.40	6.6
1.36 - 1.38	226.	2.6	12.8	3.73	85.8	6.2	1.92	16.8	36.2	7.22	4.2
1.38 - 1.40	140.	1.6	14.6	3.96	87.4	6.4	1.96	14.2	40.5	7.86	2.3
1.40 - 1.50	312.	3.6	18.8	4.55	91.0	6.9	2.06	12.6	43.8	8.36	1.0
1.50 - 1.60	107.	1.2	26.8	5.46	92.2	7.1	2.11	9.0	53.7	9.86	
Sink - 1.60	680.	7.8	57.9	10.56	100.0	11.1	2.77	7.8	57.9	10.56	
Totals	8733.	100.0									

DATA SHEET 22.—PURSGLOVE MINE SAMPLE, ⅜-INCH CRUSHING. 10 FEET NORTH OF STATION 9987. SIZE, ⅜ INCH BY 14 MESH.



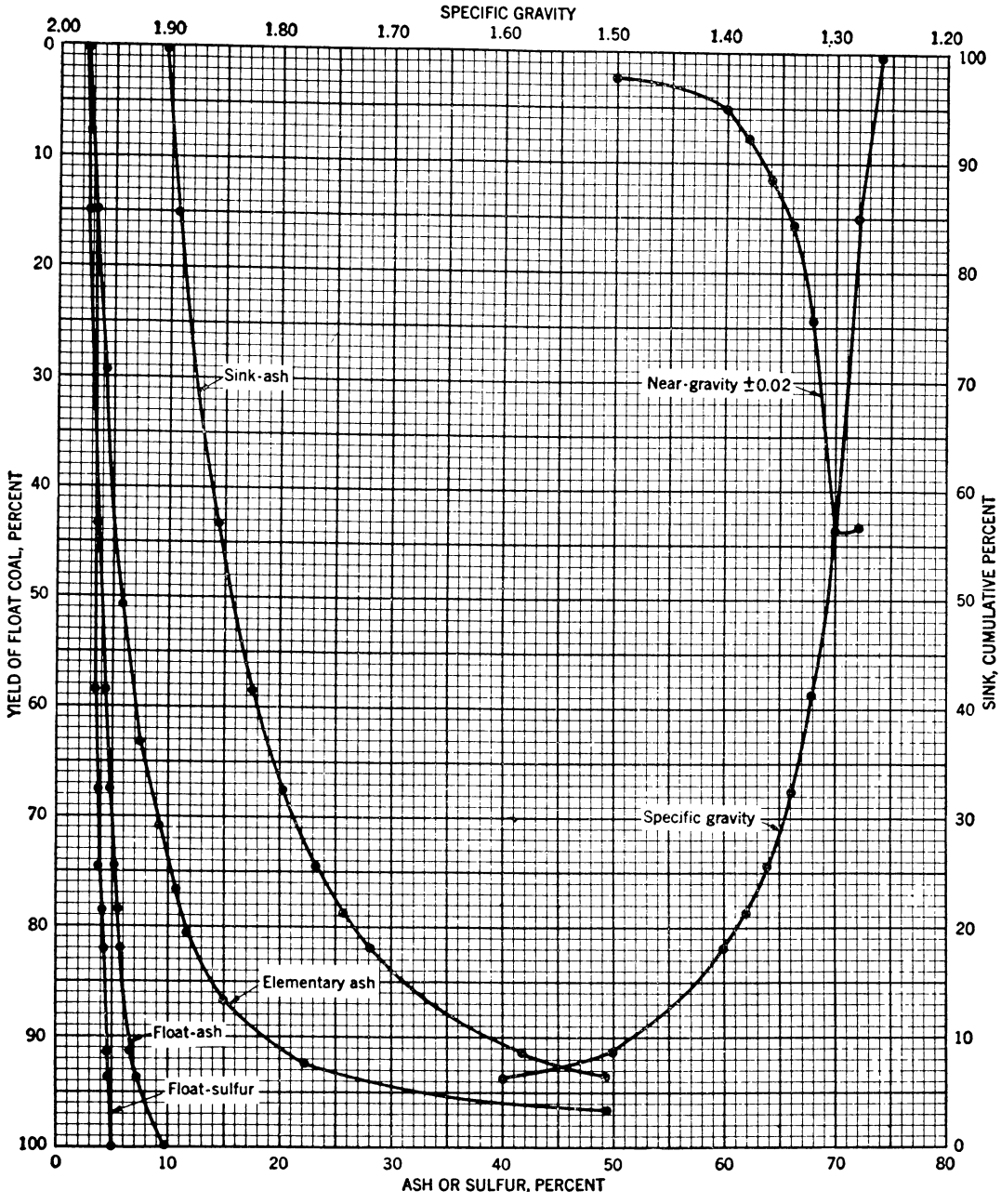
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	138.	4.9	2.3	1.41	4.9	2.3	1.41	100.0	8.1	2.40	
1.26 - 1.28	1260.	44.7	3.1	1.46	49.6	3.0	1.46	95.1	8.4	2.45	63.5
1.28 - 1.30	530.	18.8	5.2	1.57	68.4	3.6	1.49	50.4	13.2	3.33	27.0
1.30 - 1.32	230.	8.2	7.1	1.82	76.6	4.0	1.52	31.6	17.9	4.38	13.0
1.32 - 1.34	136.	4.8	7.4	2.15	81.4	4.2	1.56	23.4	21.7	5.27	7.8
1.34 - 1.36	85.	3.0	9.9	2.55	84.4	4.4	1.59	18.6	25.3	6.08	5.7
1.36 - 1.38	77.	2.7	11.3	2.97	87.1	4.6	1.64	15.6	28.3	6.76	4.3
1.38 - 1.40	44.	1.6	12.7	3.28	88.7	4.7	1.67	12.9	31.9	7.56	2.4
1.40 - 1.50	107.	3.8	16.0	4.02	92.5	5.2	1.76	11.3	34.6	8.15	1.0
1.50 - 1.60	35.	1.2	21.3	4.64	93.7	5.4	1.80	7.5	44.0	10.24	
Sink - 1.60	177.	6.3	48.5	11.35	100.0	8.1	2.40	6.3	48.5	11.35	
Totals	2819.	100.0									

DATA SHEET 23.—PURSGLOVE MINE SAMPLE, ⅜-INCH CRUSHING. 10 FEET NORTH OF STATION 9987. SIZE, 14 BY 100 MESH.



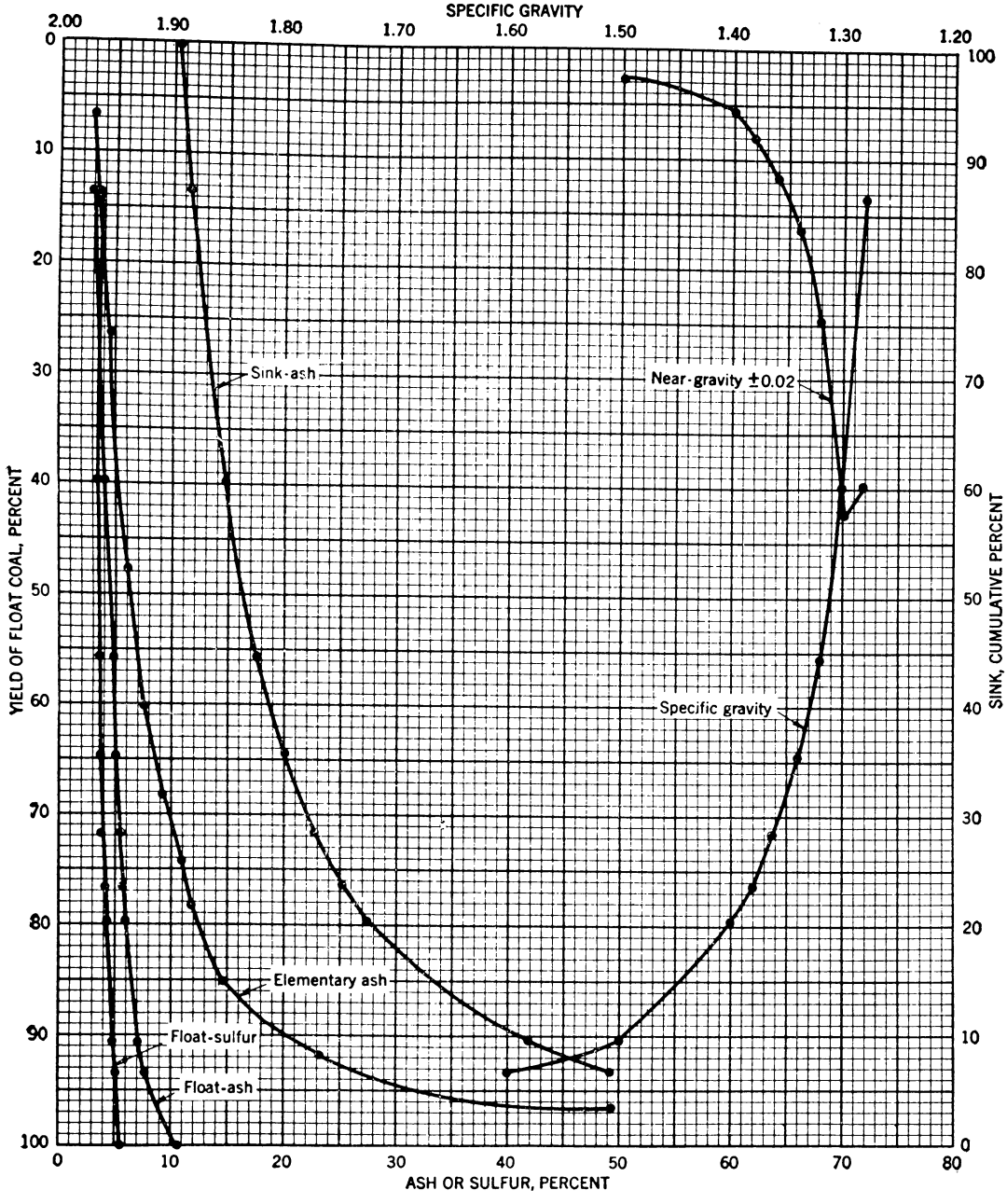
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	118.	6.1	2.7	1.36	6.1	2.7	1.36	100.0	9.9	2.39	
1.26 - 1.28	720.	37.0	3.6	1.35	43.1	3.4	1.35	93.9	10.4	2.45	59.0
1.28 - 1.30	428.	22.0	5.6	1.48	65.1	4.2	1.39	56.9	14.8	3.17	31.5
1.30 - 1.32	185.	9.5	7.4	1.63	74.6	4.6	1.42	34.9	20.5	4.23	14.9
1.32 - 1.34	105.	5.4	9.1	1.99	80.0	4.9	1.46	25.4	25.4	5.20	9.1
1.34 - 1.36	72.	3.7	10.8	2.37	83.7	5.1	1.50	20.0	29.8	6.06	5.9
1.36 - 1.38	44.	2.2	12.6	2.78	85.9	5.3	1.54	16.3	34.1	6.89	4.2
1.38 - 1.40	40.	2.0	13.8	3.05	87.9	5.5	1.57	14.1	37.5	7.55	2.7
1.40 - 1.50	71.	3.6	17.9	3.86	91.5	6.0	1.66	12.1	41.5	8.31	1.0
1.50 - 1.60	23.	1.2	26.1	4.18	92.7	6.3	1.70	8.5	51.7	10.22	
Sink - 1.60	142.	7.3	55.8	11.20	100.0	9.9	2.39	7.3	55.8	11.20	
Totals	1948.	100.0									

DATA SHEET 24.—PURSGLOVE MINE SAMPLE, 14-MESH CRUSHING. 10 FEET NORTH OF STATION 9987. SIZE, 14 BY 100 MESH.



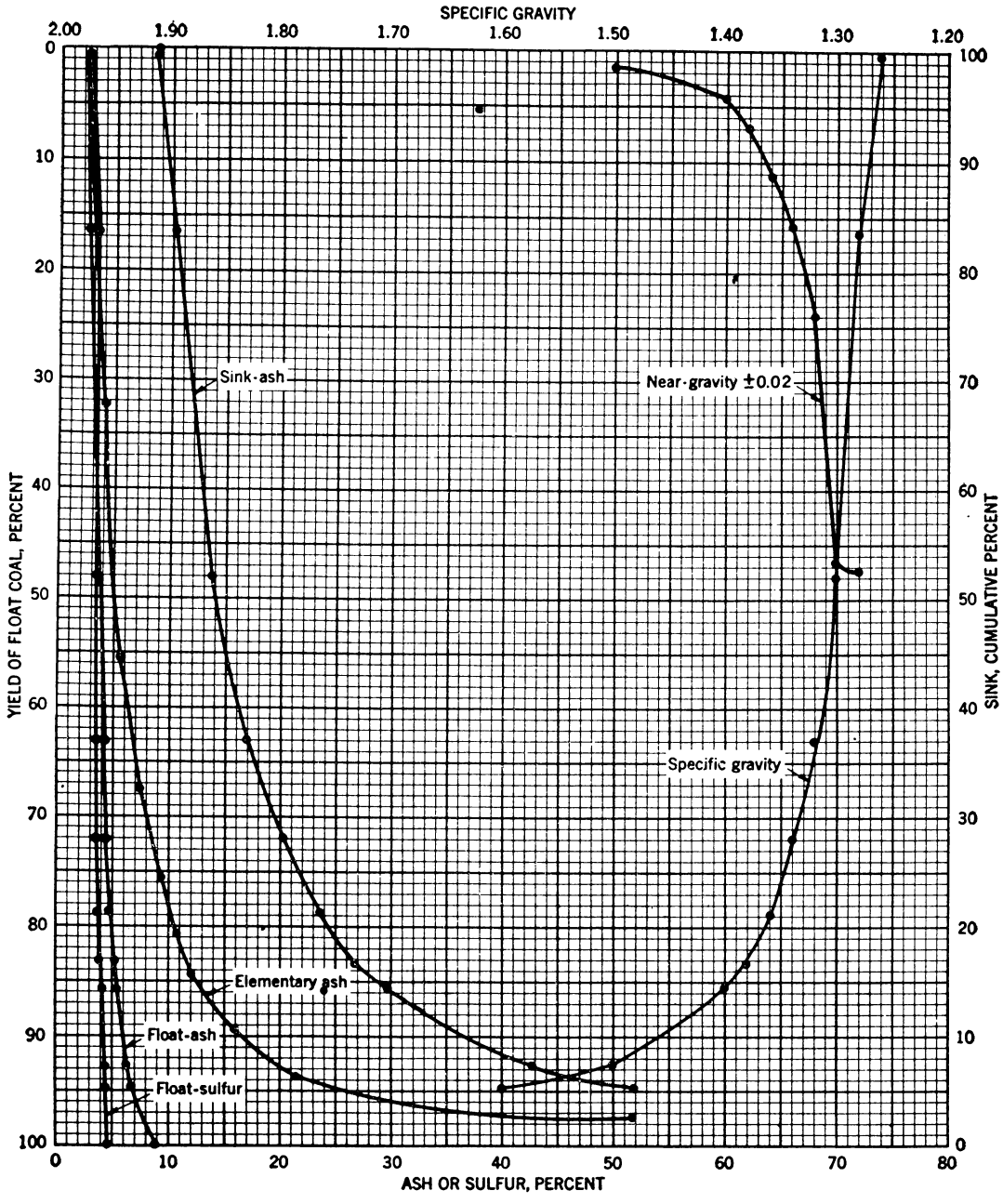
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	53.	.2	2.3	2.58	.2	2.3	2.58	100.0	9.7	4.93	
1.26 - 1.28	3334.	14.8	2.9	3.38	15.0	2.9	3.37	99.8	9.7	4.94	43.1
1.28 - 1.30	6390.	28.3	4.2	3.58	43.3	3.8	3.51	85.0	10.9	5.21	43.6
1.30 - 1.32	3442.	15.3	5.9	4.02	58.6	4.3	3.64	56.7	14.3	6.02	24.2
1.32 - 1.34	2018.	8.9	7.4	4.67	67.5	4.7	3.78	41.4	17.4	6.76	15.8
1.34 - 1.36	1557.	6.9	9.1	5.06	74.4	5.1	3.90	32.5	20.1	7.34	11.4
1.36 - 1.38	1009.	4.5	10.8	6.49	78.9	5.5	4.04	25.6	23.1	7.95	7.6
1.38 - 1.40	695.	3.1	11.6	7.13	82.0	5.7	4.16	21.1	25.7	8.26	5.0
1.40 - 1.50	2096.	9.3	15.0	8.86	91.3	6.6	4.64	18.0	28.0	8.45	2.4
1.50 - 1.60	550.	2.4	22.3	9.54	93.7	7.1	4.76	8.7	41.9	8.02	
Sink - 1.60	1421.	6.3	49.4	7.43	100.0	9.7	4.93	6.3	49.4	7.43	
Totals	22565.	100.0									

DATA SHEET 25.—ALEXANDER MINE SAMPLE, 1½-INCH CRUSHING. INBY 25 NORTH FACE, 8 EAST BUTT. SIZE, 1½ INCHES BY 100 MESH.



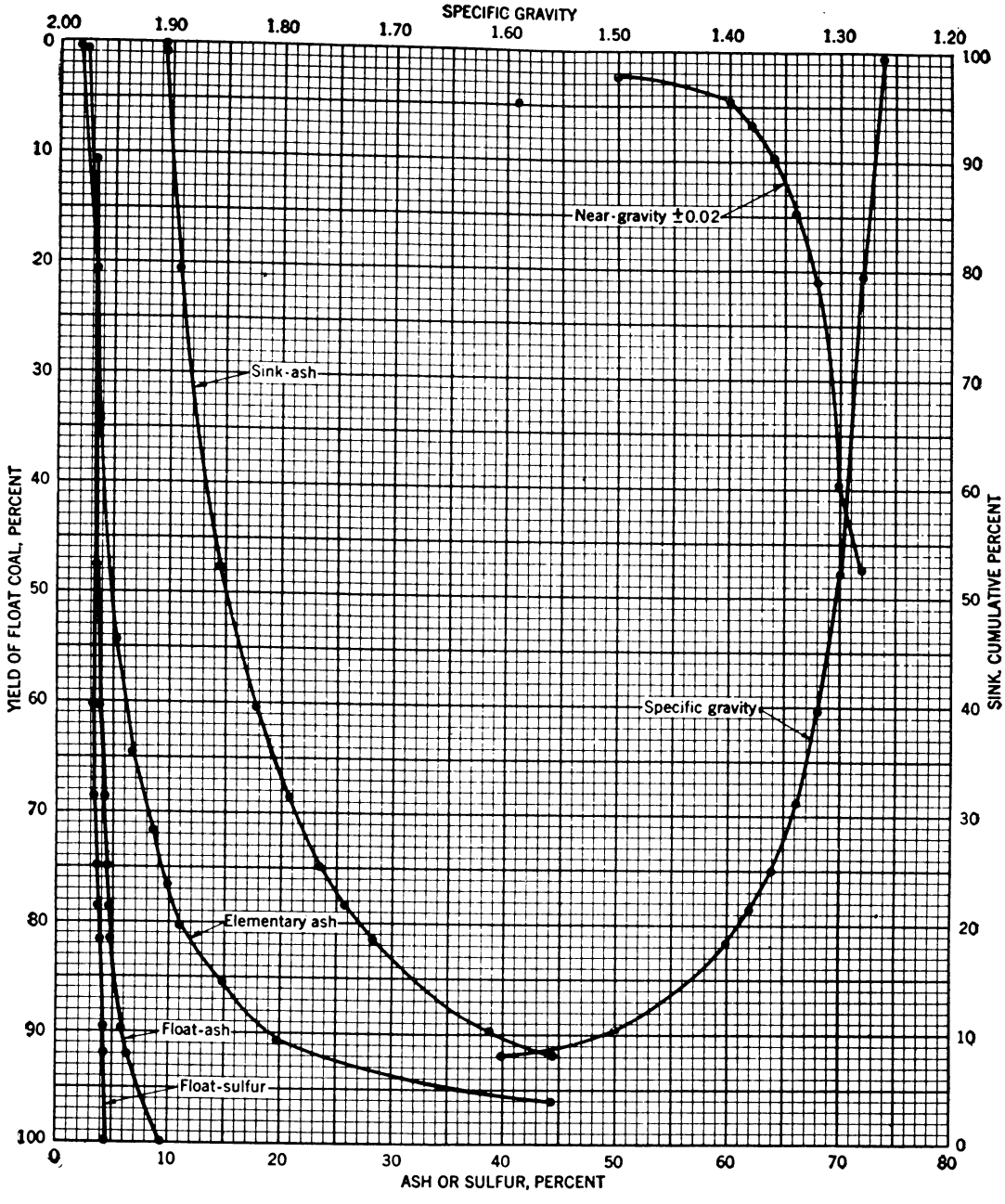
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	5.	.0	.0	.0	.0	.0	.0	.0	.0	.0	
1.26 - 1.28	1740.	13.5	3.0	3.44	13.5	3.0	3.44	100.0	10.3	5.13	39.9
1.28 - 1.30	3412.	26.4	4.5	3.57	39.9	4.0	3.53	86.5	11.4	5.40	42.2
1.30 - 1.32	2047.	15.8	6.0	4.04	55.7	4.6	3.67	60.1	14.5	6.20	24.8
1.32 - 1.34	1158.	9.0	7.5	4.85	64.7	5.0	3.83	44.3	17.5	6.97	16.1
1.34 - 1.36	912.	7.1	9.1	5.16	71.8	5.4	3.96	35.3	20.0	7.51	11.8
1.36 - 1.38	610.	4.7	11.0	6.93	76.5	5.7	4.15	28.2	22.8	8.09	8.0
1.38 - 1.40	430.	3.3	11.6	7.40	79.8	6.0	4.28	23.5	25.1	8.32	5.5
1.40 - 1.50	1402.	10.8	14.6	9.47	90.6	7.0	4.90	20.2	27.3	8.47	2.7
1.50 - 1.60	343.	2.6	23.1	9.54	93.2	7.5	5.04	9.4	41.9	7.33	
Sink - 1.60	878.	6.8	49.3	6.47	100.0	10.3	5.13	6.8	49.3	6.47	
Totals	12937.	100.0									

DATA SHEET 26.—ALEXANDER MINE SAMPLE, 1½-INCH CRUSHING. INBY 25 NORTH FACE, 8 EAST BUTT. SIZE, 1½ BY ⅜ INCH.



