THE MEIGS CREEK NO. 9 COAL BED IN OHIO

PART I - GEOLOGY AND RESERVES

By William H. Smith, Russell A. Brant, Fred Amos

PART II - WASHABILITY CHARACTERISTICS
AND OTHER PROPERTIES

By Peter O. Krumin

1952

Division of Geological Survey
R. I. No. 17

Engineering Experiment Station
Bull. No.151

STATE OF OHIO
Frank J. Lausche, Governor

NATURAL RESOURCES COMMISSION
George Wenger, Chairman

John A. Slipher,
Vice Chairman

Bryce Browning,
Secretary

C. D. Blubaugh
Dr. C. L. Dow
A. W. Marion
Dr. John L. Rich
Milton Ronsheim
Dean L. L. Rummell

DEPARTMENT OF NATURAL RESOURCES
A. W. Marion, Director

DIVISION OF GEOLOGICAL SURVEY
John H. Melvin, Chief

THE OHIO STATE UNIVERSITY

COLLEGE OF ENGINEERING
Lawrence D. Jones, Acting Dean

ENGINEERING EXPERIMENT STATION
J. R. Shank, Assistant Director

THE MEIGS CREEK NO. 9 COAL BED IN OHIO

PART I - GEOLOGY AND RESERVES

By William H. Smith, Russell A. Brant, Fred Amos
Coal Geologists, Division of Geological Survey
Department of Natural Resources

PART II - WASHABILITY CHARACTERISTICS AND OTHER PROPERTIES

By Peter O. Krumin
Associate Professor of Fuel Research
The Engineering Experiment Station and
Department of Chemical Engineering
The Ohio State University

This publication is issued as Report of Investigation No. 17 of the Division of Geological Survey and as Bulletin No. 151 of the Engineering Experiment Station and represents cooperative work on the part of both agencies.

Blank Page

TABLE OF CONTENTS

PART I. GEOLOGY AND RESERVES

PART II. WASHABILITY CHARACTERISTICS AND OTHER PROPERTIES

TABLE OF CONTENTS (Part II Cont'd.)

PART I. - GEOLOGY AND RESERVES

By William H. Smith, Russell A. Brant, Fred Amos

Page 2 is blank

GEOLOGY AND RESERVES

ABSTRACT

The location of the Meigs Creek coal deposits is shown on Map I. (See following page.) As calculated in this study this bed extends in mineable thickness over 1040 square miles, and contains 3,973,331,000 tons of coal reserves. These remaining reserves in the Meigs Creek bed are believed to be the largest in any of Ohio's easily available coal deposits, except perhaps in the Pittsburgh #8 seam. The coal lies near the surface and is easily accessible by stripping. This has caused a 400% rise in the production of coal from the seam during the past 8 years. Quality wise, the coal in the #9 seam does not compare well with other Ohio coals, so that to date its chief utilization has been in the production of electrical power. In much of the field, the seam occurs as two beds, or benches, separated by as much as 30 inches of clay parting which adds to the difficulty in mining and cleaning. This has neccessitated the compilation of reserve tonnage separately for each of the benches. Part II of the report discusses laboratory investigations of methods of improving the quality of the coal by mechanical cleaning. Part I contains a discussion of the geology of the seam and gives the reserves by thickness (14"-28", 28"-42", 42"-54", etc.) and by reliability category (proven, probable, and inferred) for each township in which mineable Meigs Creek coal occurs.

INTRODUCTION

SCOPE OF THE PROBLEM

The Meigs Creek coal is the youngest of the Pennsylvanian age coal beds mined to a large extent in Ohio. It lies near the surface over large areas and has experienced a great increase in development during the past 5 years due to large and ever growing demands for low cost fuel for new industries located along the Muskingum and Ohio Rivers.

Because the Meigs Creek bed is as yet a largely undeveloped coal resource, which is being eagerly sought after, it was chosen as the first to be compiled in the new program of study and appraisal of Ohio coal reserves.