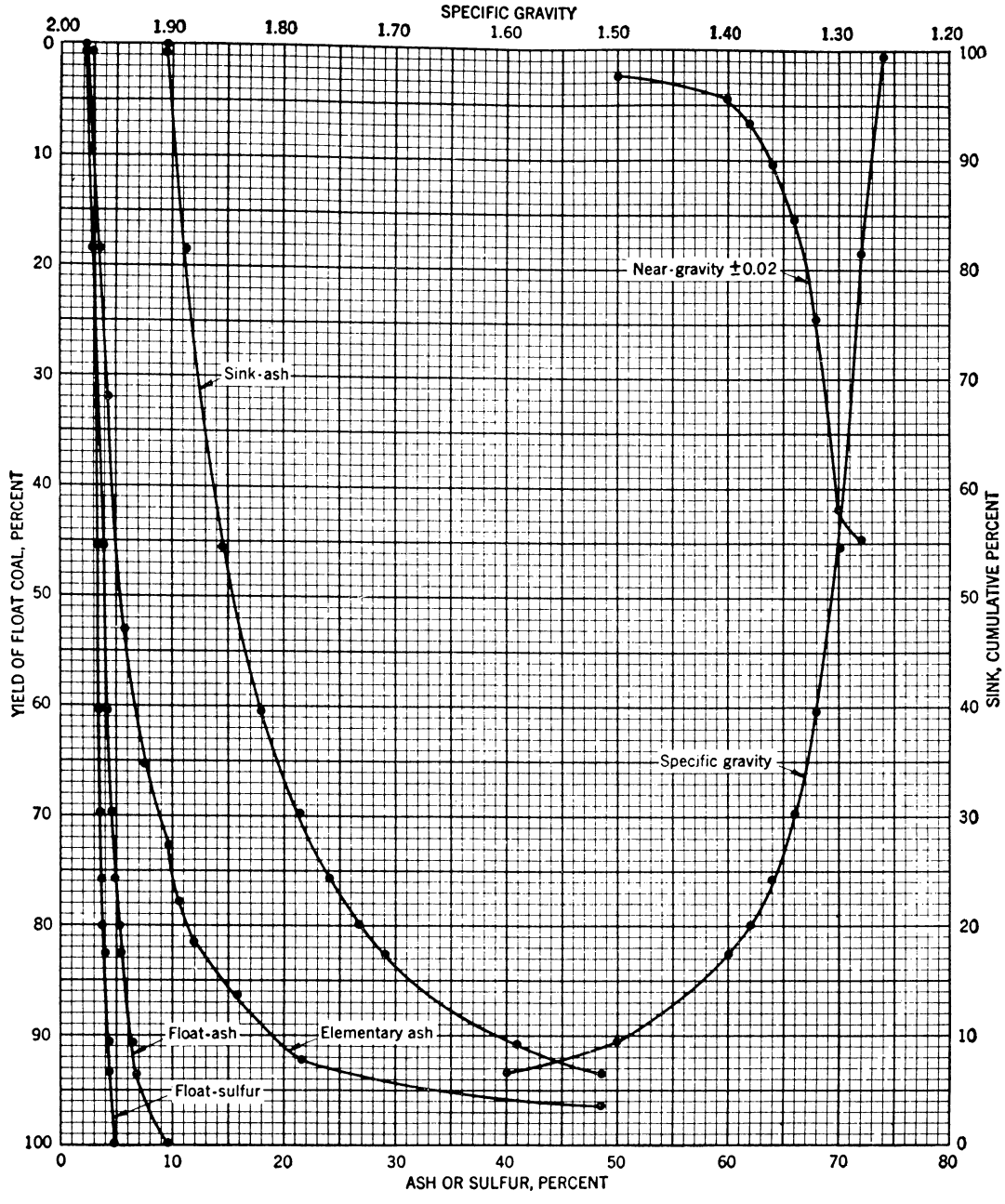
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	37.	.5	2.3	2.62	.5	2.3	2.62	100.0	8.9	4.70	
1.26 - 1.28	1232.	15.7	2.7	3.33	16.2	2.7	3.31	99.5	8.9	4.71	47.5
1.28 - 1.30	2484.	31.8	4.0	3.99	48.0	3.6	3.50	83.8	10.1	4.97	46.8
1.30 - 1.32	1171.	15.0	5.7	4.00	63.0	4.1	3.62	52.0	13.8	5.82	24.0
1.32 - 1.34	705.	9.0	7.5	4.54	72.0	4.5	3.73	37.0	17.0	6.55	15.8
1.34 - 1.36	535.	6.8	9.3	5.00	78.8	4.9	3.84	28.0	20.1	7.20	11.1
1.36 - 1.38	334.	4.3	10.7	5.96	83.1	5.2	3.95	21.2	23.6	7.91	7.0
1.38 - 1.40	212.	2.7	12.0	6.98	85.8	5.4	4.05	16.9	26.8	8.41	4.1
1.40 - 1.50	547.	7.0	16.0	7.91	92.8	6.2	4.34	14.2	29.7	8.68	1.8
1.50 - 1.60	165.	2.1	21.4	9.98	94.9	6.6	4.46	7.2	42.9	9.42	
Sink - 1.60	398.	5.1	51.7	9.19	100.0	8.9	4.70	5.1	51.7	9.19	
Totals	7820.	100.0									

DATA SHEET 27.—ALEXANDER MINE SAMPLE, 1½-INCH CRUSHING. INBY 25 NORTH FACE, 8 EAST BUTT. SIZE, ⅜ INCH BY 14 MESH.



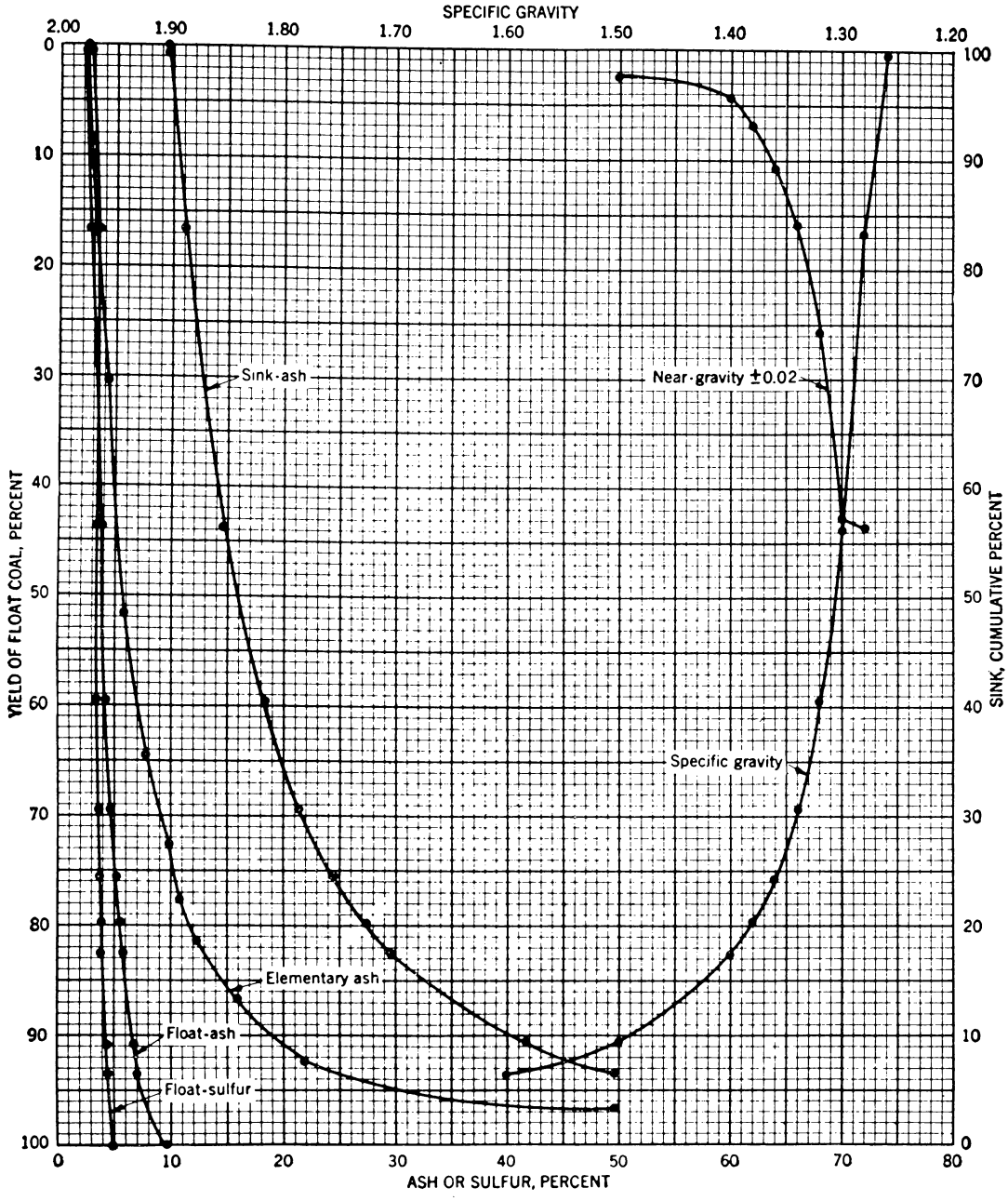
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	11.	.6	1.9	2.48	.6	1.9	2.48	100.0	9.3	4.49	
1.26 - 1.28	362.	20.0	3.2	3.29	20.6	3.2	3.27	99.4	9.4	4.51	47.3
1.28 - 1.30	494.	27.3	3.6	3.58	47.9	3.4	3.44	79.4	10.9	4.81	39.7
1.30 - 1.32	224.	12.4	5.3	3.89	60.3	3.8	3.54	52.1	14.7	5.46	21.0
1.32 - 1.34	155.	8.6	6.7	3.94	68.9	4.2	3.59	39.7	17.6	5.95	14.7
1.34 - 1.36	110.	6.1	8.7	4.50	75.0	4.6	3.66	31.1	20.6	6.50	9.7
1.36 - 1.38	65.	3.6	9.9	5.08	78.6	4.8	3.73	25.0	23.5	6.99	6.5
1.38 - 1.40	53.	2.9	11.0	5.63	81.5	5.0	3.79	21.4	25.9	7.31	4.5
1.40 - 1.50	147.	8.2	14.8	6.69	89.7	5.9	4.06	18.5	28.2	7.58	2.1
1.50 - 1.60	42.	2.3	19.7	7.94	92.0	6.3	4.15	10.3	38.8	8.27	
Sink - 1.60	145.	8.0	44.3	8.37	100.0	9.3	4.49	8.0	44.3	8.37	
Totals	1808.	100.0									

DATA SHEET 28.—ALEXANDER MINE SAMPLE, 1½-INCH CRUSHING. INBY 25 NORTH FACE, 8 EAST BUTT. SIZE, 14 BY 100 MESH.



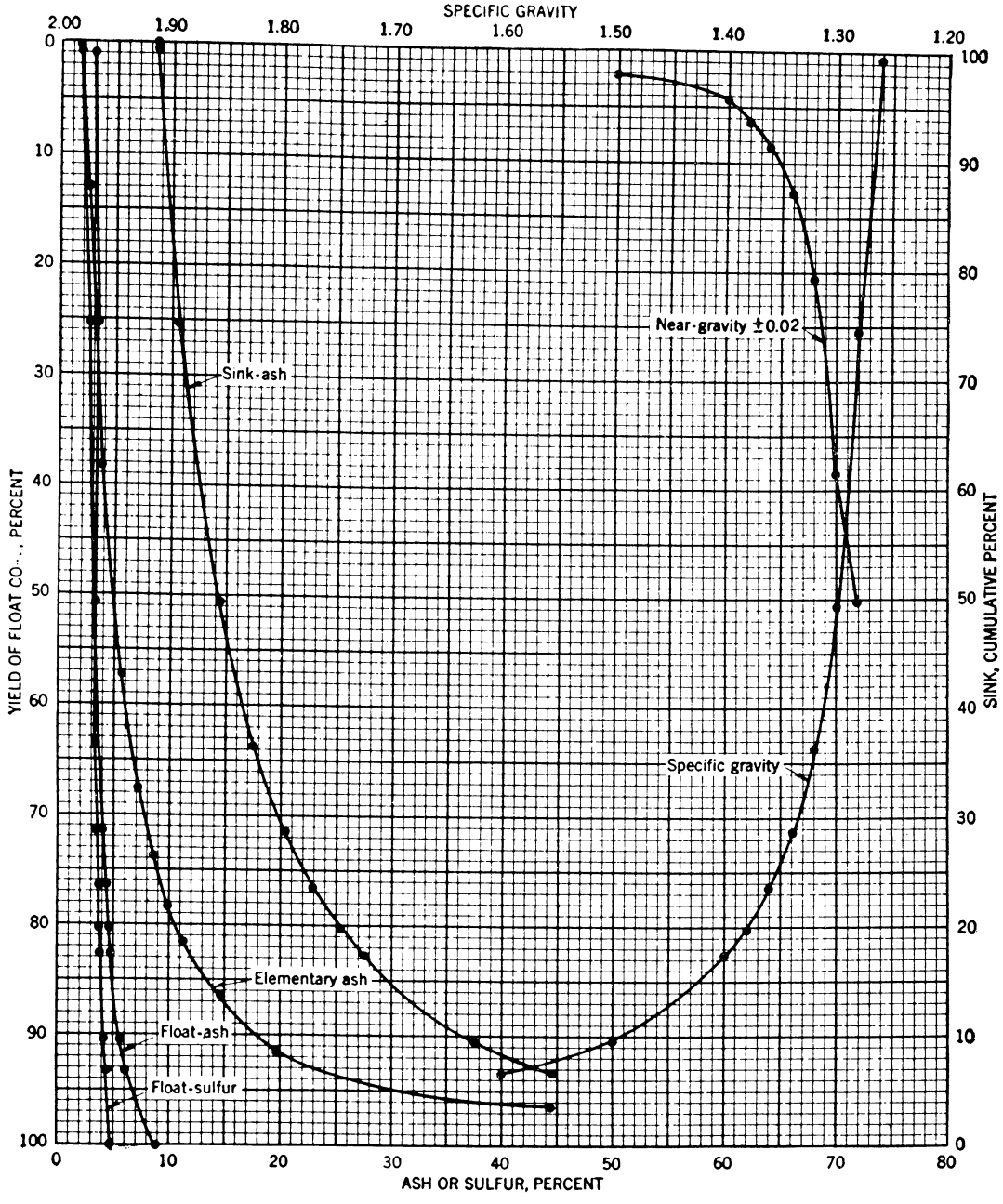
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	62.	.6	2.1	2.70	.6	2.1	2.70	100.0	9.5	4.82	
1.26 - 1.28	2013.	18.0	2.7	3.25	18.6	2.7	3.23	99.4	9.6	4.83	44.8
1.28 - 1.30	3005.	26.8	4.1	3.49	45.4	3.6	3.39	81.4	11.1	5.18	42.0
1.30 - 1.32	1708.	15.2	5.6	3.86	60.6	4.1	3.50	54.6	14.5	6.01	24.5
1.32 - 1.34	1037.	9.3	7.5	4.40	69.9	4.5	3.62	39.4	17.9	6.84	15.3
1.34 - 1.36	676.	6.0	9.8	5.17	75.9	4.9	3.75	30.1	21.1	7.59	10.1
1.36 - 1.38	465.	4.1	10.6	5.89	80.0	5.2	3.86	24.1	24.0	8.20	6.8
1.38 - 1.40	305.	2.7	12.0	6.55	82.7	5.5	3.95	20.0	26.7	8.68	4.3
1.40 - 1.50	903.	8.0	15.6	8.12	90.7	6.4	4.32	17.3	29.0	9.01	2.2
1.50 - 1.60	297.	2.7	21.5	10.27	93.4	6.8	4.48	9.3	40.8	9.78	
Sink - 1.60	737.	6.6	48.5	9.59	100.0	9.5	4.82	6.6	48.5	9.59	
Totals	11208.	100.0									

DATA SHEET 29.—ALEXANDER MINE SAMPLE, ⅜-INCH CRUSHING. INBY 25 NORTH FACE, 8 EAST BUTT. SIZE, ⅜ INCH BY 100 MESH.



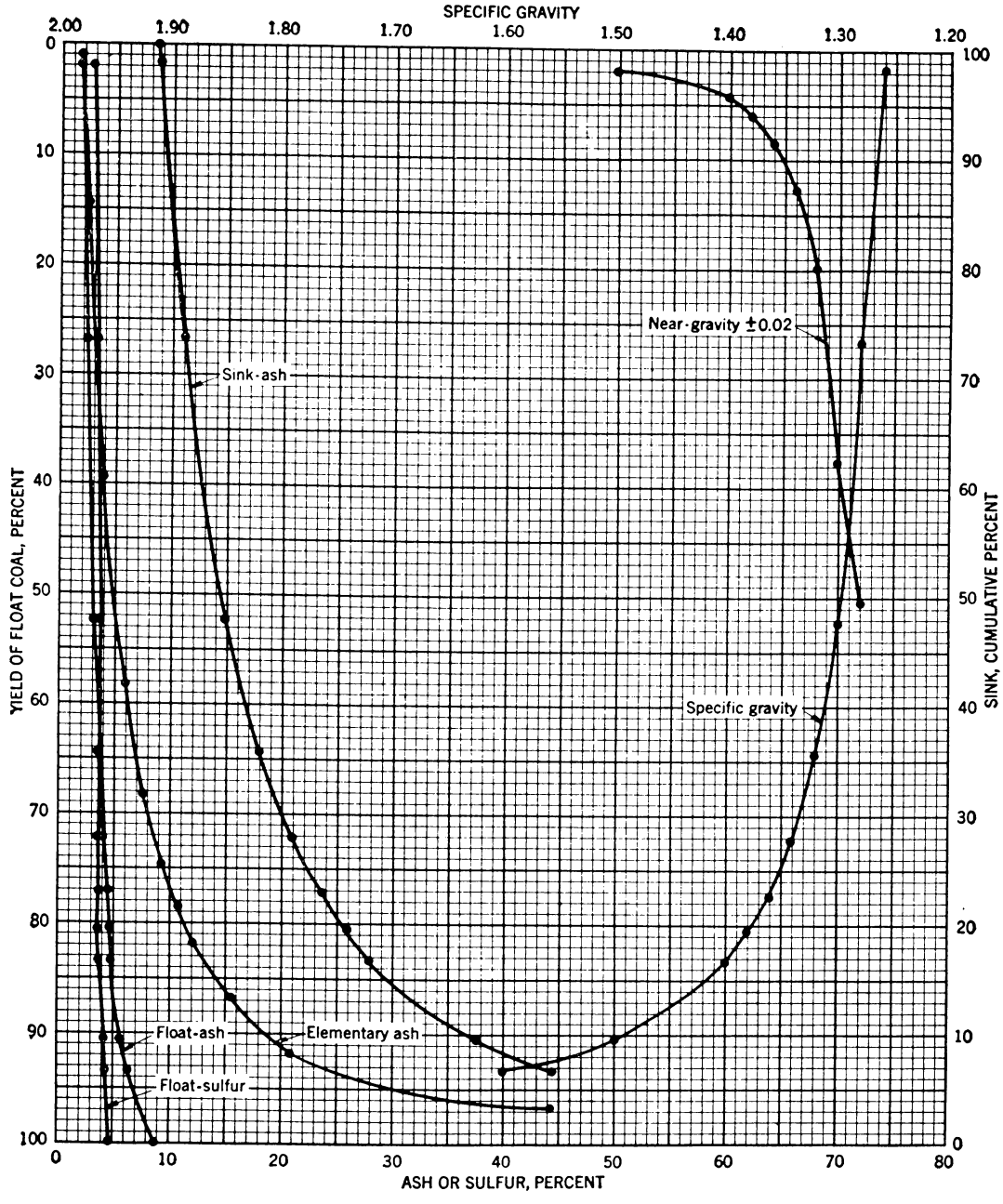
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	45.	.5	2.2	2.64	.5	2.2	2.64	100.0	9.8	4.86	
1.26 - 1.28	1459.	16.3	2.8	3.23	16.8	2.8	3.21	99.5	9.8	4.87	43.4
1.28 - 1.30	2421.	27.1	4.2	3.51	43.9	3.7	3.40	83.2	11.2	5.20	42.9
1.30 - 1.32	1416.	15.8	5.6	3.85	59.7	4.2	3.52	56.1	14.5	6.01	25.5
1.32 - 1.34	862.	9.7	7.6	4.40	69.4	4.7	3.64	40.3	18.1	6.86	16.0
1.34 - 1.36	562.	6.3	10.0	5.22	75.7	5.1	3.77	30.6	21.3	7.64	10.5
1.36 - 1.38	378.	4.2	10.9	5.98	79.9	5.4	3.89	24.3	24.3	8.27	6.9
1.38 - 1.40	245.	2.7	12.2	6.68	82.6	5.7	3.98	20.1	27.1	8.75	4.3
1.40 - 1.50	728.	8.2	15.8	8.25	90.8	6.6	4.36	17.4	29.5	9.08	2.2
1.50 - 1.60	237.	2.7	21.9	10.43	93.5	7.0	4.54	9.2	41.7	9.81	
Sink - 1.60	579.	6.5	49.7	9.56	100.0	9.8	4.86	6.5	49.7	9.56	
Totals	8932.	100.0									

DATA SHEET 30.—ALEXANDER MINE SAMPLE, ⅜-INCH CRUSHING. INBY 25 NORTH FACE, 8 EAST BUTT. SIZE, ⅜ INCH BY 14 MESH.



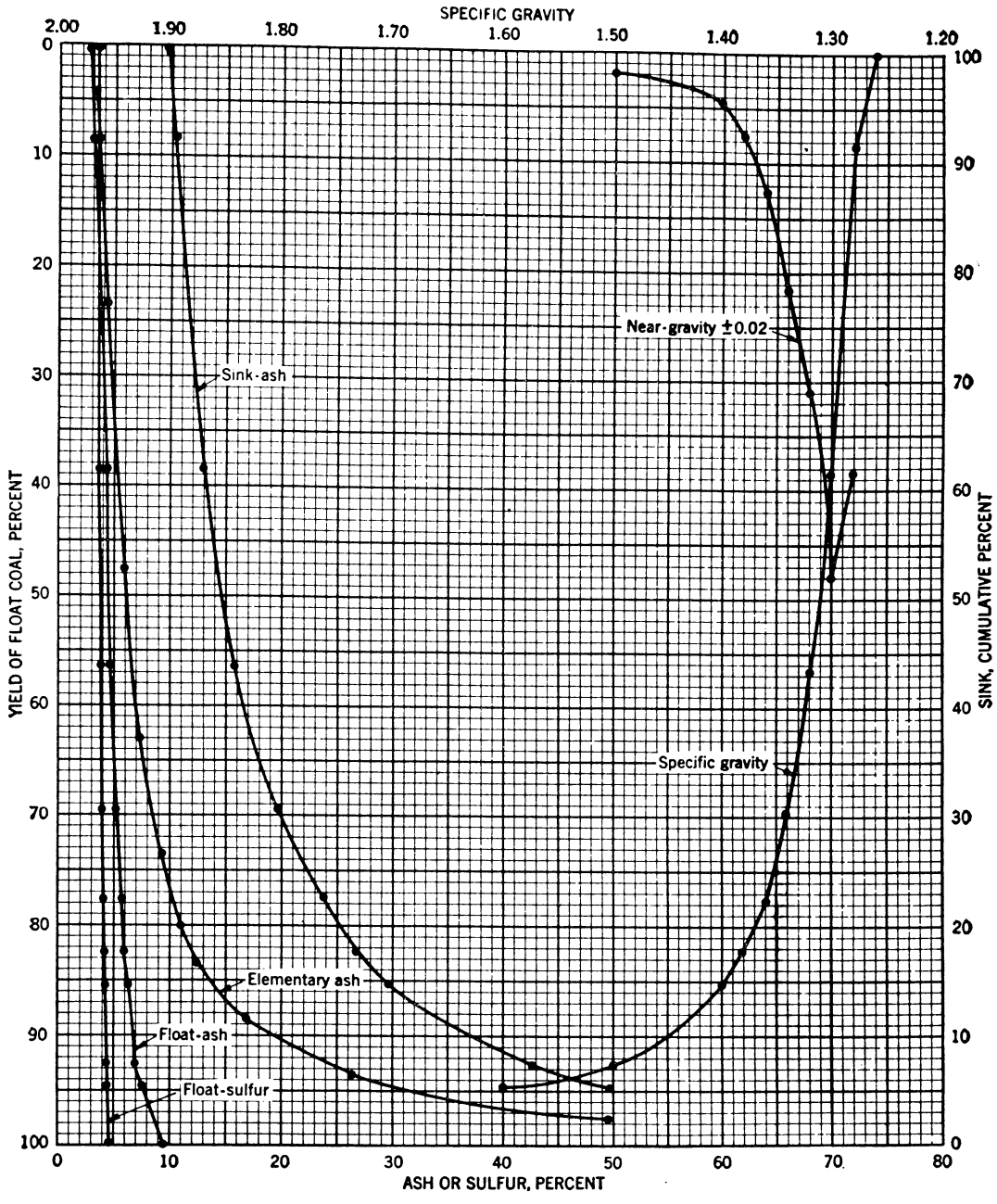
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	17.	.8	1.8	2.87	.8	1.8	2.87	100.0	8.6	4.66	
1.26 - 1.28	554.	24.4	2.5	3.30	25.2	2.5	3.29	99.2	8.7	4.67	50.1
1.28 - 1.30	584.	25.7	3.7	3.40	50.9	3.1	3.34	74.8	10.7	5.12	38.5
1.30 - 1.32	292.	12.8	5.4	3.88	63.7	3.6	3.45	49.1	14.3	6.02	20.5
1.32 - 1.34	175.	7.7	7.0	4.41	71.4	4.0	3.56	36.3	17.5	6.77	12.7
1.34 - 1.36	114.	5.0	8.6	4.90	76.4	4.3	3.64	28.6	20.3	7.40	8.8
1.36 - 1.38	87.	3.8	9.8	5.50	80.2	4.5	3.73	23.6	22.7	7.93	6.4
1.38 - 1.40	60.	2.6	11.1	6.02	82.8	4.7	3.81	19.8	25.2	8.39	4.1
1.40 - 1.50	175.	7.7	14.7	7.61	90.5	5.6	4.13	17.2	27.4	8.76	2.1
1.50 - 1.60	60.	2.6	19.9	9.63	93.1	6.0	4.29	9.5	37.6	9.68	
Sink - 1.60	158.	6.9	44.3	9.70	100.0	8.6	4.66	6.9	44.3	9.70	
Totals	2276.	100.0									

DATA SHEET 31.—ALEXANDER MINE SAMPLE, ¾-INCH CRUSHING. INBY 25 NORTH FACE, 8 EAST BUTT. SIZE, 14 BY 100 MESH.



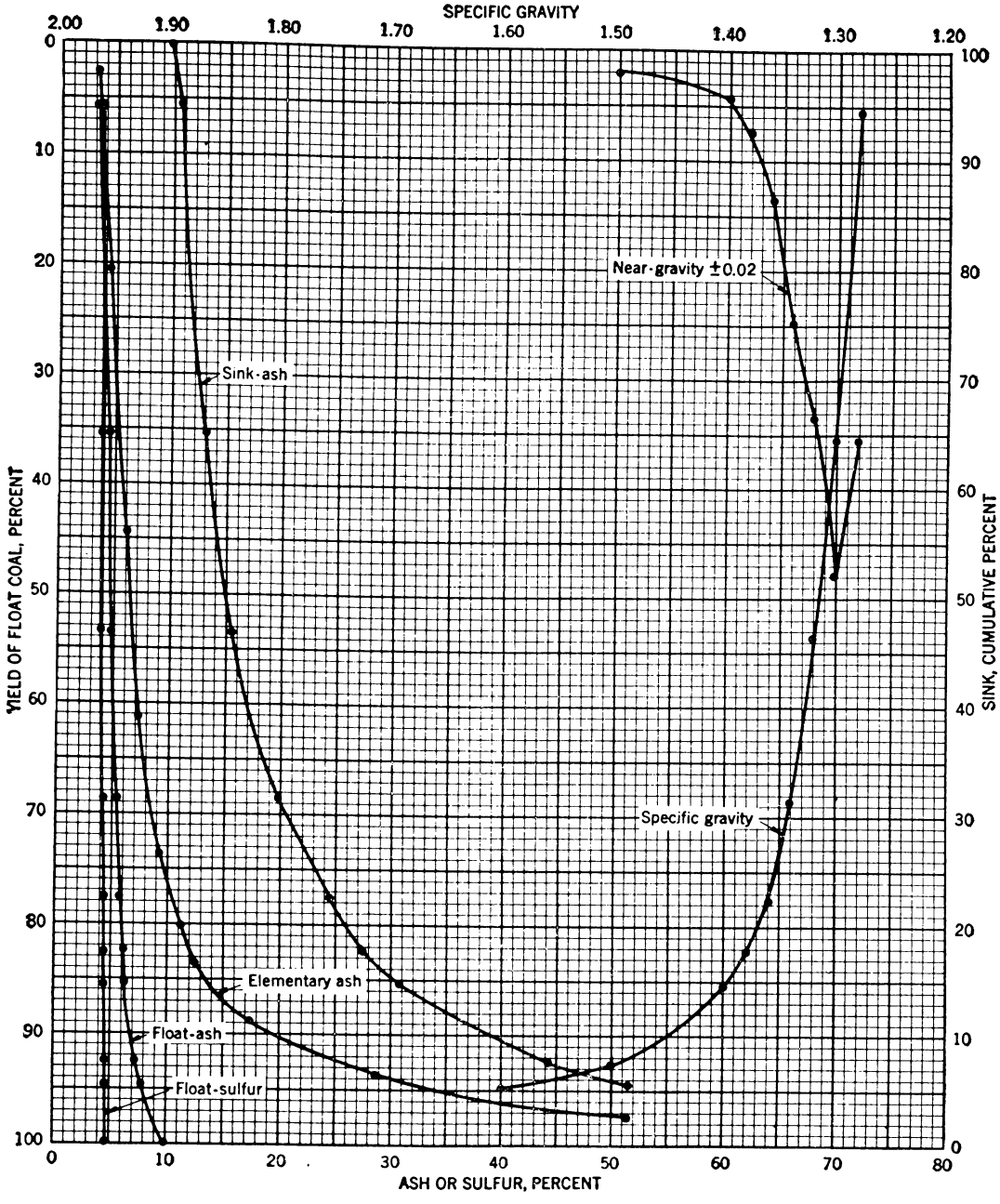
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	34.	1.9	1.7	2.76	1.9	1.7	2.76	100.0	8.6	4.74	
1.26 - 1.28	455.	24.9	2.3	3.15	26.8	2.2	3.12	98.1	8.8	4.78	50.3
1.28 - 1.30	465.	25.4	3.8	3.61	52.2	3.0	3.36	73.2	11.0	5.34	37.6
1.30 - 1.32	224.	12.2	5.6	3.85	64.4	3.5	3.45	47.8	14.8	6.25	19.9
1.32 - 1.34	140.	7.7	7.4	4.21	72.1	3.9	3.53	35.6	18.0	7.08	12.8
1.34 - 1.36	94.	5.1	9.2	4.65	77.2	4.3	3.61	27.9	20.9	7.87	8.5
1.36 - 1.38	62.	3.4	10.6	5.37	80.6	4.5	3.68	22.8	23.5	8.60	6.0
1.38 - 1.40	47.	2.6	12.0	6.02	83.2	4.8	3.75	19.4	25.8	9.16	4.1
1.40 - 1.50	133.	7.3	15.5	7.73	90.5	5.6	4.07	16.8	27.9	9.65	2.0
1.50 - 1.60	51.	2.8	20.7	9.83	93.3	6.1	4.25	9.5	37.4	11.11	
Sink - 1.60	123.	6.7	44.3	11.64	100.0	8.6	4.74	6.7	44.3	11.64	
Totals	1828.	100.0									

DATA SHEET 32.—ALEXANDER MINE SAMPLE, 14-MESH CRUSHING. INBY 25 NORTH FACE, 8 EAST BUTT. SIZE, 14 BY 100 MESH.



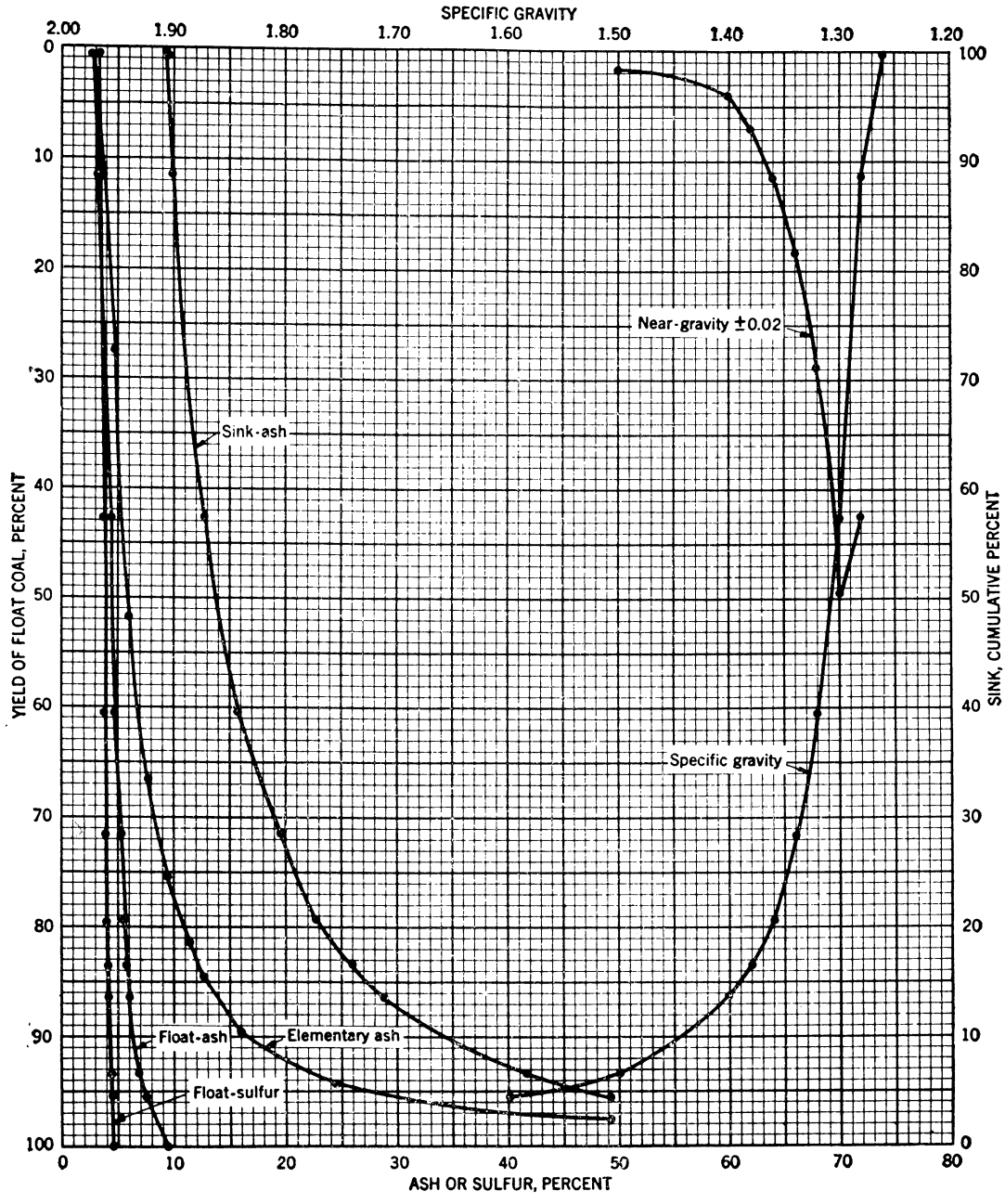
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	38.	.2	3.5	2.78	.2	3.5	2.78	100.0	9.6	4.67	
1.26 - 1.28	1545.	8.2	3.0	3.46	8.4	3.0	3.44	99.8	9.6	4.67	38.4
1.28 - 1.30	5703.	30.2	4.5	3.71	38.6	4.2	3.65	91.6	10.2	4.78	48.0
1.30 - 1.32	3360.	17.8	6.0	4.09	56.4	4.8	3.79	61.4	13.0	5.31	31.0
1.32 - 1.34	2496.	13.2	7.3	4.77	69.6	5.2	3.98	43.6	15.9	5.81	21.4
1.34 - 1.36	1549.	8.2	9.1	5.43	77.8	5.7	4.13	30.4	19.7	6.26	12.6
1.36 - 1.38	832.	4.4	11.0	5.86	82.2	5.9	4.22	22.2	23.6	6.57	7.3
1.38 - 1.40	544.	2.9	12.3	6.81	85.1	6.2	4.31	17.8	26.7	6.75	4.4
1.40 - 1.50	1408.	7.5	16.6	7.26	92.6	7.0	4.55	14.9	29.5	6.73	2.0
1.50 - 1.60	415.	2.2	26.2	5.56	94.8	7.4	4.57	7.4	42.6	6.20	
Sink - 1.60	972.	5.2	49.6	6.47	100.0	9.6	4.67	5.2	49.6	6.47	
Totals	18862.	100.0									

DATA SHEET 33.—ALEXANDER MINE SAMPLE, 1½-INCH CRUSHING. 40 FEET INBY 25 NORTH FACE. SIZE, 1½ INCHES BY 100 MESH.



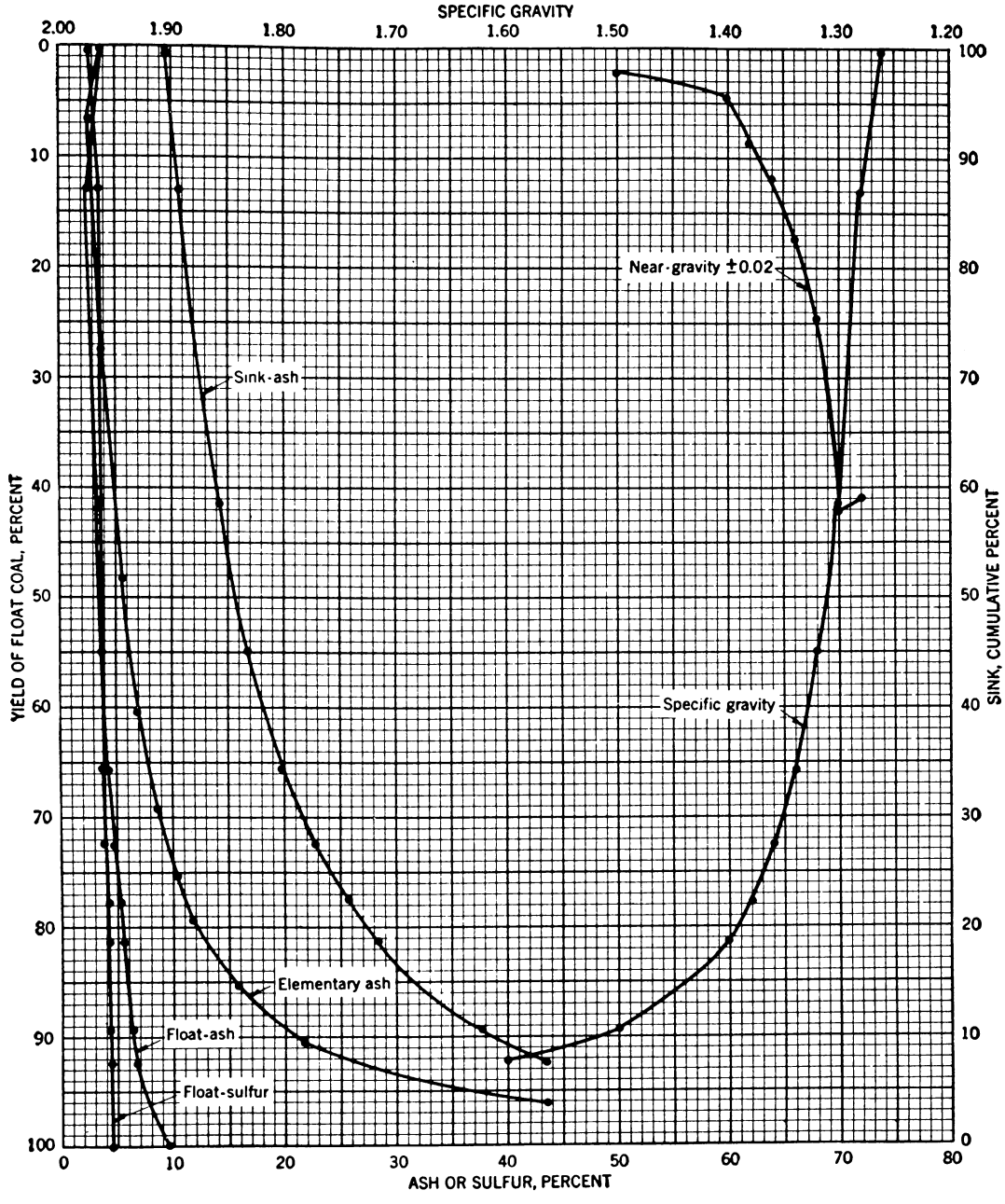
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float - 1.26	0	0	0	0	0	0	0	0	0	0	
1.26 - 1.28	553.	5.6	3.1	3.37	5.6	3.1	3.37	100.0	9.9	4.74	35.1
1.28 - 1.30	2920.	29.5	4.5	3.74	35.1	4.2	3.68	94.4	10.3	4.82	48.0
1.30 - 1.32	1835.	18.5	6.0	4.17	53.6	4.9	3.85	64.9	13.0	5.31	33.5
1.32 - 1.34	1488.	15.0	7.2	4.94	68.6	5.4	4.09	46.4	15.7	5.76	24.3
1.34 - 1.36	915.	9.3	9.1	5.58	77.9	5.8	4.27	31.4	19.8	6.15	13.5
1.36 - 1.38	420.	4.2	11.1	5.95	82.1	6.1	4.35	22.1	24.3	6.39	7.2
1.38 - 1.40	300.	3.0	12.3	7.03	85.1	6.3	4.45	17.9	27.4	6.49	4.5
1.40 - 1.50	755.	7.6	17.2	7.06	92.7	7.2	4.66	14.9	30.5	6.38	2.0
1.50 - 1.60	218.	2.2	28.3	3.93	94.9	7.7	4.65	7.3	44.4	5.67	
Sink - 1.60	503.	5.1	51.4	6.43	100.0	9.9	4.74	5.1	51.4	6.43	
Totals	9907.	100.0									

DATA SHEET 34.—ALEXANDER MINE SAMPLE, 1½-INCH CRUSHING. 40 FEET INBY 25 NORTH FACE. SIZE, 1½ INCHES BY ⅜ INCH.