The entire field of mineable coal has been mapped on large sheets covering 1° of longitude and $1/2^{\circ}$ of latitude, in accordance with the recommendations of the National Bituminous Coal Advisory Council. These maps show by numbers and symbols all of the known data regarding the location, thickness, geological characteristics, quality, etc. regarding this coal. Such maps, requiring many months of preparation and interpetation, constitute the essence of any reserve study. This report will consist primarily of a discussion of the salient features regarding the coal which are evident from a study of the resource maps together with a presentation of graphs and charts giving details of the amounts of coal in the field. As an example of the detailed work undertaken for this estimate, twenty maps (most of them covering an area equivalent to eight topographic sheets) were prepared to represent information concerning the thickness of the coal and the extent of mined-out coal. Reproductions of the hand-prepared copies of these work maps are being made available, for a small charge, to mining engineers and others concerned with explicit details of the coal; however, their large size and intricate detail preclude the possibility of their being published with the funds currently available for this work.

SOURCES OF INFORMATION

The geologic information upon which this reserve estimate is based has been accumulated over a period of seventy years in the public files, and printed reports of the Ohio Geological Survey and other agencies. Thus, this report and the reserve estimate constitute to a large extent a compilation and summary of basic data collected by many geologists and engineers, most of whom are listed, together with the sources of the information, in a bibliography at the end of Part I.

LOCATION AND EXTENT

The reserves of mineable Meigs Creek coal are present in ten counties in eastern and southeastern Ohio. The extent of the bed in these counties is shown in Map I. The coal is present only as a thin seam south of the Hocking River and gradually diminishes southward into Meigs County and Gallia County, where it can no longer be traced with regularity as a definite element in the stratigraphic

sequence. All along the western edge of the coal outcrop (see Map I), from McConnelsville to Steubenville, the coal is of a fair quality and contains large areas of strippable resources. To the east the coal becomes deeper due to regional dip and passes into West Virginia, Pennsylvania, and Maryland where it is known as the Sewickley seam.

SUMMARY OF RESERVE ESTIMATE

The total estimated original reserves in the Meigs Creek bed are nearly 4,021,000,000 tons. In the summary table further on in the report, this is subdivided and reported by counties and townships for each of the reliability and thickness categories outlined below. Deducting the total production of coal to date from this bed, there remains a reserve as of January 1, 1952 of 3,973,000,000 short tons, of which at least half should ultimately be recoverable. The reserves in the principal counties are as follows:

Table I. Summary of Meigs Creek Coal Reserves by County and Thickness
(In thousands of short tons.)

	Thickness				
County	14"-28"	28"-42"	42"-54"	Over 54"	Total
Athens	26,874	12,718	8,206	5,258	53,056
Belmont	333,345	511,438	668,842	126,072	1,639,697
Guernsey	2,746	5,034	10,582	-	18,362
Harrison	9,516	31,321	65,463	26,734	133,034
Jefferson	20,557	38,121	6,636	-	65,314
Monroe	222,077	43,907	10,313	-	276,297
Morgan	69,089	112,762	131,957	16,534	330,342
Muskingum	5,258	34,983	84,968	13,059	138,268
Noble	141,514	235,954	347,135	129,436	854,039
Washington	287,908	151,178	68,783	4,484	512,353
Total	1,118,884	1,177,416	1,402,885	321,577	4,020,762

Reserves of coal in the Meigs Creek bed were classified according to the thickness of the coal at intervals of 14 to 28 inches, 28 to 42 inches, 42 to 54 inches, and over 54 inches, thereby conforming to categories of thickness recommended by the National Bituminous Coal Advisory Council for reporting coal reserves. Within each of these categories of thickness the coal was divided, on the basis of all known geological data concerning it, into four categories depending on reliability of the information, namely: proven coal, which is within 1/2 mile of known information regarding thickness and continuity; probable coal, which is beyond 1/2 mile, but no more than 2 miles from positive data; strongly inferred coal, from 2 miles to 4 miles from positive data; and weakly inferred coal, which is beyond 4 miles from known thickness measurements, but geologic evidence suggests that the coal should be present.

ACKNOWLEDGEMENTS

The authors wish to express their appreciation to numerous individuals, coal companies, and other state departments for contributions that were invaluable in the preparation of this report. The Ohio Division of Mines and the Division of Reclamation furnished data relative to mining activity and extent of past mining; the management of numerous coal companies permitted geologists in the field to examine exposures of the coal and collect samples for quality analyses. Staff members who contributed to the completion of this report are: Mrs. Marian Klein, who aided in organizing the statistical summaries and in editing; Mr. Gilbert Smith, who compiled preliminary data from Athens County; Mr. Richard Turner, who was in charge of the drafting for the project and

Extent of Meigs Creek coal bed in Ohio

Outcrop of Meigs Creek coal

Coal less than 14" in thickness

Coal more than 14" in thickness

SCALE 0 5 10 miles

1 inch equal about 6.7 miles

MAP I

who prepared for publication the map illustrations found in this report; and Mrs. Dorothy Watkins, who aided in compiling the selected bibliography. William Halls, John Caine and numerous other assistants in the Division of Geological Survey aided in collecting and drafting the voluminous data involved.