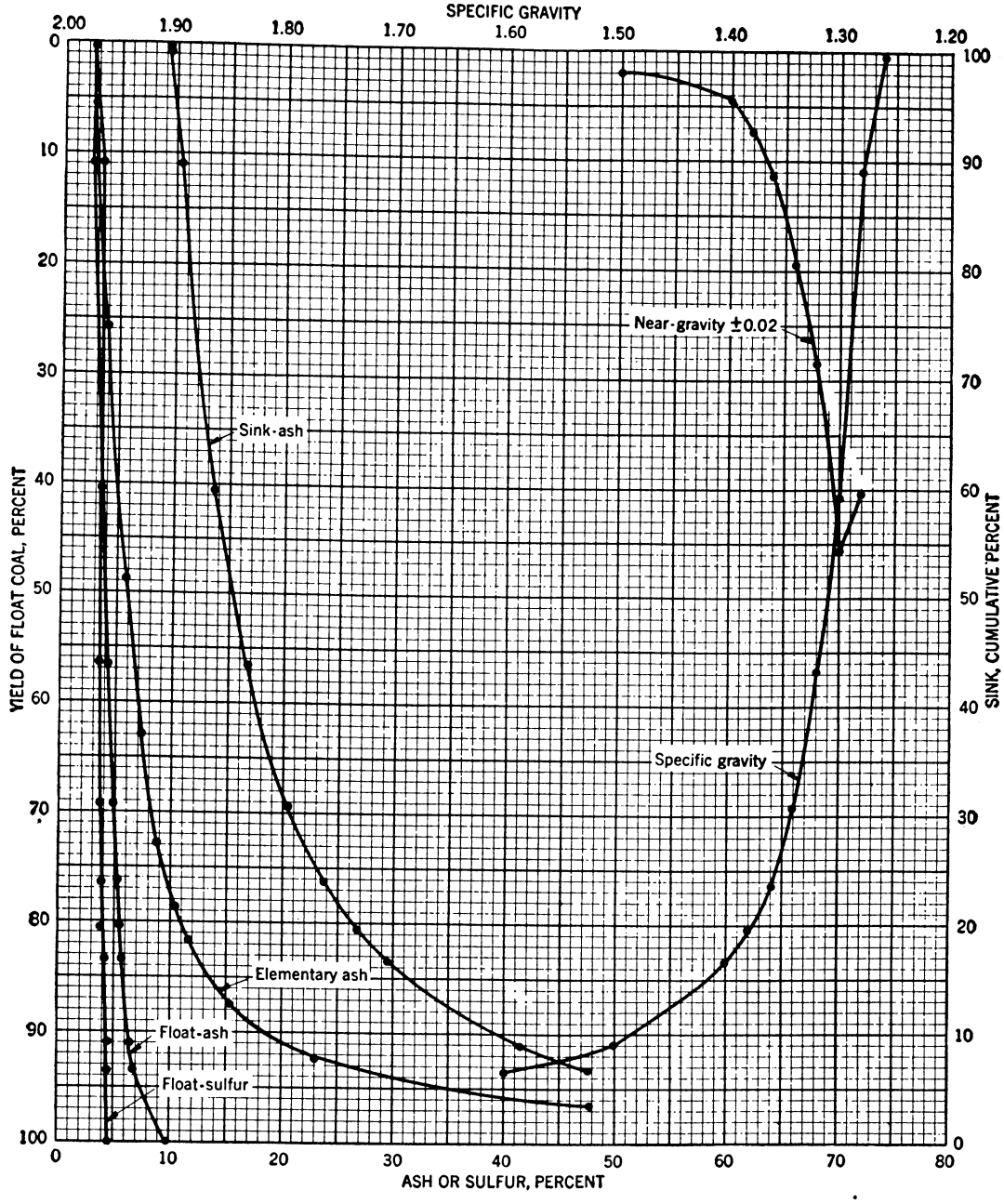
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	33.	.5	3.5	2.81	.5	3.5	2.81	100.0	9.2	4.61	
1.26 - 1.28	792.	10.7	3.1	3.49	11.2	3.1	3.46	99.5	9.2	4.62	42.4
1.28 - 1.30	2338.	31.7	4.8	3.66	42.9	4.4	3.61	88.8	10.0	4.76	49.4
1.30 - 1.32	1310.	17.7	6.0	4.00	60.6	4.8	3.72	57.1	12.9	5.36	29.0
1.32 - 1.34	836.	11.3	7.6	4.57	71.9	5.3	3.86	39.4	15.9	5.98	18.5
1.34 - 1.36	530.	7.2	9.3	5.30	79.1	5.6	3.99	28.1	19.3	6.55	11.6
1.36 - 1.38	327.	4.4	11.2	5.93	83.5	5.9	4.09	20.9	22.8	6.98	7.0
1.38 - 1.40	193.	2.6	12.4	6.81	86.1	6.1	4.17	16.5	25.9	7.26	4.0
1.40 - 1.50	525.	7.1	15.9	7.80	93.2	6.9	4.45	13.9	28.4	7.34	1.8
1.50 - 1.60	152.	2.1	24.4	7.62	95.3	7.3	4.52	6.8	41.6	6.86	
Sink - 1.60	345.	4.7	49.1	6.52	100.0	9.2	4.61	4.7	49.1	6.52	
Totals	7381.	100.0									

DATA SHEET 35.—ALEXANDER MINE SAMPLE, 1½-INCH CRUSHING. 40 FEET INBY 25 NORTH FACE. SIZE, ⅜ INCH BY 14 MESH.



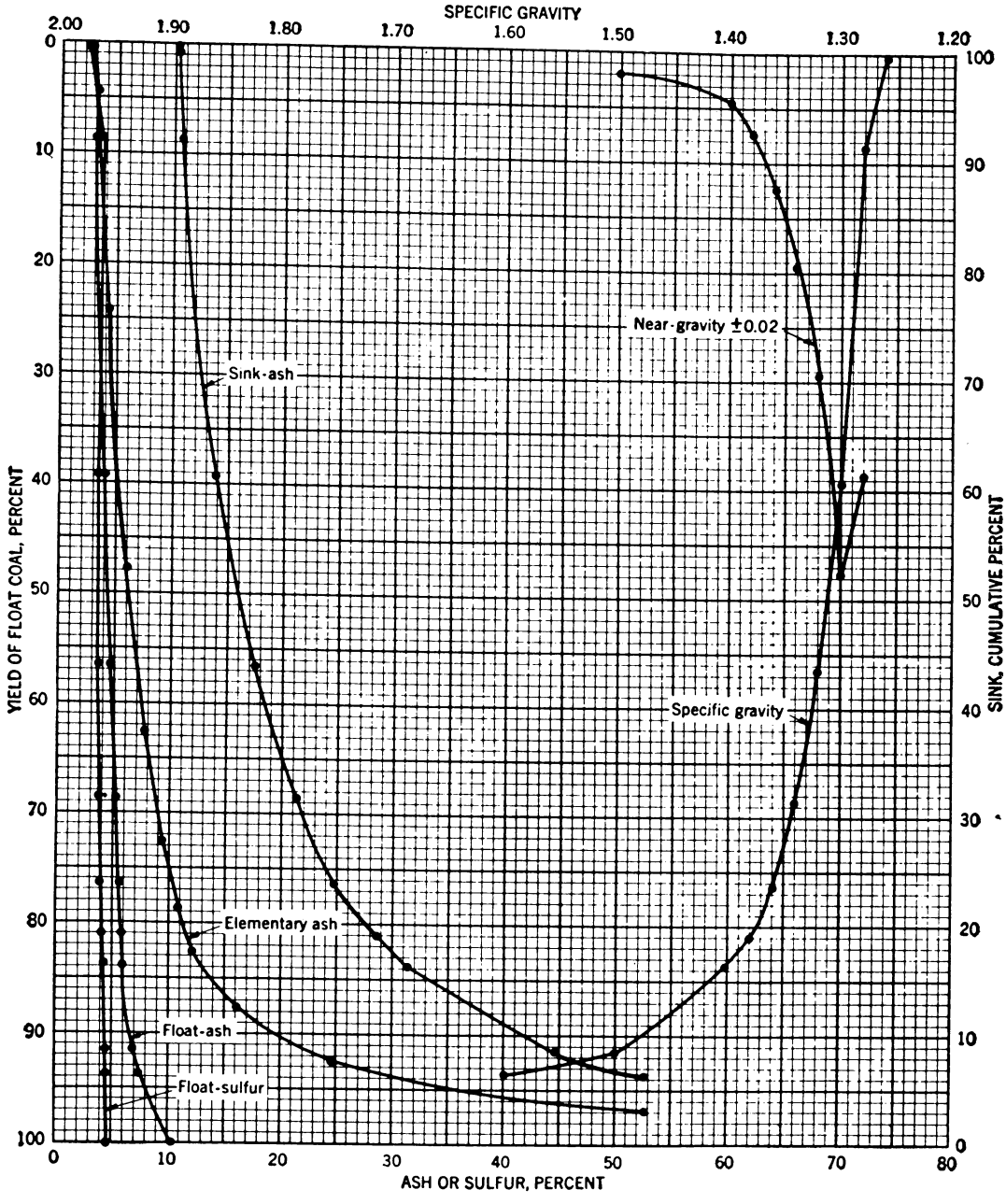
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	5.	.3	3.6	2.60	.3	3.6	2.60	100.0	9.7	4.51	
1.26 - 1.28	200.	12.7	2.5	3.60	13.0	2.5	3.58	99.7	9.7	4.52	41.0
1.28 - 1.30	445.	28.3	3.7	3.75	41.3	3.3	3.69	87.0	10.7	4.65	42.0
1.30 - 1.32	215.	13.7	5.5	3.99	55.0	3.8	3.77	58.7	14.1	5.09	24.6
1.32 - 1.34	172.	10.9	6.9	4.32	65.9	4.3	3.86	45.0	16.8	5.42	17.5
1.34 - 1.36	104.	6.6	8.5	4.74	72.5	4.7	3.94	34.1	19.9	5.77	12.0
1.36 - 1.38	85.	5.4	10.2	5.12	77.9	5.1	4.02	27.5	22.7	6.02	8.6
1.38 - 1.40	51.	3.2	11.7	5.51	81.1	5.4	4.08	22.1	25.8	6.24	4.8
1.40 - 1.50	128.	8.1	15.6	6.20	89.2	6.3	4.27	18.9	28.2	6.37	2.2
1.50 - 1.60	45.	2.9	21.8	6.51	92.1	6.8	4.34	10.8	37.7	6.50	
Sink - 1.60	124.	7.9	43.5	6.49	100.0	9.7	4.51	7.9	43.5	6.49	
Totals	1574.	100.0									

DATA SHEET 36.—ALEXANDER MINE SAMPLE, 1½-INCH CRUSHING. 40 FEET INBY 25 NORTH FACE. SIZE, 14 BY 100 MESH.



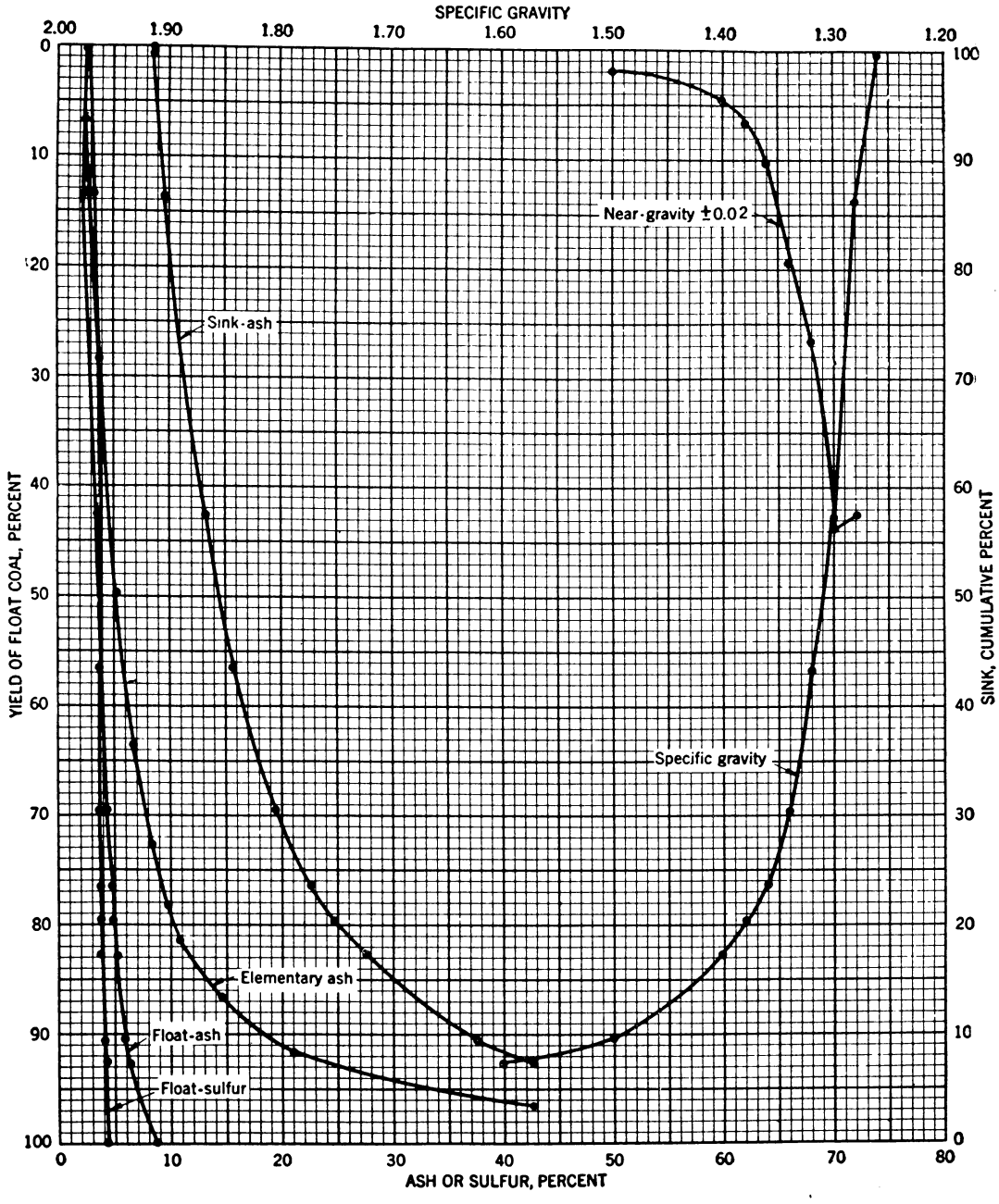
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	29.	.3	2.8	2.70	.3	2.8	2.70	100.0	9.6	4.50	
1.26 - 1.28	878.	10.7	2.7	3.37	11.0	2.7	3.35	99.7	9.6	4.50	40.5
1.28 - 1.30	2760.	29.8	4.0	3.61	40.8	3.6	3.54	89.0	10.4	4.64	45.8
1.30 - 1.32	1547.	16.0	5.7	3.81	56.8	4.2	3.62	59.2	13.6	5.16	28.3
1.32 - 1.34	1120.	12.3	7.1	4.28	69.1	4.7	3.73	43.2	16.6	5.66	19.5
1.34 - 1.36	677.	7.2	8.8	4.98	76.3	5.1	3.85	30.9	20.3	6.21	11.3
1.36 - 1.38	407.	4.1	10.5	5.71	80.4	5.4	3.95	23.7	23.8	6.58	7.1
1.38 - 1.40	264.	3.0	11.6	6.34	83.4	5.6	4.03	19.6	26.6	6.76	4.5
1.40 - 1.50	705.	7.6	15.3	7.33	91.0	6.4	4.31	16.6	29.3	6.83	2.0
1.50 - 1.60	219.	2.4	23.0	7.49	93.4	6.8	4.39	9.0	41.2	6.41	
Sink - 1.60	584.	6.6	47.7	6.03	100.0	9.6	4.50	6.6	47.7	6.03	
Totals	9190.	100.0									

DATA SHEET 37.—ALEXANDER MINE SAMPLE, ⅜-INCH CRUSHING. 40 FEET INBY 25 NORTH FACE. SIZE, ⅜ INCH BY 100 MESH.



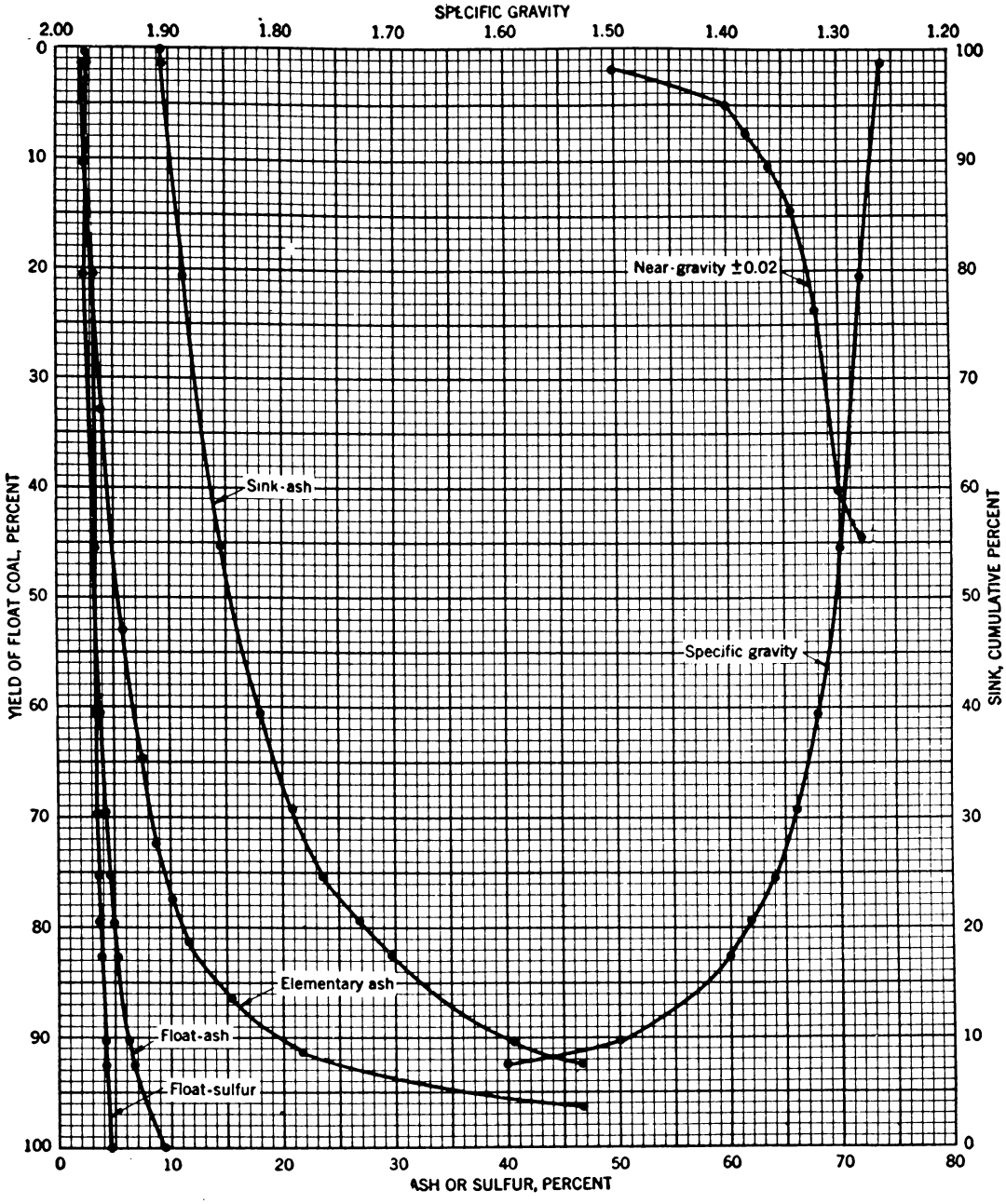
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	24.	.3	2.8	2.53	.3	2.8	2.53	100.0	10.1	4.56	
1.26 - 1.28	623.	8.6	3.1	3.38	8.9	3.1	3.35	99.7	10.1	4.57	38.9
1.28 - 1.30	2200.	30.3	4.2	3.61	39.2	4.0	3.55	91.1	10.8	4.68	47.8
1.30 - 1.32	1276.	17.5	6.0	3.85	56.7	4.6	3.64	60.8	14.0	5.21	29.6
1.32 - 1.34	878.	12.1	7.6	4.37	68.8	5.1	3.77	43.3	17.3	5.77	19.6
1.34 - 1.36	547.	7.5	9.1	5.14	76.3	5.5	3.91	31.2	21.1	6.31	12.2
1.36 - 1.38	339.	4.7	10.8	5.90	81.0	5.8	4.02	23.7	24.9	6.68	7.5
1.38 - 1.40	204.	2.8	12.1	6.82	83.8	6.0	4.11	19.0	28.3	6.87	4.3
1.40 - 1.50	560.	7.7	16.0	7.72	91.5	6.9	4.42	16.2	31.1	6.87	2.0
1.50 - 1.60	174.	2.4	24.6	7.54	93.9	7.3	4.50	8.5	44.8	6.11	
Sink - 1.60	445.	6.1	52.6	5.55	100.0	10.1	4.56	6.1	52.6	5.55	
Totals	7270.	100.0									

DATA SHEET 38.—ALEXANDER MINE SAMPLE, ⅜-INCH CRUSHING. 40 FEET INBY 25 NORTH FACE. SIZE, ⅜ INCH BY 14 MESH.



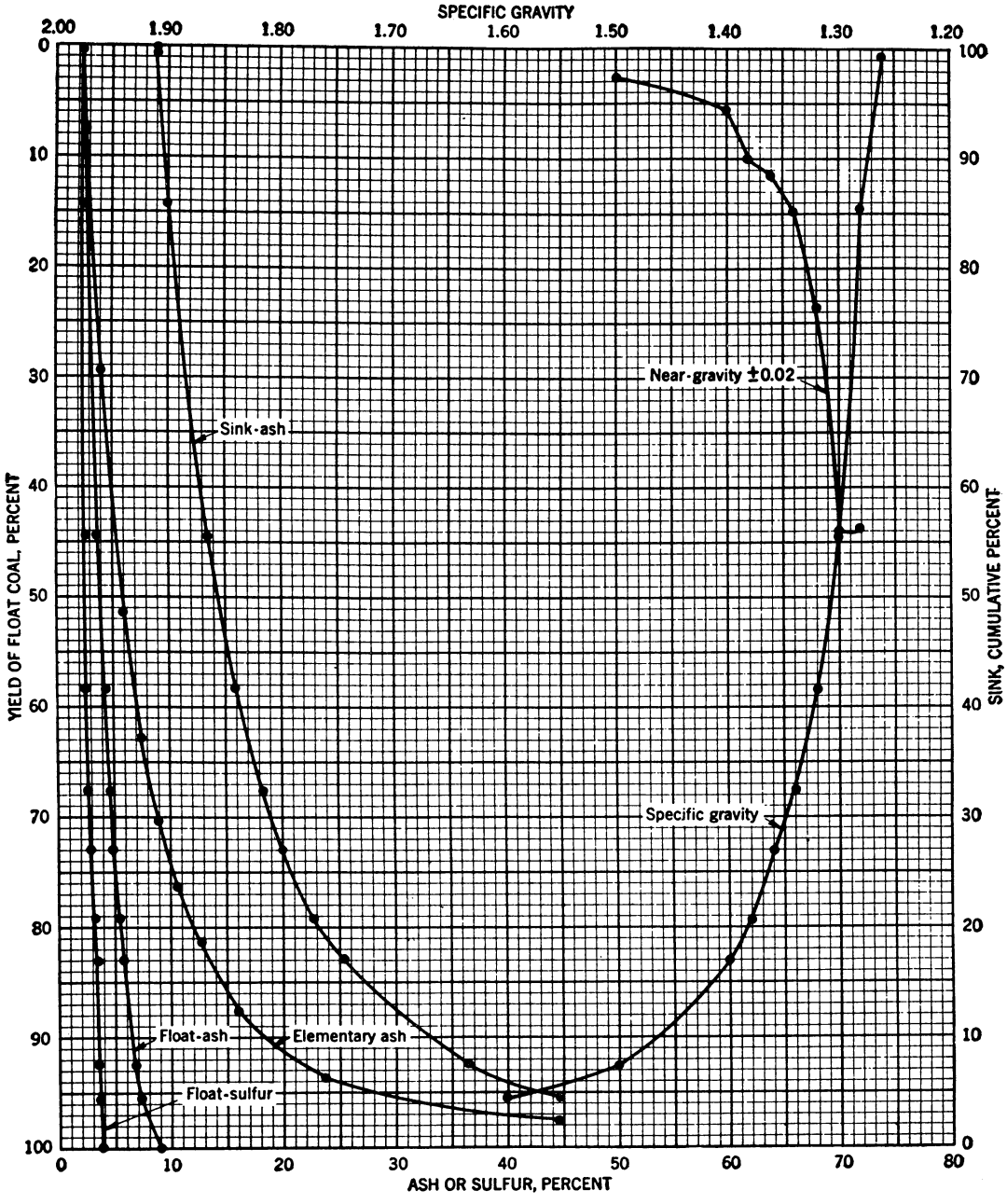
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	5.	.3	2.7	2.97	.3	2.7	2.97	100.0	8.9	4.43	
1.26 - 1.28	255.	13.3	2.4	3.37	13.6	2.4	3.36	99.7	8.9	4.43	42.5
1.28 - 1.30	560.	29.2	3.7	3.62	42.8	3.3	3.54	86.4	9.9	4.59	43.3
1.30 - 1.32	271.	14.1	5.2	3.76	56.9	3.8	3.59	57.2	13.1	5.09	26.7
1.32 - 1.34	242.	12.6	6.6	4.17	69.5	4.3	3.70	43.1	15.7	5.52	19.4
1.34 - 1.36	130.	6.8	8.3	4.76	76.3	4.6	3.79	30.5	19.4	6.08	10.3
1.36 - 1.38	68.	3.5	9.9	5.40	79.8	4.9	3.86	23.7	22.5	6.45	6.6
1.38 - 1.40	60.	3.1	10.9	5.81	82.9	5.1	3.94	20.2	24.8	6.63	4.6
1.40 - 1.50	145.	7.6	14.4	6.84	90.5	5.9	4.18	17.1	27.3	6.79	2.0
1.50 - 1.60	45.	2.3	21.0	7.43	92.8	6.3	4.26	9.5	37.4	6.74	
Sink - 1.60	139.	7.2	42.7	6.52	100.0	8.9	4.43	7.2	42.7	6.52	
Totals	1920.	100.0									

DATA SHEET 39.—ALEXANDER MINE SAMPLE, ⅜-INCH CRUSHING. 40 FEET INBY 25 NORTH FACE. SIZE, 14 BY 100 MESH.



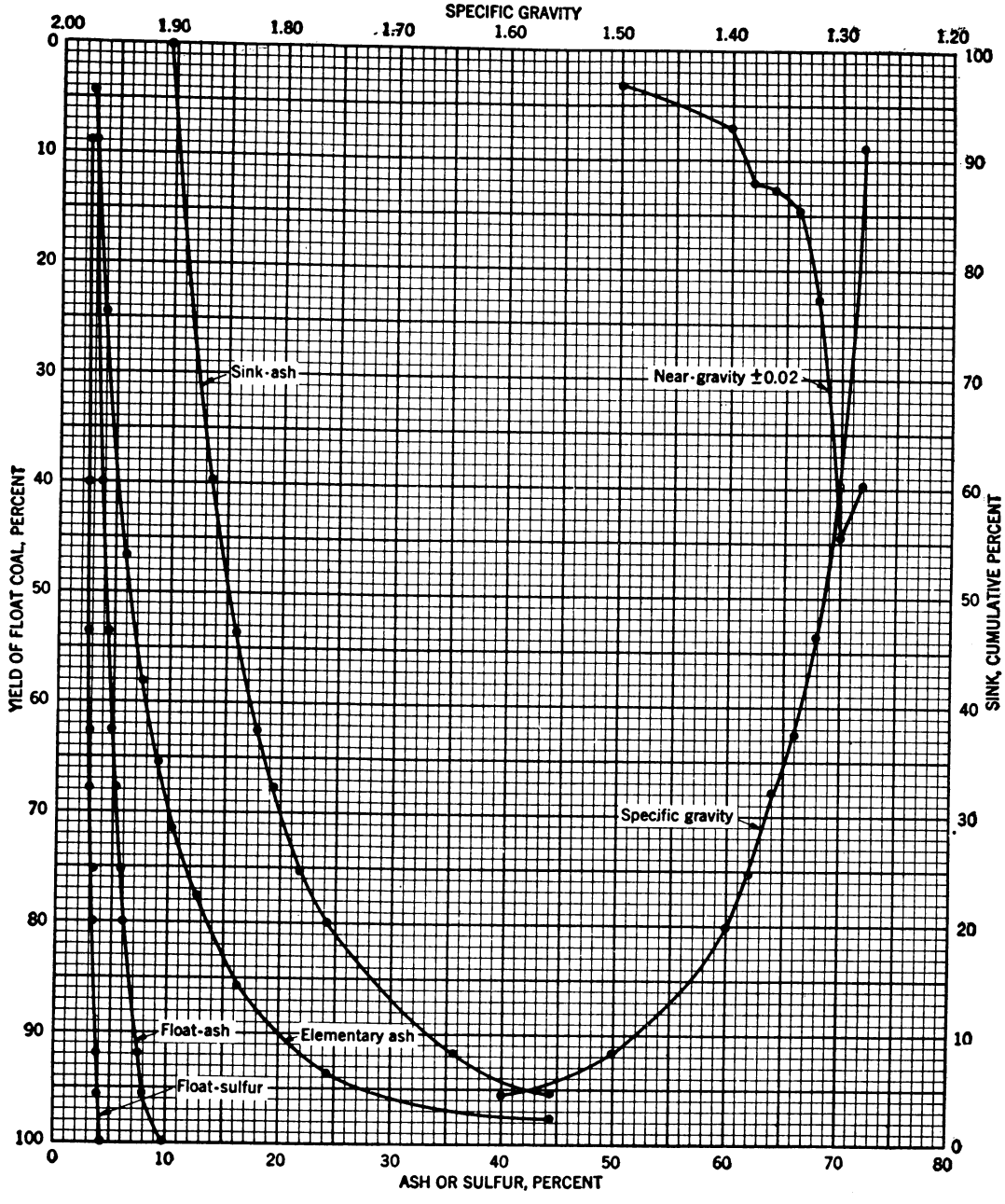
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	18.	1.1	2.7	2.68	1.1	2.7	2.68	100.0	9.4	4.47	
1.26 - 1.28	316.	19.5	2.5	3.41	20.6	2.5	3.37	98.9	9.5	4.49	44.3
1.28 - 1.30	402.	24.8	4.0	3.31	45.4	3.3	3.34	79.4	11.2	4.76	40.2
1.30 - 1.32	250.	15.4	5.7	3.73	60.8	3.9	3.44	54.6	14.6	5.41	23.7
1.32 - 1.34	135.	8.3	7.5	4.32	69.1	4.3	3.54	39.2	18.0	6.08	14.5
1.34 - 1.36	101.	6.2	8.9	4.48	75.3	4.7	3.62	30.9	20.9	6.55	10.2
1.36 - 1.38	65.	4.0	10.1	5.26	79.3	5.0	3.70	24.7	23.9	7.07	7.5
1.38 - 1.40	57.	3.5	11.4	5.97	82.8	5.3	3.80	20.7	26.6	7.43	5.0
1.40 - 1.50	118.	7.3	15.2	7.27	90.1	6.1	4.08	17.2	29.7	7.73	2.0
1.50 - 1.60	40.	2.5	21.8	8.27	92.6	6.5	4.19	9.9	40.5	8.07	
Sink - 1.60	119.	7.4	46.7	8.00	100.0	9.4	4.47	7.4	46.7	8.00	
Totals	1621.	100.0									

DATA SHEET 40.—ALEXANDER MINE SAMPLE, 14-MESH CRUSHING. 40 FEET INBY 25 NORTH FACE. SIZE, 14 BY 100 MESH.



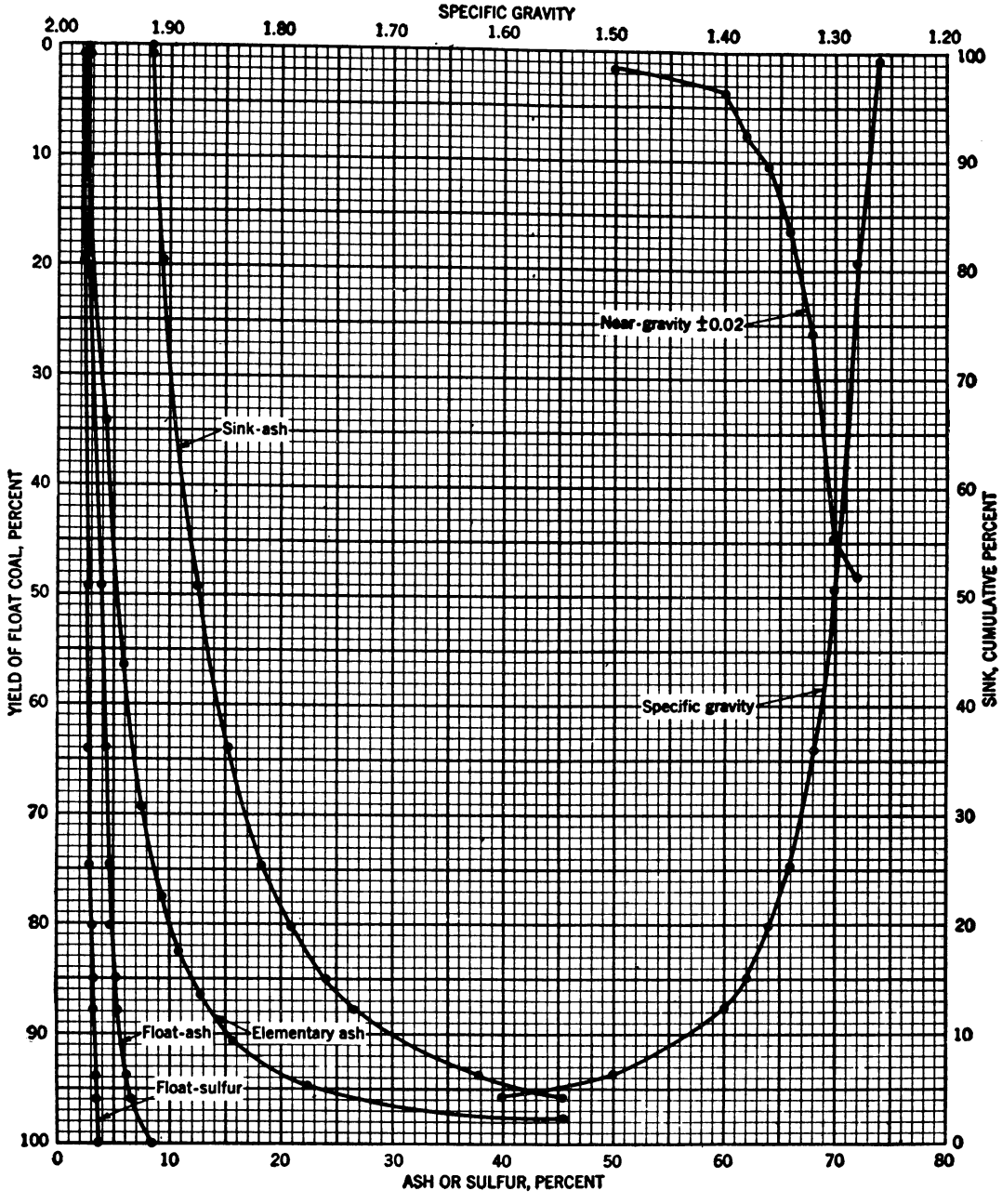
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	145.	.6	2.4	2.28	.6	2.4	2.28	100.0	9.0	3.94	
1.26 - 1.28	3416.	13.6	2.6	2.45	14.2	2.6	2.44	99.4	9.0	3.95	43.8
1.28 - 1.30	7633.	30.2	4.0	2.66	44.4	3.6	2.59	85.8	10.0	4.18	44.0
1.30 - 1.32	3495.	13.8	5.9	3.01	58.2	4.1	2.69	55.6	13.3	5.01	23.3
1.32 - 1.34	2396.	9.5	7.4	3.92	67.7	4.6	2.86	41.8	15.7	5.67	14.8
1.34 - 1.36	1347.	5.3	9.0	4.54	73.0	4.9	2.99	32.3	18.2	6.19	11.5
1.36 - 1.38	1558.	6.2	10.4	5.34	79.2	5.4	3.17	27.0	20.0	6.52	10.0
1.38 - 1.40	952.	3.8	12.6	5.47	83.0	5.7	3.27	20.8	22.8	6.86	5.7
1.40 - 1.50	2399.	9.5	16.0	6.33	92.5	6.7	3.59	17.0	25.1	7.17	2.5
1.50 - 1.60	742.	2.9	23.7	8.17	95.4	7.3	3.73	7.5	36.5	8.23	
Sink - 1.60	1161.	4.6	44.7	8.27	100.0	9.0	3.94	4.6	44.7	8.27	
Totals	25244.	100.0									

DATA SHEET 41.—HITCHMAN MINE SAMPLE, 1½-INCH CRUSHING. 1 BREAK-THROUGH INBY 6 AND 7. SIZE, 1½ INCHES BY 100 MESH.



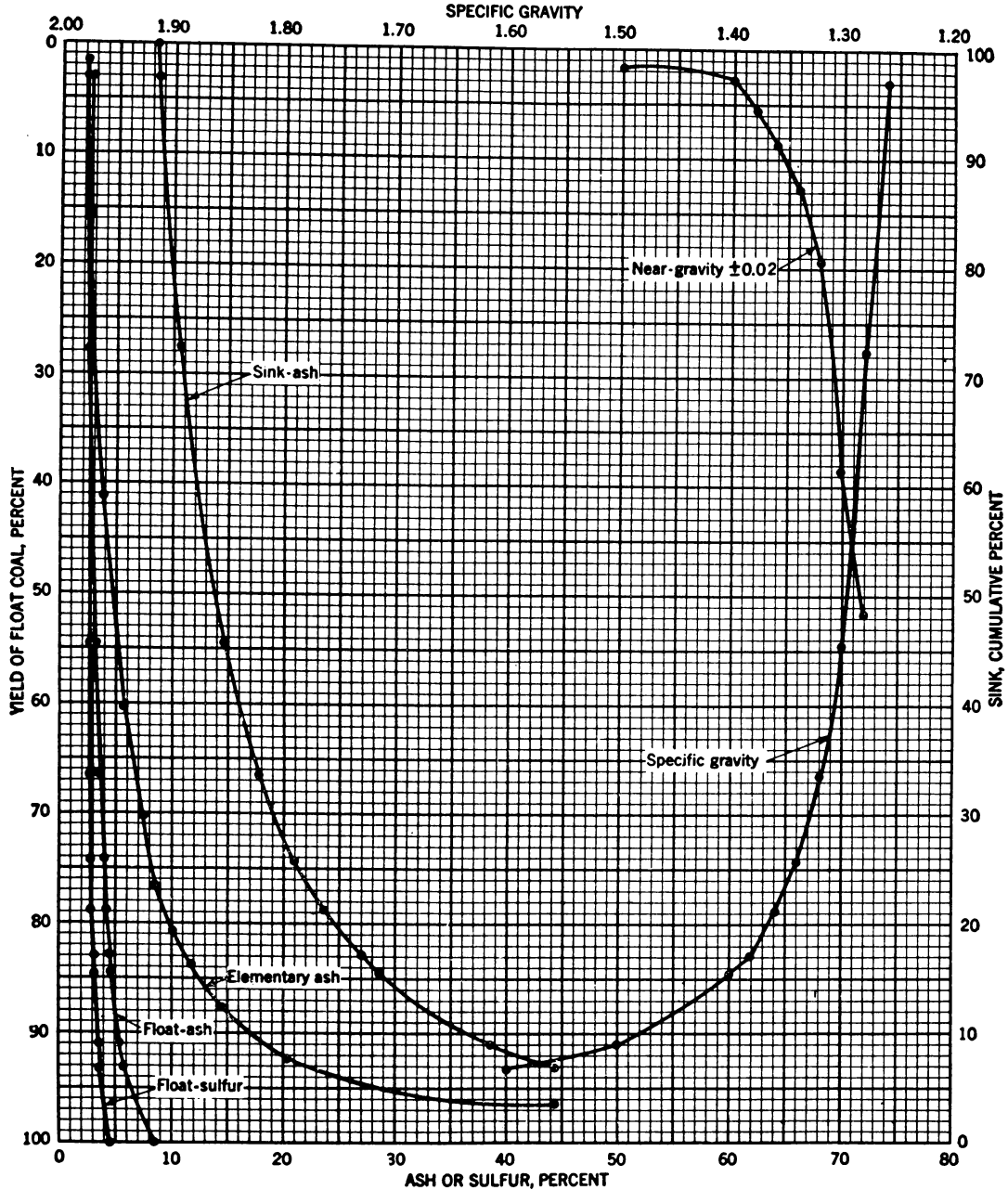
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	2.	0	0	0	0	0	0	0	0	0	
1.26 - 1.28	1287.	8.9	2.8	2.41	8.9	2.8	2.41	100.0	9.6	4.02	39.9
1.28 - 1.30	4476.	31.0	4.0	2.60	39.9	3.7	2.56	91.1	10.3	4.18	44.6
1.30 - 1.32	1960.	13.6	6.0	2.89	53.5	4.3	2.64	60.1	13.6	4.99	22.6
1.32 - 1.34	1305.	9.0	7.4	3.95	62.5	4.8	2.83	46.5	15.8	5.60	14.4
1.34 - 1.36	776.	5.4	9.0	4.61	67.9	5.1	2.97	37.5	17.8	6.00	12.7
1.36 - 1.38	1053.	7.3	10.2	5.29	75.2	5.6	3.20	32.1	19.3	6.23	12.1
1.38 - 1.40	688.	4.8	12.6	5.60	80.0	6.0	3.34	24.8	21.9	6.51	7.2
1.40 - 1.50	1719.	11.9	16.3	6.51	91.9	7.3	3.75	20.0	24.1	6.73	3.1
1.50 - 1.60	524.	3.6	24.5	7.85	95.5	8.0	3.91	8.1	35.6	7.04	
Sink - 1.60	655.	4.5	44.4	6.39	100.0	9.6	4.02	4.5	44.4	6.39	
Totals	14445.	100.0									

DATA SHEET 42.—HITCHMAN MINE SAMPLE, 1½-INCH CRUSHING. 1 BREAK-THROUGH INBY 6 AND 7. SIZE, 1½ BY ⅜ INCHES.