The authors also wish to express their indebtedness to Dr. Gilbert H. Cady, consultant to the Division of Geological Survey, who generously contributed his wealth of experience in setting forth the methods and procedures followed in this first modern coal reserves calculation undertaken in Ohio. Our gratitude is also extended to the U. S. Geological Survey for its contribution of data in Belmont County, and to the U. S. Bureau of Mines for analysing samples submitted for chemical and petrographic analysis.

COAL GEOLOGY

The Meigs Creek coal lies near the middle of the Monongahela Series. It is generally found 90 to 110 feet above the Pittsburgh coal and 150 to 170 feet below the Waynesburg coal, which marks the upper limit of Pennsylvanian age deposits in Ohio. The name was first supplied to the seam in Ohio by C. N. Brown in 1884 when he found that the central part of the field of thick coal in Morgan County was drained by Meigs Creek. The seam is stratigraphically equivalent to the Sewickley coal of Pennsylvania and West Virginia.

The Meigs Creek is the uppermost (youngest) of the Ohio coal seams that is of workable thickness over an extensive area in this state. This coal is unique among the Ohio coal beds as it is moderately thick over a very large area (1,040 sq. mi.), yet its reserves have remained virtually untouched until the past five years. This has been due to the ready availability of coals of lower ash content, such as the Pittsburgh coal, which are equally available in the same marketing areas.

Although detailed reserve figures, such as are presented in this report for the No. 9 bed, are not available as yet for other Ohio coals, it seems safe to state that no other Ohio coal bed offers a reserve equal to that found in the Meigs Creek seam. This is especially true as far as potential strippable coal is concerned.

The Meigs Creek coal in Ohio, as an entity in the geologic column, can be traced throughout an area of more than 2,000 sq. mi. from southern Jefferson County, southwestward across the state to the Hocking River in central Athens County without significant interruptions. In southern Athens County, Meigs, and Gallia Counties the bed becomes thin and inconspicuous and more or less loses its identity. Therefore, in this estimation of reserves, the coal lying south of the Hocking River is not considered.

The thickest deposits of Meigs Creek coal occur in southern Harrison, western Belmont, north central Washington, Noble, eastern Guernsey, and eastern Morgan Counties (see Map II). Elsewhere in the coal field in Jefferson, Monroe, Muskingum and Athens Counties, the bed is generally thinner and more irregular.

In the northern part of the coal field, (Belmont County and West Virginia panhandle) the Meigs Creek coal is associated with a limestone series of strata. That is to say, the coal and its associated underclay and roof shale were deposited in a basin which was receiving principally calcareous sediments. In the extreme southern part of the basin of accumulation of the Meigs Creek coal (Meigs and Gallia Counties) there was dominantly clastic sedimentation taking place both prior to and following the coal period, so that here the coal is thin and often undefinable and occurs embedded in thick deposits of sandstone and sandy shale. In the central part of the field the Meigs Creek coal is found interbedded with deposits representing a mingling of the chemical and clastic deposits, so that the type of overburden often changes quite rapidly. Here also are quite often found channel type sandstones which extend down to, or occassionally cut out, the coal bed.

The structure of the Meigs Creek coal follows the regional dip of the strata in eastern Ohio-about 30 feet per mile to the southeast. The general dip of the bed, however, is subject to many local irregularities caused by structural features such as the Parkersburg-Loraine syncline and the Cambridge anticline.

Elevation data on Meigs Creek coal bed is insufficient at present to allow construction of structure contour lines on the coal resources maps prepared in connection with this reserves study. The need for detailed maps showing structural irregularities of the coal bed is of course obvious to anyone concerned with coal mining, and it is anticipated that such structure maps will be prepared area by area as sufficient data become available.

Over a great part of its extent in Ohio, the Meigs Creek seam is characterized by two benches of coal. These two benches of mineable coal are separated by a parting varying from 4" to 3' or more

in thickness which is most pronounced in southeastern Noble County (see Maps II & III). Here both benches as well as the parting are at their maximum thickness. It appears that the parting represents an influx of clastic deposits (silt and mud) into the coal basin after the accumulation of the lower bench. This was followed by a repetition of coal-forming conditions bringing about the formation of the upper bench.

The parting diminishes in thickness from the above mentioned area outward toward the margins of the field and the upper bench also becomes thinner. It thus appears that where the parting is not present the bone coal and shale at the top of the single remaining seam represents the equivalent of the upper bench of mineable coal in the center of the coal field.

Maps II and III illustrate the distribution of the upper and lower benches, and the region where the thickness of the parting necessitates separate consideration of each bench in mining and in calculation of reserves.

When all coal thickness data had been plotted on the work maps and analysed, it was apparent that the upper bench was not of mineable thickness where the parting was less than 4 inches thick. Also it was felt that a parting of about 4 inches was probably the maximum that could be included with the coal in mining. In those areas where the parting is less than 4 inches thick, it could not be distinguished from other, more local partings, and the entire coal seam was considered as lower bench in calculating the reserves.

ANALYSIS OF THE COAL

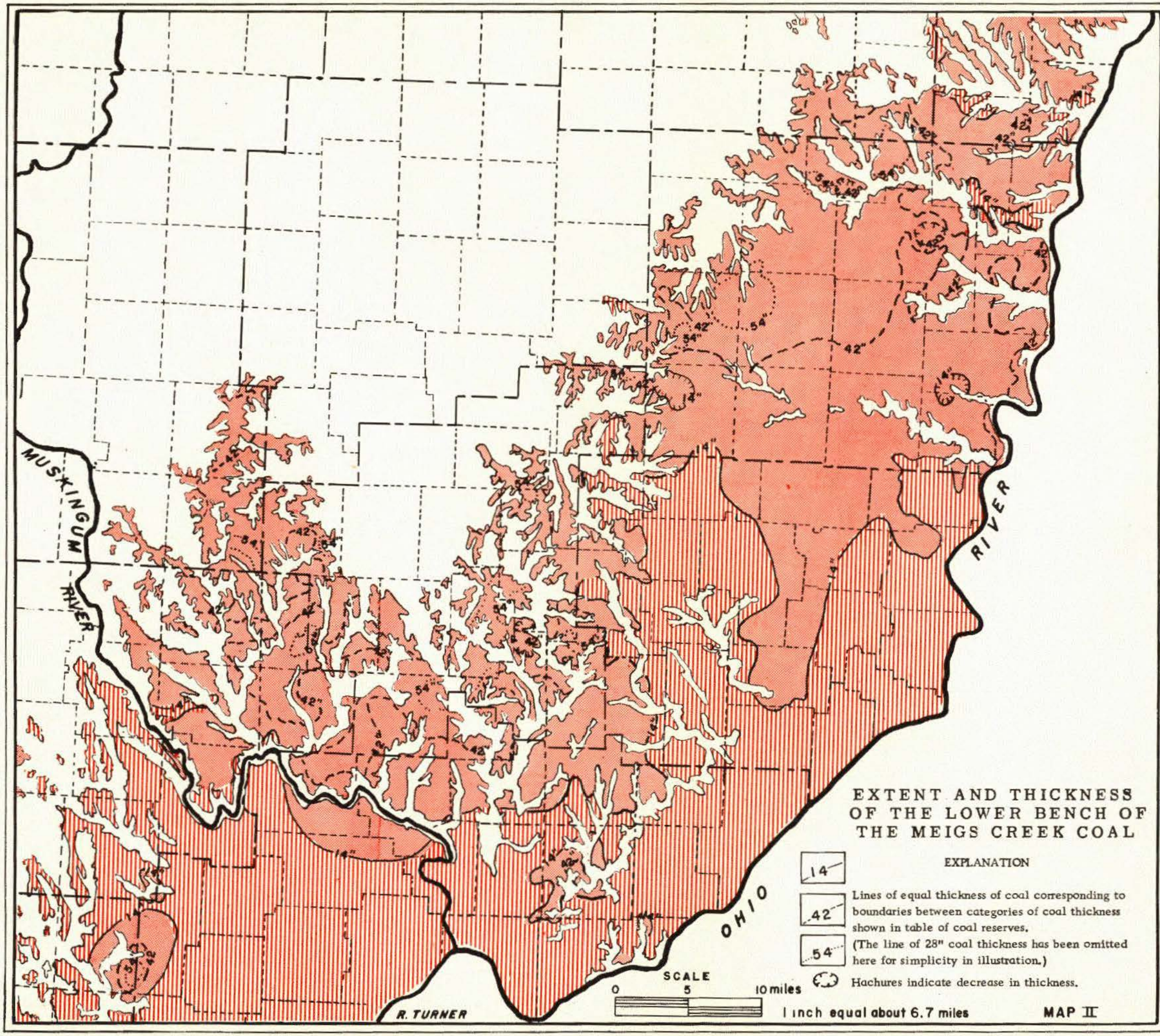
The Meigs Creek coal throughout the Ohio field is classed as High Volatile Bituminous A.[1] The rank index[2] of the coal appears to range between 140 and 144, with some indication that it falls below 140 in the southwestern part of the field.