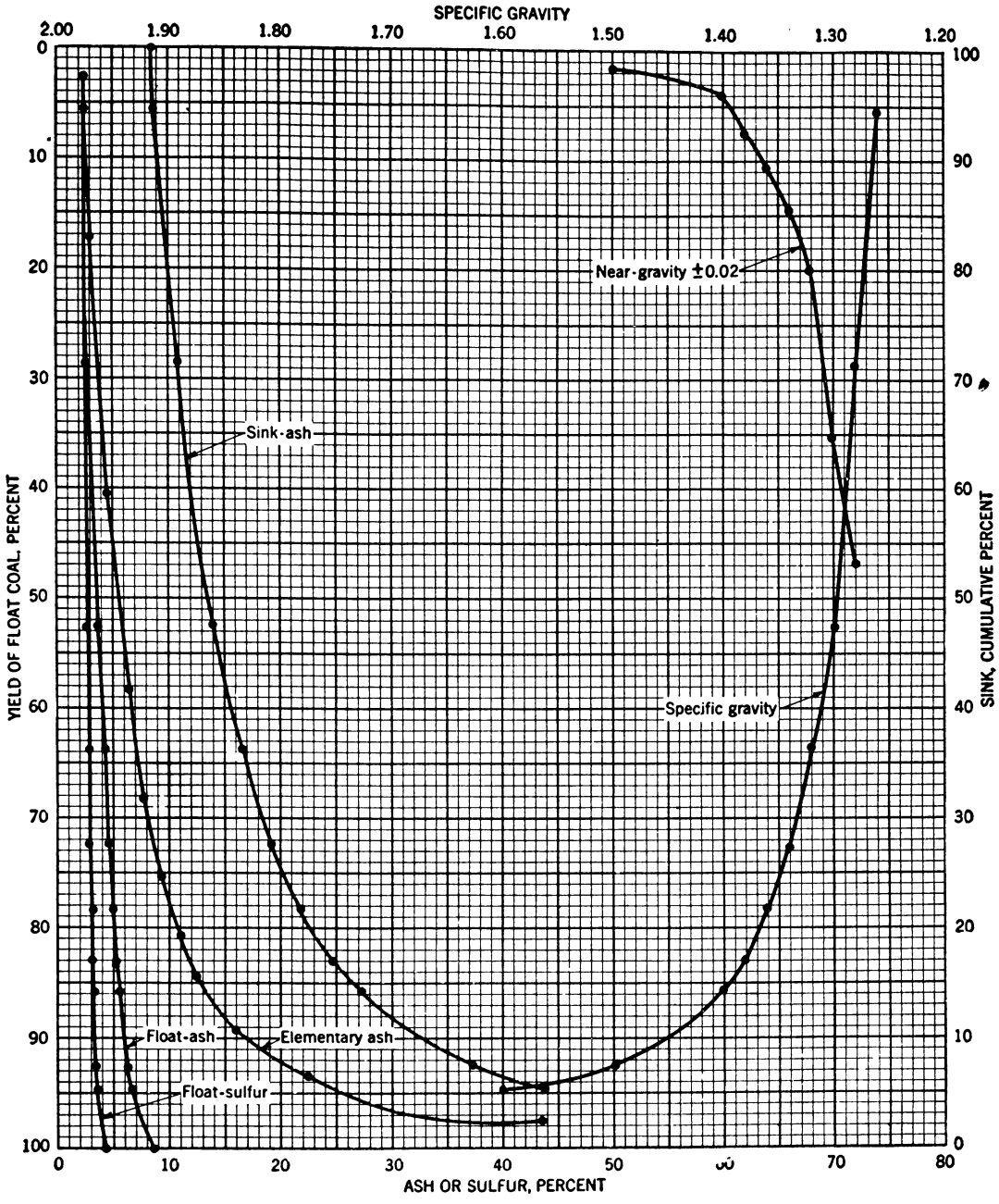
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	75.	.9	2.7	2.23	.9	2.7	2.23	100.0	8.1	3.77	
1.26 - 1.28	1568.	18.4	2.6	2.45	19.3	2.6	2.44	99.1	8.1	3.79	48.2
1.28 - 1.30	2540.	29.8	4.2	2.72	49.1	3.6	2.61	80.7	9.4	4.09	44.7
1.30 - 1.32	1270.	14.9	5.9	3.15	64.0	4.1	2.74	50.9	12.4	4.89	25.6
1.32 - 1.34	913.	10.7	7.5	3.94	74.7	4.6	2.91	36.0	15.1	5.62	16.1
1.34 - 1.36	461.	5.4	9.2	4.53	80.1	4.9	3.02	25.3	18.3	6.33	10.3
1.36 - 1.38	415.	4.9	10.9	5.04	85.0	5.2	3.13	19.9	20.8	6.82	7.6
1.38 - 1.40	227.	2.7	12.7	5.13	87.7	5.5	3.19	15.0	24.0	7.39	3.9
1.40 - 1.50	532.	6.2	15.4	5.80	93.9	6.1	3.37	12.3	26.5	7.88	1.6
1.50 - 1.60	170.	2.0	22.3	9.22	95.9	6.5	3.49	6.1	37.8	10.01	
Sink - 1.60	349.	4.1	45.4	10.39	100.0	8.1	3.77	4.1	45.4	10.39	
Totals	8520.	100.0									

DATA SHEET 43.—HITCHMAN MINE SAMPLE, 1½-INCH CRUSHING. 1 BREAK-THROUGH INBY 6 AND 7. SIZE, ⅜ INCH BY 14 MESH.



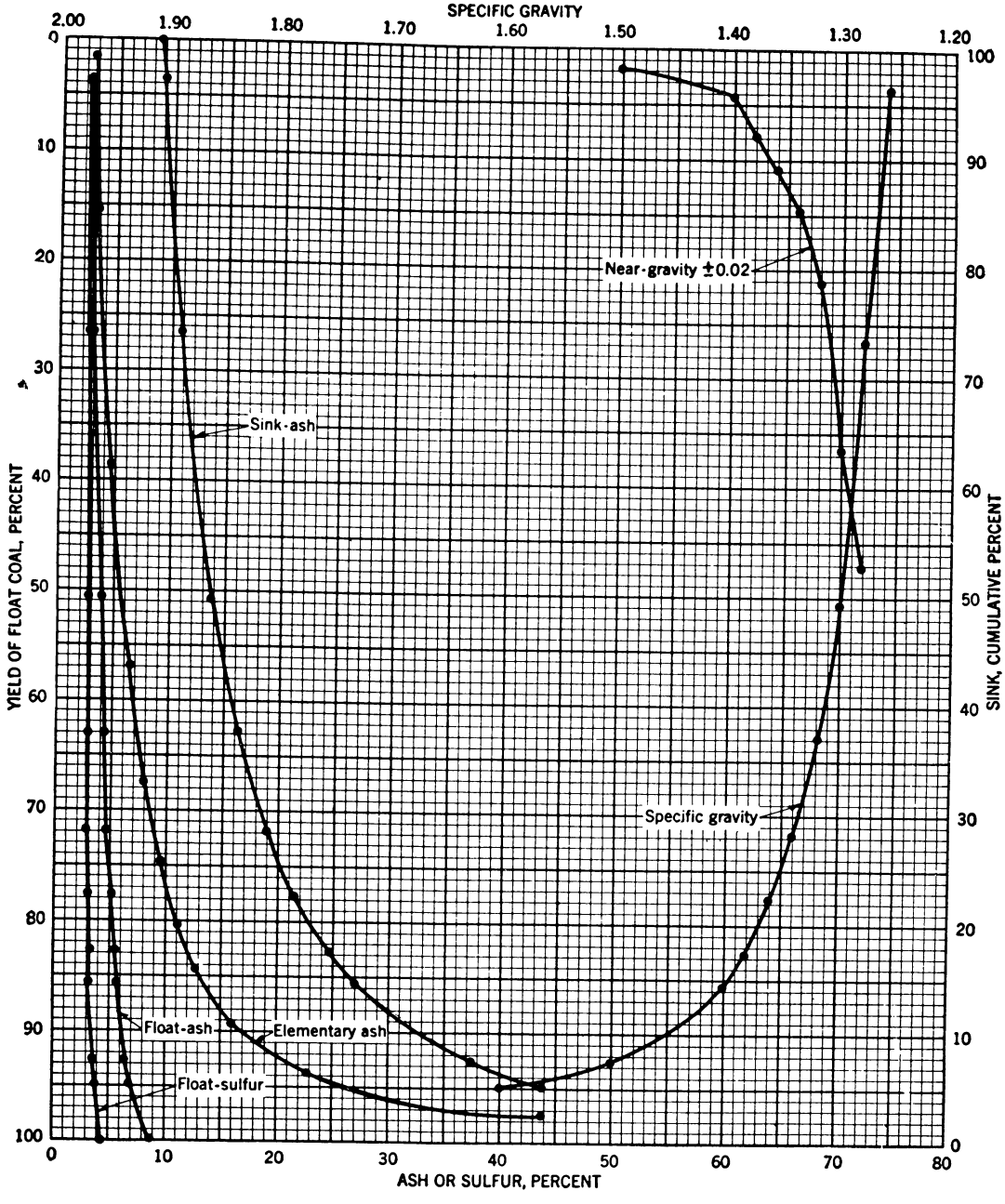
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	68.	3.0	2.1	2.38	3.0	2.1	2.38	100.0	8.3	4.04	
1.26 - 1.28	561.	24.6	2.4	2.55	27.6	2.4	2.53	97.0	8.5	4.09	51.7
1.28 - 1.30	617.	27.1	3.9	2.83	54.7	3.1	2.68	72.4	10.6	4.62	38.7
1.30 - 1.32	265.	11.6	5.6	3.23	66.3	3.5	2.78	45.3	14.7	5.68	19.4
1.32 - 1.34	178.	7.8	7.3	3.60	74.1	3.9	2.86	33.7	17.8	6.53	12.6
1.34 - 1.36	110.	4.8	8.5	4.10	78.9	4.2	2.94	25.9	21.0	7.41	8.8
1.36 - 1.38	90.	4.0	10.0	7.31	82.9	4.5	3.15	21.1	23.8	8.17	5.6
1.38 - 1.40	37.	1.6	11.7	5.19	84.5	4.6	3.19	17.1	27.0	8.37	2.9
1.40 - 1.50	148.	6.5	14.5	6.23	91.0	5.3	3.40	15.5	28.6	8.70	1.7
1.50 - 1.60	48.	2.1	20.3	7.81	93.1	5.7	3.50	9.0	38.8	10.48	
Sink - 1.60	157.	6.9	44.4	11.30	100.0	8.3	4.04	6.9	44.4	11.30	
Totals	2279.	100.0									

DATA SHEET 44.—HITCHMAN MINE SAMPLE, 1½-INCH CRUSHING. 1 BREAK-THROUGH INBY 6 AND 7. SIZE, 14 BY 100 MESH.



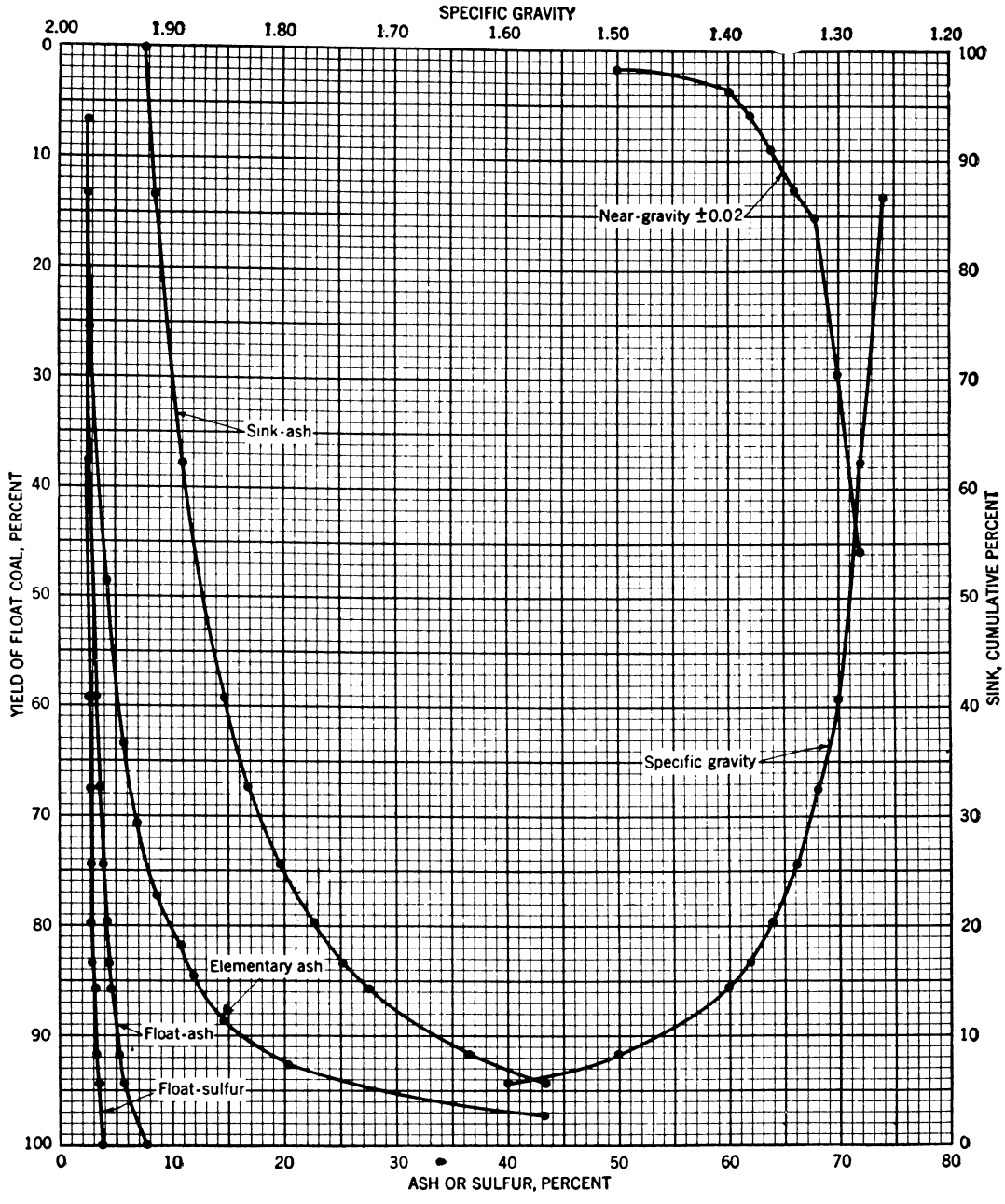
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	698.	5.5	2.6	2.54	5.5	2.6	2.54	100.0	8.6	4.02	
1.26 - 1.28	2975.	23.2	3.0	2.62	28.7	2.9	2.60	94.5	8.9	4.11	46.9
1.28 - 1.30	3034.	23.7	4.5	2.86	52.4	3.6	2.72	71.3	10.8	4.59	35.1
1.30 - 1.32	1459.	11.4	6.3	3.20	63.8	4.1	2.81	47.6	14.0	5.46	20.0
1.32 - 1.34	1097.	8.6	7.6	3.85	72.4	4.5	2.93	36.2	16.4	6.17	14.4
1.34 - 1.36	740.	5.8	9.2	4.48	78.2	4.9	3.04	27.6	19.1	6.89	10.6
1.36 - 1.38	612.	4.8	11.0	5.06	83.0	5.2	3.16	21.8	21.7	7.52	7.5
1.38 - 1.40	350.	2.7	12.4	5.63	85.7	5.5	3.24	17.0	24.7	8.21	4.0
1.40 - 1.50	864.	6.7	15.8	7.03	92.4	6.2	3.52	14.3	27.1	8.70	1.8
1.50 - 1.60	297.	2.3	22.3	9.09	94.7	6.6	3.65	7.6	37.1	10.19	
Sink - 1.60	673.	5.3	43.7	10.68	100.0	8.6	4.02	5.3	43.7	10.68	
Totals	12799.	100.0									

DATA SHEET 45.—HITCHMAN MINE SAMPLE, ⅜-INCH CRUSHING. 1 BREAK-THROUGH INBY 6 AND 7. SIZE, ⅜ INCH BY 100 MESH.



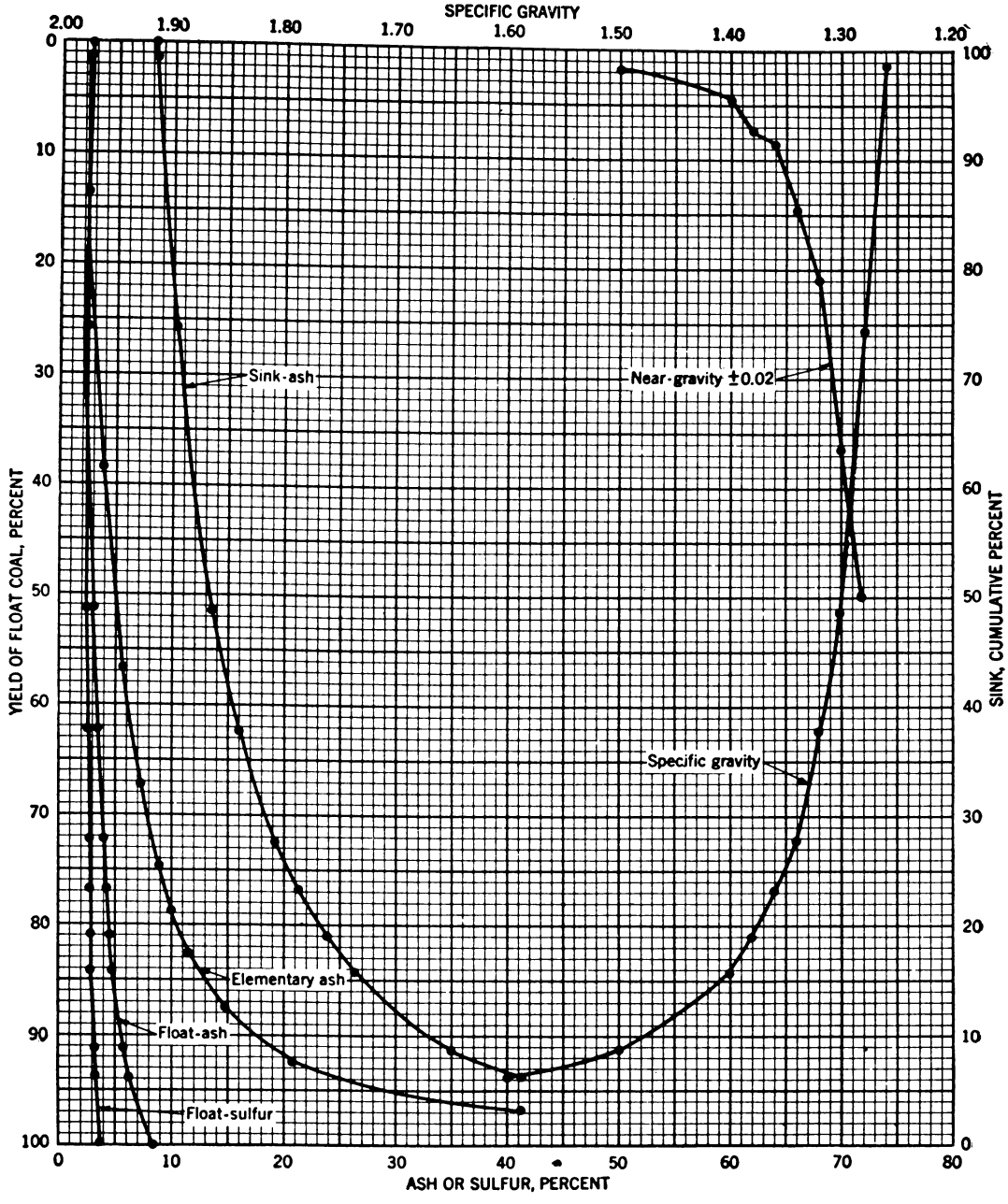
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	375.	3.6	2.7	2.48	3.6	2.7	2.48	100.0	8.7	4.06	
1.26 - 1.28	2370.	22.9	3.1	2.63	26.5	3.0	2.61	96.4	9.0	4.12	47.2
1.28 - 1.30	2510.	24.3	4.6	2.86	50.8	3.8	2.73	73.5	10.8	4.58	36.4
1.30 - 1.32	1254.	12.1	6.4	3.21	62.9	4.3	2.82	49.2	13.8	5.43	21.1
1.32 - 1.34	927.	9.0	7.7	3.90	71.9	4.7	2.96	37.1	16.3	6.16	14.8
1.34 - 1.36	603.	5.8	9.4	4.56	77.7	5.1	3.08	28.1	19.0	6.88	10.9
1.36 - 1.38	529.	5.1	11.0	5.11	82.8	5.4	3.20	22.3	21.5	7.49	7.9
1.38 - 1.40	288.	2.8	12.6	5.70	85.6	5.7	3.28	17.2	24.7	8.20	4.2
1.40 - 1.50	719.	7.0	16.0	7.11	92.6	6.4	3.57	14.4	27.0	8.68	1.9
1.50 - 1.60	237.	2.3	22.9	9.39	94.9	6.8	3.71	7.4	37.3	10.16	
Sink - 1.60	530.	5.1	43.8	10.50	100.0	8.7	4.06	5.1	43.8	10.50	
Totals	10342.	100.0									

DATA SHEET 46.—HITCHMAN MINE SAMPLE, ⅜-INCH CRUSHING. 1 BREAK-THROUGH INBY 6 AND 7. SIZE, ⅜ INCH BY 14 MESH.



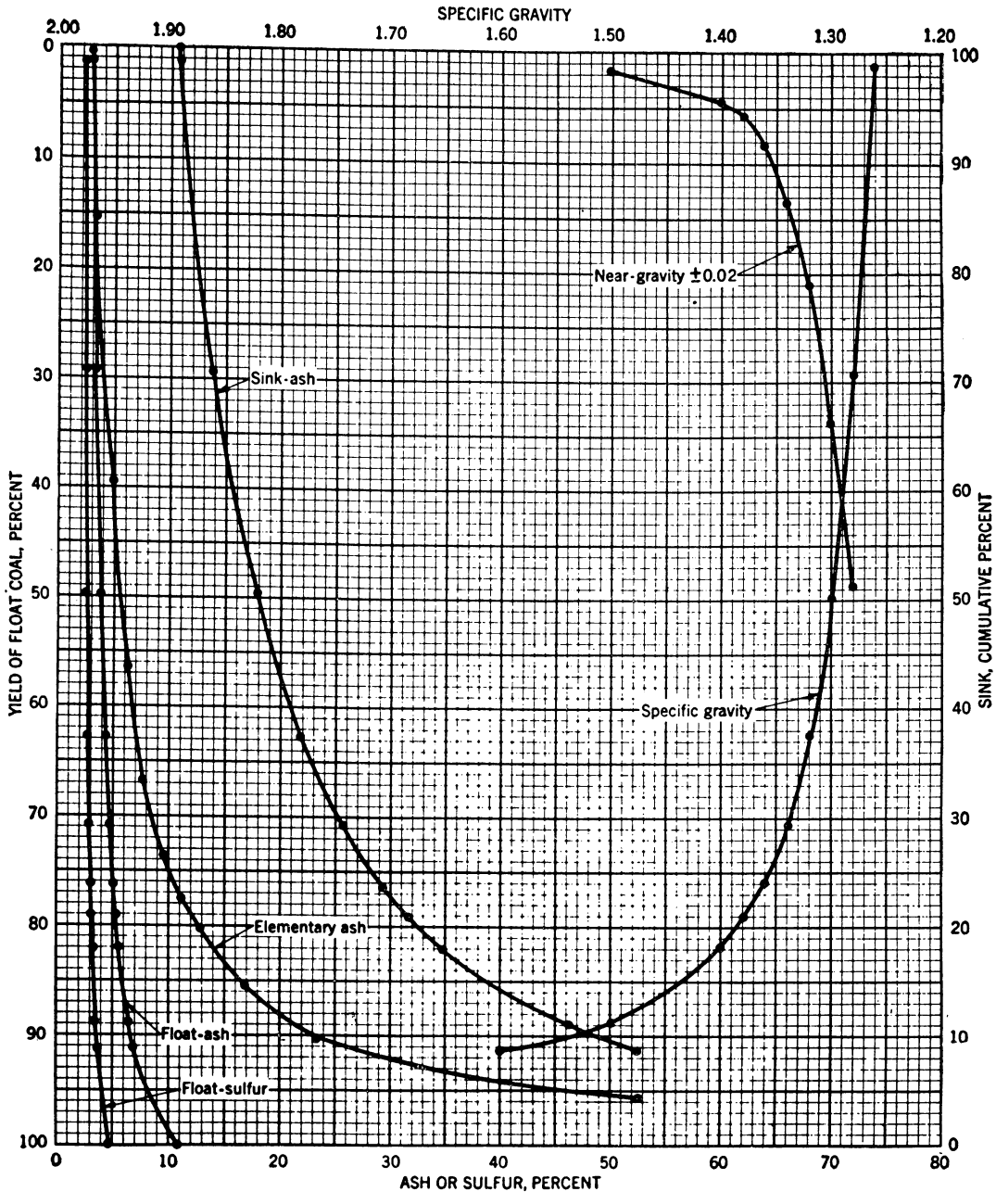
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	323.	13.2	2.6	2.62	13.2	2.6	2.62	100.0	7.8	3.86	
1.26 - 1.28	605.	24.6	2.6	2.56	37.8	2.6	2.58	86.8	8.6	4.05	45.9
1.28 - 1.30	524.	21.3	4.2	2.86	59.1	3.2	2.68	62.2	11.0	4.64	29.6
1.30 - 1.32	205.	8.3	5.7	3.16	67.4	3.5	2.74	40.9	14.6	5.57	15.2
1.32 - 1.34	170.	6.9	7.0	3.56	74.3	3.8	2.82	32.6	16.9	6.19	12.5
1.34 - 1.36	137.	5.6	8.4	4.15	79.9	4.1	2.91	25.7	19.5	6.90	9.0
1.36 - 1.38	83.	3.4	10.8	4.72	83.3	4.4	2.98	20.1	22.6	7.67	5.9
1.38 - 1.40	62.	2.5	11.7	5.29	85.8	4.6	3.05	16.7	25.0	8.27	3.7
1.40 - 1.50	145.	5.9	14.6	6.65	91.7	5.3	3.28	14.2	27.4	8.79	1.7
1.50 - 1.60	60.	2.5	20.1	7.91	94.2	5.7	3.40	8.3	36.5	10.33	
Sink - 1.60	143.	5.8	43.4	11.34	100.0	7.8	3.86	5.8	43.4	11.34	
Totals	2457.	100.0									

DATA SHEET 47.—HITCHMAN MINE SAMPLE, ⅜-INCH CRUSHING. 1 BREAK-THROUGH INBY 6 AND 7. SIZE, 14 BY 100 MESH.



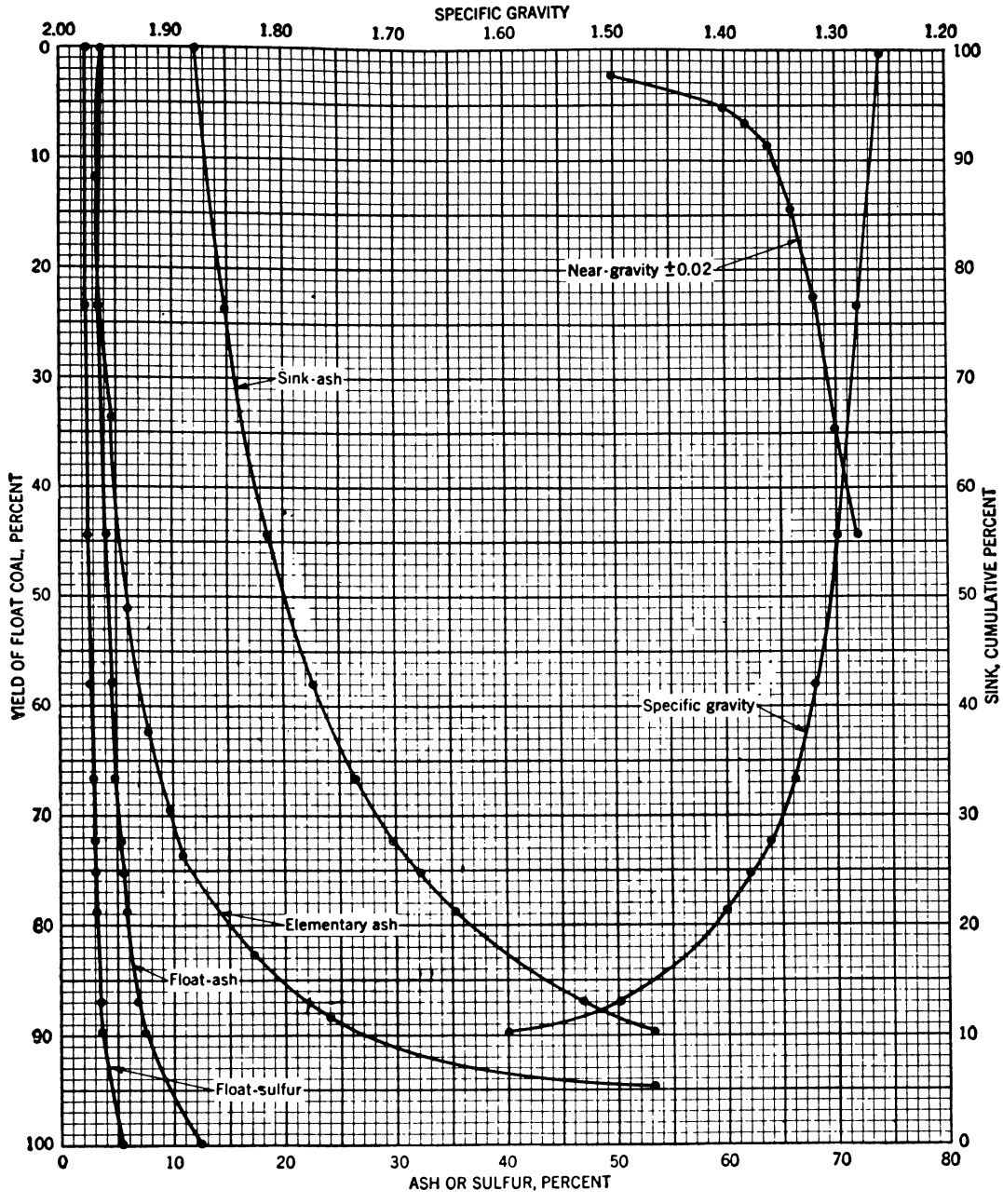
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	28.	1.2	2.5	2.30	1.2	2.5	2.30	100.0	8.2	3.77	
1.26 - 1.28	556.	24.7	2.2	2.33	25.9	2.2	2.33	98.8	8.3	3.79	50.0
1.28 - 1.30	570.	25.3	3.8	2.61	51.2	3.0	2.47	74.1	10.3	4.28	36.3
1.30 - 1.32	248.	11.0	5.6	2.74	62.2	3.5	2.52	48.8	13.6	5.14	21.0
1.32 - 1.34	225.	10.0	7.1	3.25	72.2	4.0	2.62	37.8	16.0	5.84	14.6
1.34 - 1.36	104.	4.6	8.7	3.77	76.8	4.3	2.69	27.8	19.2	6.77	8.8
1.36 - 1.38	95.	4.2	10.0	4.25	81.0	4.6	2.77	23.2	21.3	7.36	7.3
1.38 - 1.40	70.	3.1	11.5	4.72	84.1	4.8	2.84	19.0	23.8	8.05	4.5
1.40 - 1.50	158.	7.0	14.9	6.13	91.1	5.6	3.09	15.9	26.2	8.71	1.9
1.50 - 1.60	60.	2.7	20.9	7.75	93.8	6.0	3.23	8.9	35.0	10.74	
Sink - 1.60	140.	6.2	41.1	12.02	100.0	8.2	3.77	6.2	41.1	12.02	
Totals	2254.	100.0									

DATA SHEET 48.—HITCHMAN MINE SAMPLE, 14-MESH CRUSHING. 1 BREAK-THROUGH INBY 6 AND 7. SIZE, 14 BY 100 MESH.



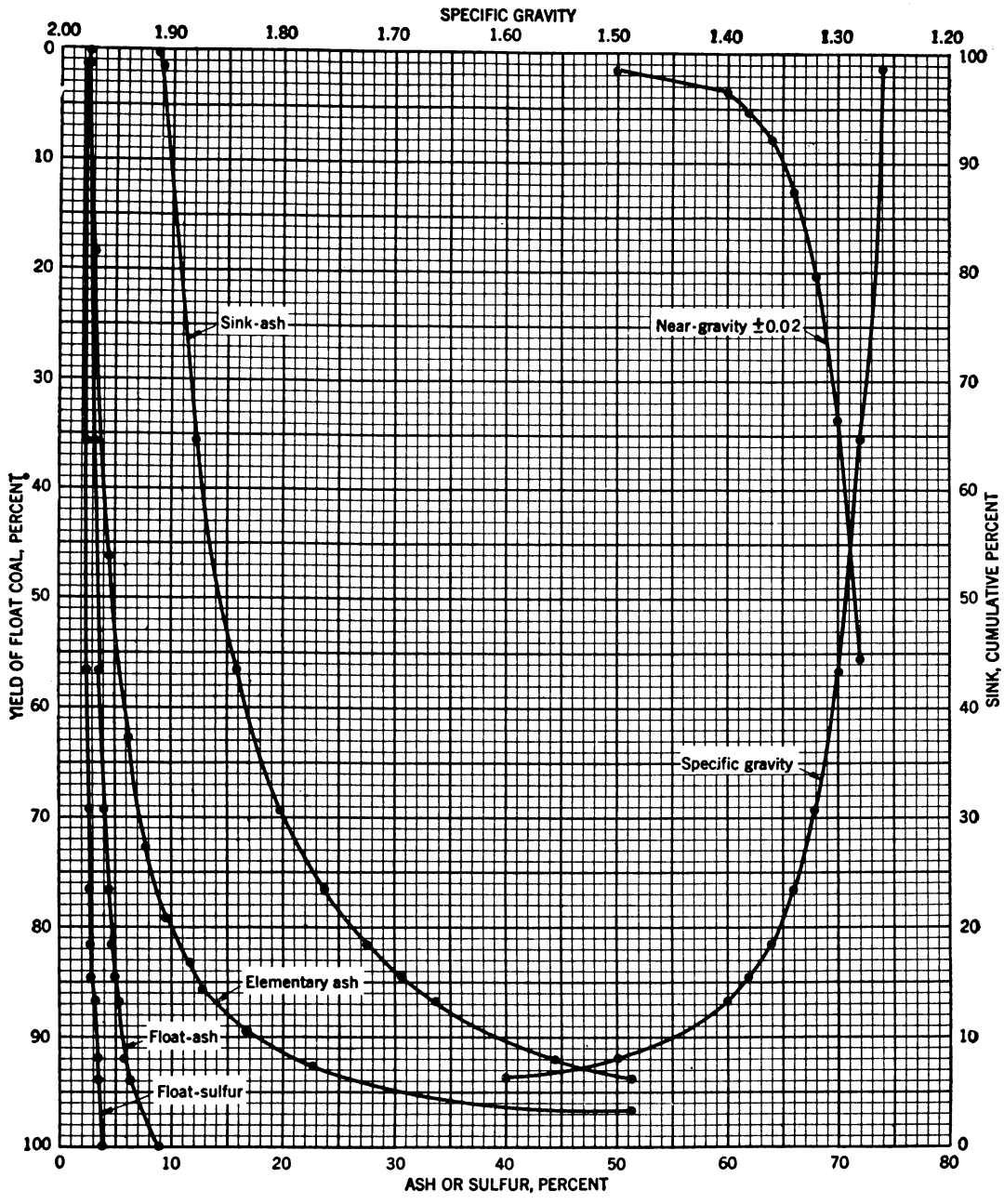
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	271.	1.1	2.8	2.24	1.1	2.8	2.24	100.0	10.7	4.67	
1.26 - 1.28	7137.	28.1	3.2	2.43	29.2	3.2	2.42	98.9	10.8	4.70	48.7
1.28 - 1.30	5239.	20.6	4.6	2.73	49.8	3.7	2.55	70.8	13.9	5.60	33.6
1.30 - 1.32	3299.	13.0	6.1	3.19	62.8	4.2	2.68	50.2	17.7	6.78	21.0
1.32 - 1.34	2038.	8.0	7.6	3.87	70.8	4.6	2.82	37.2	21.7	8.02	13.3
1.34 - 1.36	1363.	5.3	9.5	4.24	76.1	5.0	2.92	29.2	25.6	9.16	8.2
1.36 - 1.38	744.	2.9	11.0	5.17	79.0	5.2	3.00	23.9	29.2	10.26	5.9
1.38 - 1.40	778.	3.0	12.9	5.33	82.0	5.5	3.09	21.0	31.7	10.97	4.4
1.40 - 1.50	1748.	6.9	16.8	6.78	88.9	6.3	3.37	18.0	34.9	11.93	1.9
1.50 - 1.60	610.	2.4	23.3	8.24	91.3	6.8	3.50	11.1	46.1	15.12	
Sink - 1.60	2212.	8.7	52.4	17.02	100.0	10.7	4.67	8.7	52.4	17.02	
Totals	25439.	100.0									

DATA SHEET 49.—HITCHMAN MINE SAMPLE, 1½-INCH CRUSHING. 2 BREAK-THROUGH INBY 6 AND 7. SIZE, 1½ INCHES BY 100 MESH.



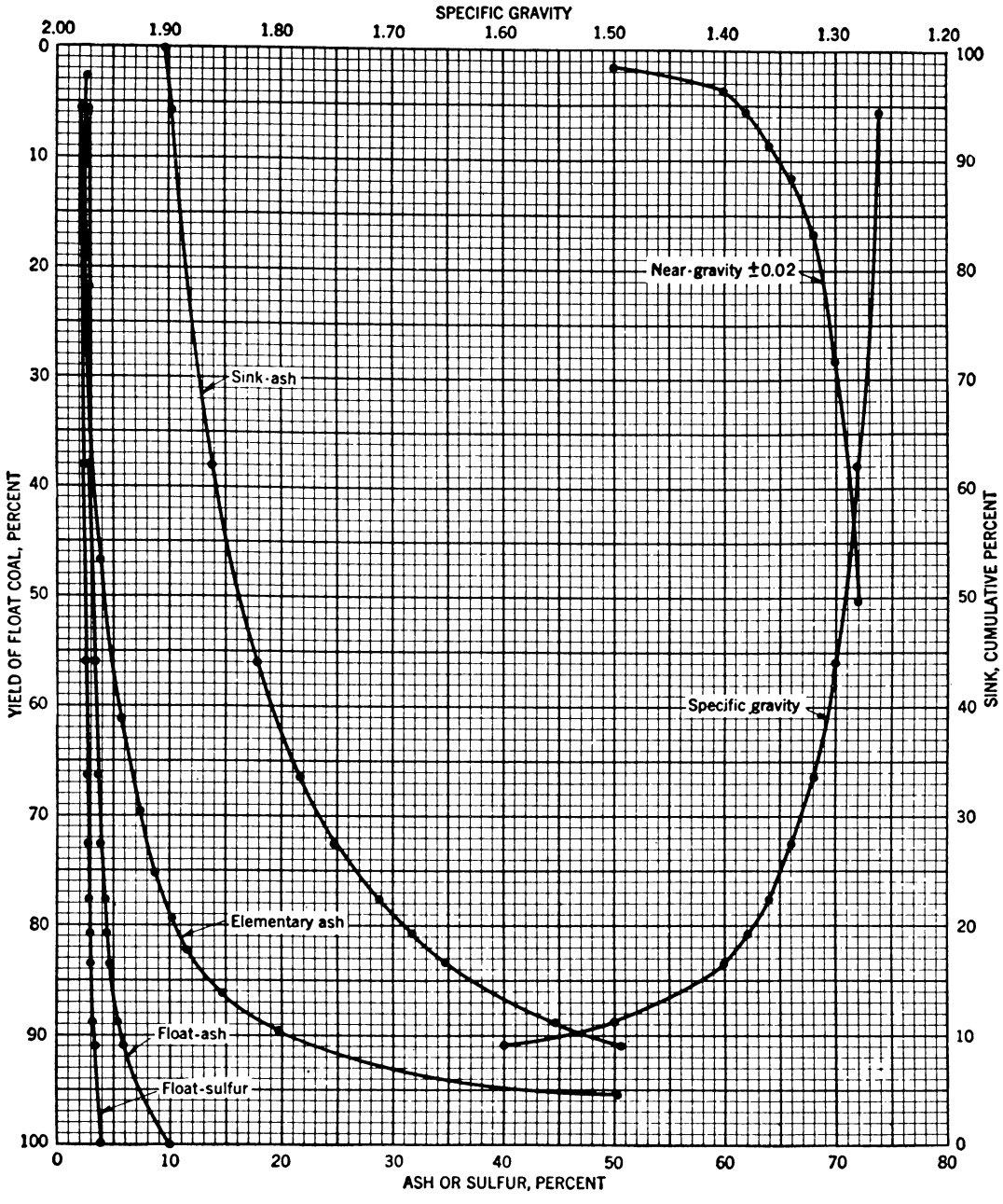
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float - 1.26	8.	.1	3.7	2.30	.1	3.7	2.30	100.0	12.1	5.27	
1.26 - 1.28	3301.	23.4	3.3	2.40	23.5	3.3	2.40	99.9	12.1	5.27	44.2
1.28 - 1.30	2928.	20.8	4.7	2.71	44.3	4.0	2.55	76.5	14.8	6.15	34.5
1.30 - 1.32	1930.	13.7	6.0	3.20	58.0	4.5	2.70	55.7	18.5	7.43	22.4
1.32 - 1.34	1222.	8.7	7.6	3.97	66.7	4.9	2.87	42.0	22.6	8.81	14.3
1.34 - 1.36	790.	5.6	9.7	4.18	72.3	5.3	2.97	33.3	26.5	10.07	8.5
1.36 - 1.38	407.	2.9	10.8	5.33	75.2	5.5	3.06	27.7	29.9	11.27	6.5
1.38 - 1.40	510.	3.6	13.1	5.34	78.8	5.8	3.16	24.8	32.1	11.96	5.2
1.40 - 1.50	1156.	8.2	17.1	7.06	87.0	6.9	3.53	21.2	35.4	13.09	2.2
1.50 - 1.60	387.	2.7	24.0	8.27	89.7	7.4	3.68	13.0	46.9	16.89	
Sink - 1.60	1447.	10.3	53.1	19.20	100.0	12.1	5.27	10.3	53.1	19.20	
Totals	14086.	100.0									

DATA SHEET 50.—HITCHMAN MINE SAMPLE, 1½-INCH CRUSHING, 2 BREAK-THROUGH INBY 6 AND 7. SIZE, 1½ BY ⅜ INCH.



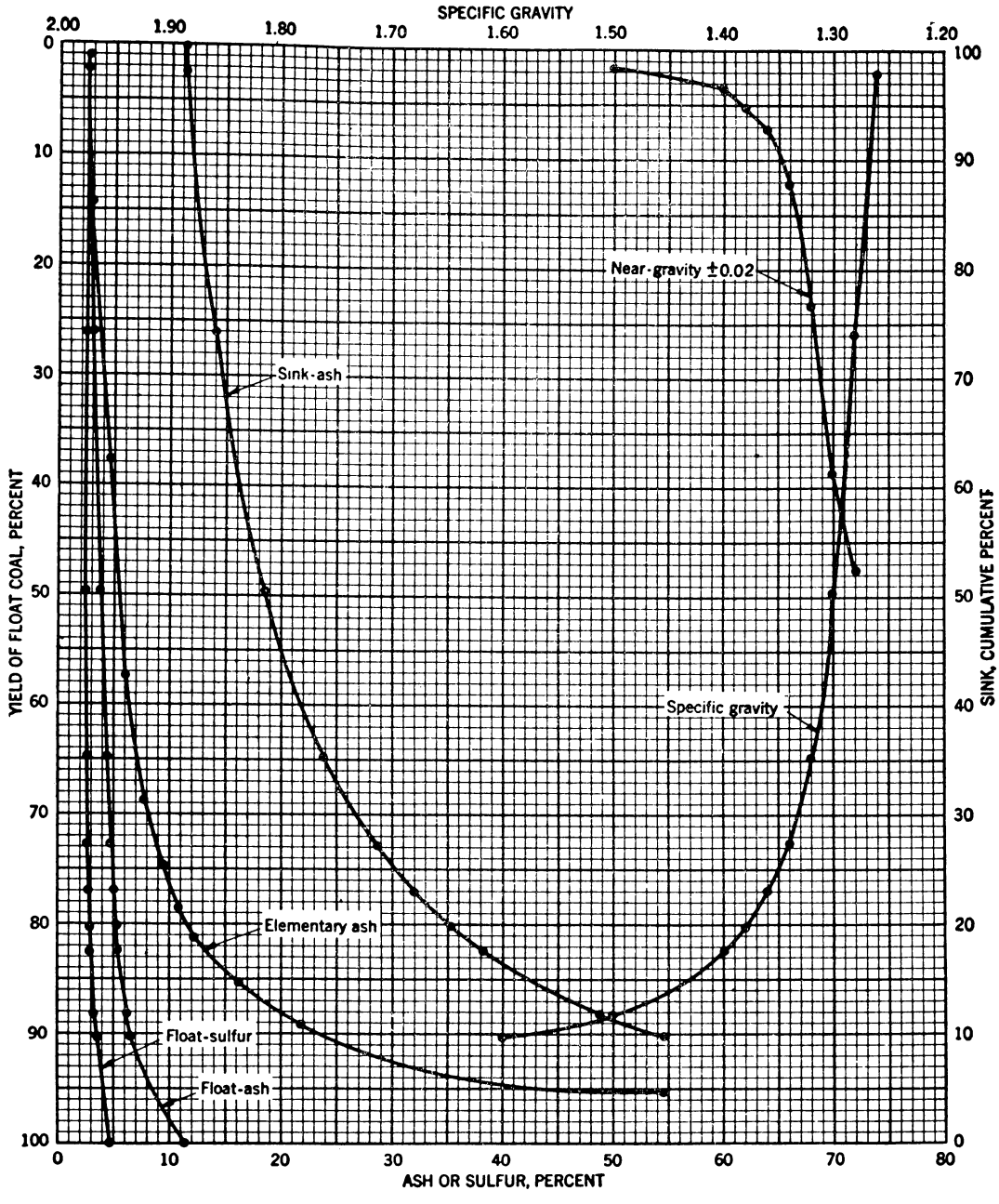
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	113.	1.3	2.5	2.19	1.3	2.5	2.19	100.0	8.9	3.96	
1.26 - 1.28	3016.	34.3	3.1	2.44	35.6	3.1	2.43	98.7	9.0	3.98	55.3
1.28 - 1.30	1852.	21.0	4.5	2.78	56.6	3.6	2.56	64.4	12.2	4.80	33.6
1.30 - 1.32	1104.	12.6	6.2	3.21	69.2	4.0	2.68	43.4	15.9	5.79	20.1
1.32 - 1.34	658.	7.5	7.8	3.79	76.7	4.4	2.79	30.8	19.8	6.84	12.5
1.34 - 1.36	441.	5.0	9.5	4.44	81.7	4.7	2.89	23.3	23.7	7.81	7.9
1.36 - 1.38	256.	2.9	11.6	5.14	84.6	5.0	2.97	18.3	27.5	8.73	5.2
1.38 - 1.40	202.	2.3	12.8	5.50	86.9	5.2	3.03	15.4	30.5	9.41	3.3
1.40 - 1.50	453.	5.1	16.9	6.43	92.0	5.8	3.22	13.1	33.7	10.09	1.4
1.50 - 1.60	170.	1.9	22.6	8.53	93.9	6.2	3.33	8.0	44.5	12.45	
Sink - 1.60	535.	6.1	51.4	13.69	100.0	8.9	3.96	6.1	51.4	13.69	
Totals	8800.	100.0									

DATA SHEET 51.—HITCHMAN MINE SAMPLE, 1½-INCH CRUSHING. 2 BREAK-THROUGH INBY 6 AND 7. SIZE, ⅜ INCH BY 40 MESH.