The average analytical values for the Meigs Creek coal as computed from 41 analyses listed in Bulletin 34 of the Ohio Geological Survey[3] are, on the "as received" basis: moisture 4.20%, volatile matter 37.84%, fixed carbon 46.03%, ash 11.93%, sulphur 4.22%, and B.t.u.'s 12,150. A number of complete analyses of this coal were carried out at the Engineering Experiment Station in connection

SECTION OF MEIGS CREEK COAL BED IN NW 1/4 SEC. 4, JEFFERSON TOWNSHIP, NOBLE COUNTY

		Inches
Upper Bench	Coal, bright, thin banded, bony	1
	Coal, bright, thin to medium banded, some thick vitrain bands	6½
	Shale, carbonaceous	⅜
	Coal, bright, medium to thin banded	1⅝
	Shale, grey	⅛
	Vitrain	⅛
	Coal, bright, medium banded	1¼
	Bone	⅛
	Coal, bright, thin to thick banded, several vitrain bands	8⅛
	Coal and bone	1¼
	Coal, bright, thin banded, somewhat bony	4¼
	Fusain, persistent band	⅛
	Coal, bright, blocky	3¾
	Total	29⅛
Parting	Shale, clayey, dark grey, massive	28
	Total	28
Lower Bench	Bone	1½
	Coal, blocky, generally dull, thin to thick banded, several wide vitrain bands and a number of pyritic and slate lenticular partings	11½
	Coal, bony, dull	1¼
	Coal, bright, medium banded	1¼
	Fusain	Trace
	Coal, blocky, thin banded	4
	Fusain	Trace
	Coal, bright, blocky, dominantly thin banded, vitrain in lower part to ¼" thick	8¼
	Bone	¼
	Coal, bright, thin banded with slate partings	2
	Coal, thin to thick banded, ⅛" to ¼" vitrain bands	1¾
	Shale	1
	Coal, bright, pyritic near top, shaley with some vitrain bands	10¾
	Coal, bright, blocky, thin banded and very brittle	14¼
	Total	57¾

1 *American Society for Testing Materials. Report of Committee D-5 on standards for coal and coke. American Society for Testing Materials, Philadelphia, Pa., pp. 79-84, 1948.*
2 *G.H. Cady, Classification and Selection of Illinois Coal, Illinois Geological Survey Bulletin 62, pp 15 to 31, 1935. Rank index is the ash free moist Btu to the nearest 100 Btu and divided by 100. Thus 13,250 Btu = 132 rank index.*
3 *Bownocker and Dean, Geological Survey of Ohio, Fourth Series, Bulletin 34, 1929.*


MUSKINGUM RIVER
OHIO RIVER
R. TURNER
42"
54"
14"
EXTENT AND THICKNESS OF THE LOWER BENCH OF THE MEIGS CREEK COAL
EXPLANATION
14
Lines of equal thickness of coal corresponding to boundaries between categories of coal thickness shown in table of coal reserves.
42
(The line of 28" coal thickness has been omitted here for simplicity in illustration.)
54
Hachures indicate decrease in thickness.
SCALE
0 5 10 miles
1 inch equal about 6.7 miles
MAP II

MUSKINGUM RIVER

OHIO RIVER

OHIO

MEIGS CREEK COAL BED AREA SHOWING EXTENT OF PARTING WHERE GREATER THAN 4 INCHES THICK AND UPPER BENCH WHERE GREATER THAN 14 INCHES THICK.