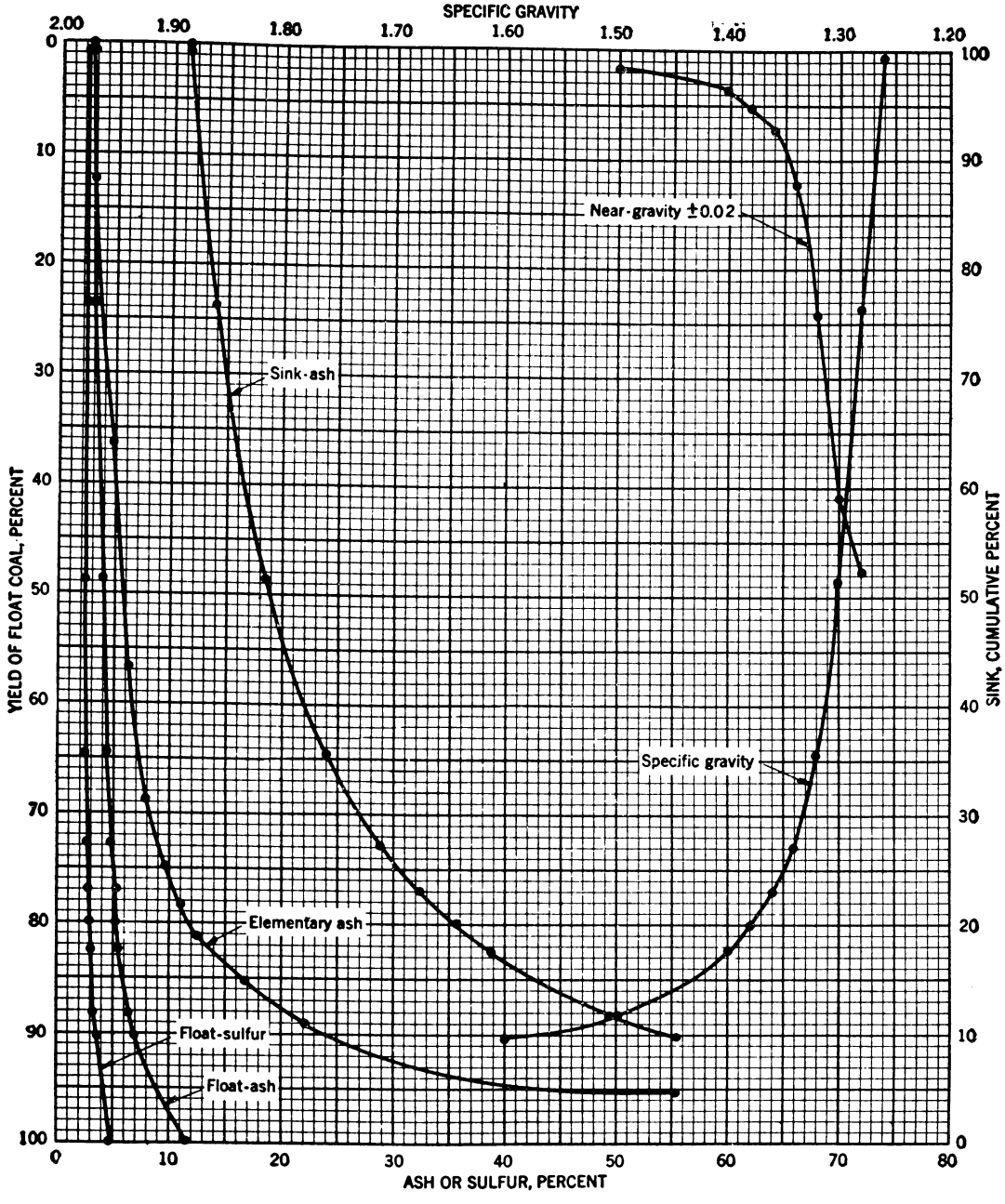
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	150.	5.9	2.9	2.28	5.9	2.9	2.28	100.0	9.6	3.87	
1.26 - 1.28	820.	32.1	2.8	2.52	38.0	2.8	2.48	94.1	10.1	3.97	50.1
1.28 - 1.30	459.	18.0	3.9	2.64	56.0	3.2	2.53	62.0	13.8	4.72	28.4
1.30 - 1.32	265.	10.4	5.7	3.01	66.4	3.6	2.61	44.0	17.8	5.57	16.6
1.32 - 1.34	158.	6.2	7.3	3.47	72.6	3.9	2.68	33.6	21.6	6.35	11.4
1.34 - 1.36	132.	5.2	8.7	3.95	77.8	4.2	2.77	27.4	24.8	7.00	8.3
1.36 - 1.38	81.	3.1	10.2	4.48	80.9	4.4	2.83	22.2	28.6	7.71	5.7
1.38 - 1.40	66.	2.6	11.5	4.71	83.5	4.7	2.89	19.1	31.6	8.25	3.7
1.40 - 1.50	139.	5.4	14.7	5.65	88.9	5.3	3.06	16.5	34.8	8.80	1.5
1.50 - 1.60	53.	2.1	19.9	7.08	91.0	5.6	3.15	11.1	44.6	10.35	
Sink - 1.60	230.	9.0	50.3	11.11	100.0	9.6	3.87	9.0	50.3	11.11	
Totals	2353.	100.0									

DATA SHEET 52.—HITCHMAN MINE SAMPLE, 1½-INCH CRUSHING. 2 BREAK-THROUGH INBY 6 AND 7. SIZE, 14 BY 100 MESH.



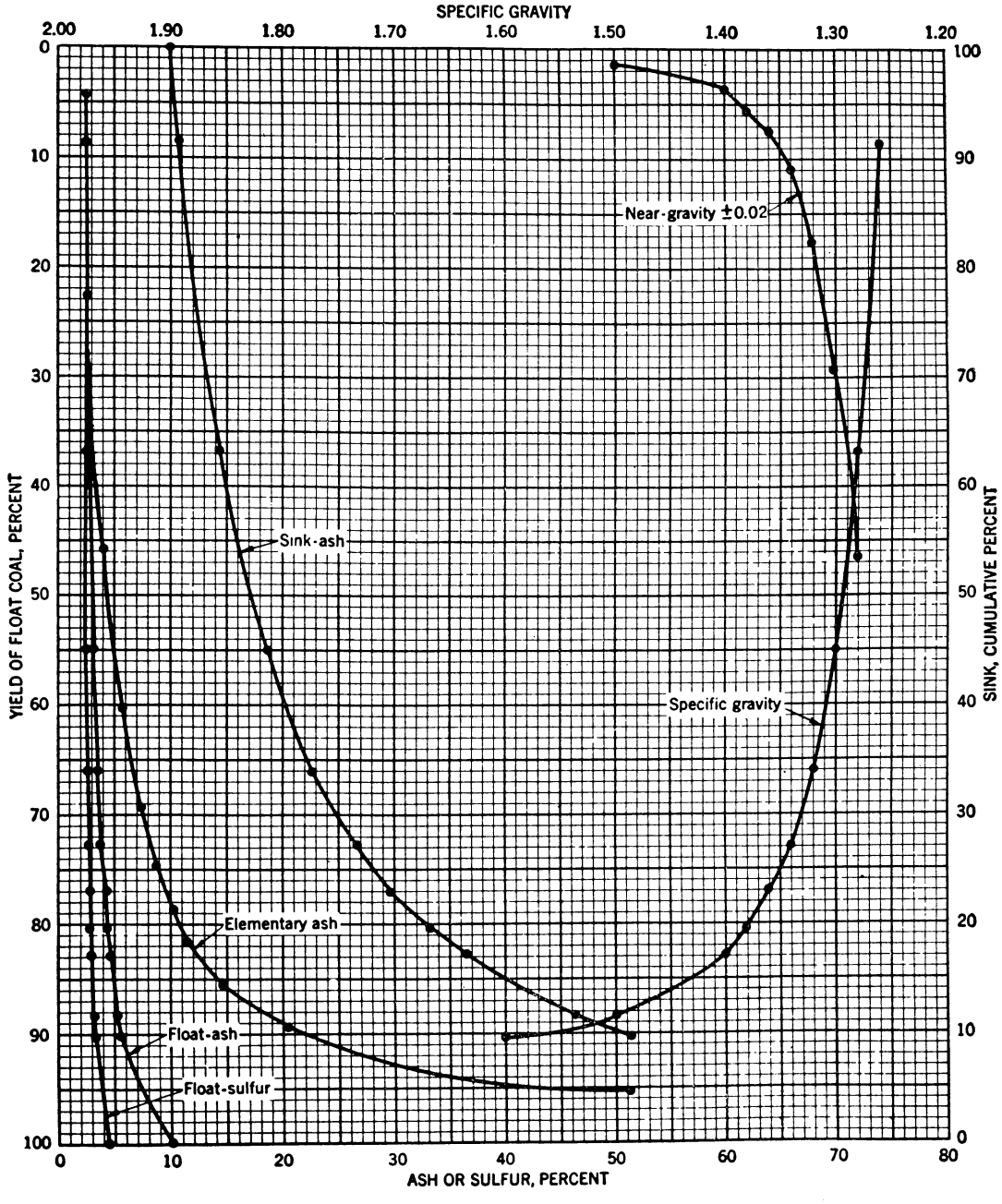
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	273.	2.1	2.4	2.35	2.1	2.4	2.35	100.0	11.1	4.53	
1.26 - 1.28	3043.	23.9	2.9	2.40	26.0	2.9	2.40	97.9	11.3	4.58	47.6
1.28 - 1.30	3016.	23.7	4.7	2.59	49.7	3.7	2.49	74.0	14.0	5.29	38.9
1.30 - 1.32	1939.	15.2	6.0	2.95	64.9	4.3	2.60	50.3	18.4	6.56	23.2
1.32 - 1.34	1018.	8.0	7.8	3.41	72.9	4.7	2.69	35.1	23.8	8.13	12.1
1.34 - 1.36	520.	4.1	9.4	4.10	77.0	4.9	2.76	27.1	28.6	9.52	7.2
1.36 - 1.38	389.	3.1	10.8	4.73	80.1	5.1	2.84	23.0	32.0	10.48	5.4
1.38 - 1.40	294.	2.3	12.2	5.22	82.4	5.3	2.90	19.9	35.2	11.37	3.4
1.40 - 1.50	733.	5.7	16.3	6.43	88.1	6.1	3.13	17.6	38.2	12.17	1.6
1.50 - 1.60	263.	2.1	21.8	9.54	90.2	6.4	3.28	11.9	48.9	14.96	
Sink - 1.60	1245.	9.8	54.6	16.11	100.0	11.1	4.53	9.8	54.6	16.11	
Totals	12733.	100.0									

DATA SHEET 53.—HITCHMAN MINE SAMPLE, ⅜-INCH CRUSHING. 2 BREAK-THROUGH INBY 6 AND 7. SIZE, ⅜ INCH BY 100 MESH.



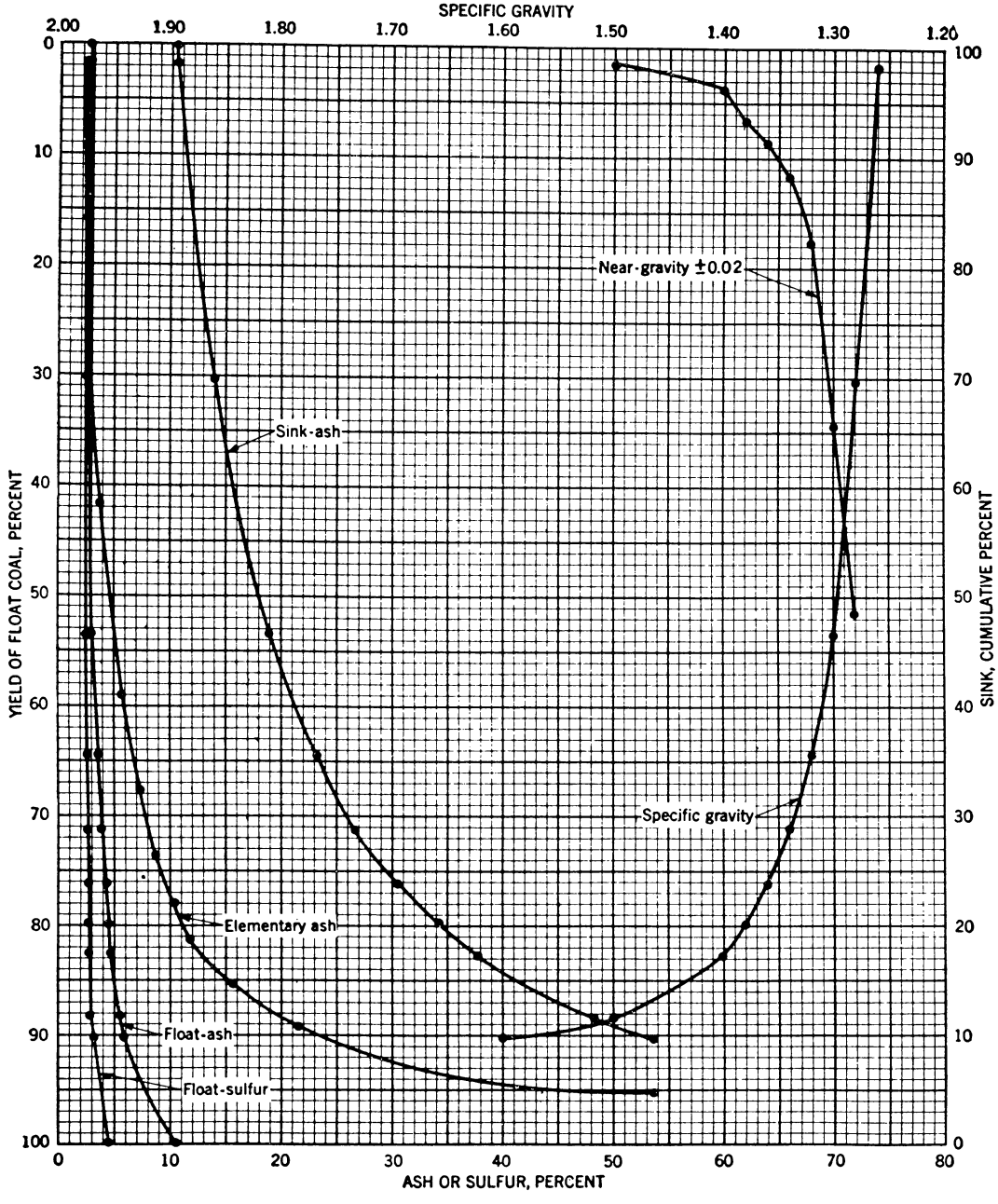
Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	85.	.8	2.6	2.21	.8	2.6	2.21	100.0	11.4	4.62	
1.26 - 1.28	2428.	23.0	3.0	2.38	23.8	3.0	2.37	99.2	11.4	4.64	47.8
1.28 - 1.30	2623.	24.8	4.8	2.58	48.6	3.9	2.48	76.2	14.0	5.33	40.9
1.30 - 1.32	1700.	16.1	6.1	2.94	64.7	4.4	2.59	51.4	18.4	6.65	24.3
1.32 - 1.34	868.	8.2	7.9	3.42	72.9	4.8	2.69	35.3	24.0	8.35	12.3
1.34 - 1.36	432.	4.1	9.5	4.17	77.0	5.1	2.77	27.1	28.9	9.85	7.1
1.36 - 1.38	316.	3.0	10.9	4.86	80.0	5.3	2.84	23.0	32.4	10.86	5.3
1.38 - 1.40	240.	2.3	12.3	5.34	82.3	5.5	2.91	20.0	35.6	11.76	3.5
1.40 - 1.50	615.	5.8	16.6	6.52	88.1	6.2	3.15	17.7	38.6	12.58	1.6
1.50 - 1.60	223.	2.1	22.1	9.85	90.2	6.6	3.31	11.9	49.4	15.55	
Sink - 1.60	1030.	9.8	55.3	16.78	100.0	11.4	4.62	9.8	55.3	16.78	
Totals	10560.	100.0									

DATA SHEET 54.—HITCHMAN MINE SAMPLE, ⅜-INCH CRUSHING. 2 BREAK-THROUGH INBY 6 AND 7. SIZE, ⅜ INCH BY 14 MESH.



Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	188.	8.6	2.4	2.42	8.6	2.4	2.42	100.0	10.0	4.10	
1.26 - 1.28	615.	28.3	2.6	2.50	36.9	2.5	2.48	91.4	10.7	4.26	46.4
1.28 - 1.30	393.	18.1	4.0	2.65	55.0	3.0	2.54	63.1	14.4	5.05	29.1
1.30 - 1.32	239.	11.0	5.7	2.99	66.0	3.5	2.61	45.0	18.6	6.02	17.9
1.32 - 1.34	150.	6.9	7.3	3.32	72.9	3.8	2.68	34.0	22.7	7.00	11.0
1.34 - 1.36	88.	4.1	8.8	3.73	77.0	4.1	2.73	27.1	26.7	7.94	7.5
1.36 - 1.38	73.	3.4	10.1	4.18	80.4	4.4	2.79	23.0	29.8	8.68	5.9
1.38 - 1.40	54.	2.5	11.5	4.68	82.9	4.6	2.85	19.6	33.2	9.45	3.6
1.40 - 1.50	118.	5.4	14.6	5.98	88.3	5.2	3.04	17.1	36.4	10.14	1.4
1.50 - 1.60	40.	1.8	20.4	7.80	90.1	5.5	3.14	11.7	46.4	12.07	
Sink - 1.60	215.	9.9	51.3	12.86	100.0	10.0	4.10	9.9	51.3	12.86	
Totals	2173.	100.0									

DATA SHEET 55.—HITCHMAN MINE SAMPLE, ⅜-INCH CRUSHING. 2 BREAK-THROUGH INBY 6 AND 7. SIZE, 14 BY 100 MESH.



Specific gravity fractions	Elementary data				Computed cumulative data						Near-gravity ±0.02 percent
	Weight grams	Percent			Float, cumulative percent			Sink, cumulative percent			
		Weight	Ash	Sulfur	Weight	Ash	Sulfur	Weight	Ash	Sulfur	
Float- 1.26	40.	1.8	2.8	2.30	1.8	2.8	2.30	100.0	10.4	4.33	
1.26 - 1.28	627.	28.3	2.4	2.36	30.1	2.5	2.36	98.2	10.6	4.36	51.7
1.28 - 1.30	520.	23.4	3.8	2.57	53.5	3.0	2.45	69.9	13.9	5.17	34.4
1.30 - 1.32	245.	11.0	5.6	2.92	64.5	3.5	2.53	46.5	18.9	6.48	17.6
1.32 - 1.34	147.	6.6	7.2	3.33	71.1	3.8	2.60	35.5	23.1	7.59	11.6
1.34 - 1.36	110.	5.0	8.7	3.61	76.1	4.2	2.67	28.9	26.7	8.56	8.8
1.36 - 1.38	85.	3.8	10.3	4.03	79.9	4.4	2.74	23.9	30.4	9.59	6.6
1.38 - 1.40	61.	2.8	11.7	4.45	82.7	4.7	2.79	20.1	34.2	10.65	3.9
1.40 - 1.50	123.	5.5	15.5	5.88	88.2	5.4	2.99	17.3	37.8	11.63	1.5
1.50 - 1.60	43.	1.9	21.4	8.22	90.1	5.7	3.10	11.8	48.3	14.33	
Sink - 1.60	219.	9.9	53.6	15.53	100.0	10.4	4.33	9.9	53.6	15.53	
Totals	2220.	100.0									

DATA SHEET 56.—HITCHMAN MINE SAMPLE, 14-MESH CRUSHING. 2 BREAK-THROUGH INBY 6 AND 7. SIZE, 14 BY 100 MESH.