Upper Bench greater than 14" in thickness

Parting greater than 4" in thickness

SCALE

0 5 10 miles

1 inch equal about 6.7 miles

MAP III

with its part of this study, and the reader is referred there for further details concerning the analysis of the coal.

The impurities in the coal (ash and sulphur), which are responsible for the retarded development of this fuel, are present to a large extent in the form of closely-spaced, paper-thin, shaley partings which can not be effectively removed by ordinary cleaning methods. Since it is the purpose of the research discussed in Part II of this report to investigate possible methods of upgrading the quality of the coal by washing, the reader is referred there for further discussion of this subject.

DESCRIPTION OF THE COAL BED [4]

The make up of the Meigs Creek (No. 9) coal bed in terms of the coal constituents has been determined from a column sample collected by R.A.Brant, W. H. Smith, Leland Sprout, and R. Turner of the Ohio Division of the Geological Survey at the mine of the Electrometallurgical Division of Union Carbide and Carbon Company in the NW 1/4, NW 1/4, Sec. 4, Jefferson Township, Noble County, Ohio. The petrographic analysis was carried on using thin sections of the coal under the supervision of Mr. Bryan C. Parks, Technologist of the Coal Constitution and Miscellaneous Analysis Section of the United States Bureau of Mines, Pittsburgh. The analysis of the bed was prepared in two parts consisting of an upper bench 29-1/4 inches, and a lower bench 58-5/8 inches, but only 57-1/2 inches were represented in the lower bench column.

Table II below reports the coal constituents and mineral matter present.

The coal of both columns is described as "one hundred percent bright xyloid" or woody coal.

The analysis indicates, in terms of petrographic ingredients, that the coal is made up of a little more than half of vitrain or microvitrain, i.e., bright unstriated coal, and between 5 and 10 percent of dull coal consisting of durain or splint coal. Fusain or mineral charcoal is more common in the lower than in the upper bench, but this may be only a local circumstance. The amount of free mineral matter is relatively high. In general it is assumed that the amount of mineral matter in coal exceeds the amount of ash resulting from combustion, but in this case no means exist for determining the inherent or organically combined mineral matter, Hence, the probabilities are that the amount of ash would be about as much as the amount of mineral matter.

Five thin layers, relatively high in opaque attritus (splint coal), were present in the lower bench but none exceeded the width of a microscopic thin section or about .7 inch.

Analyses of the individual blocks of coal used in petrographic analyses by the U. S. Bureau of Mines gave an average ash content of 17.2 percent for 38 blocks of the upper bench and 13.4 percent for 75 blocks of the lower bench, or an average of 14.7 percent for the entire bed.

Additional information is being sought concerning the mineral matter and ash distribution characteristic of the two columns of coal. This will be reported in a later publication at which time it is also hoped that additional columns of the Meigs Cfeek coal bed will have been studied.

Table II. Summary of Petrographic Constituents of the Meigs Creek Coal.

	Upper bench		Lower bench	
Petrographic constituents	As received (Percent)	Mineral matter free (Percent)	As received (Percent)	Mineral matter free (Percent)
Anthraxylon	49.2	58.9	47.3	54.9
Translucent attritus	28.1	33.6	27.0	31.4
Opaque attritus	4.7	5.6	8.0	9.3
Fusain	1.6	1.9	3.8	4.4
Translucent mineral matter	9.3	-	4.0	-
Pyrite	7.1	-	9.9	-
Total	100.0	100.0	100.0	100.0

[4] By Gilbert H. Cady

COAL RESERVES

This report on the resources of the Meigs Creek bed is the result of compiling and analysing a large amount of information which has been accumulated from the work of many geologists over the past 70 years.

Methods of approach to the problem of estimating the coal reserves of the Meigs Creek bed are those which are used and accepted in other states and by the United States Geological Survey. The classification of the reserves by thickness and category is that recommended by the National Bituminous Coal Advisory Council. The discussion below describes the definitions and premises upon which this estimate is based.

CLASSES OF RESERVES

Definitions and Premises

Thickness. -- The minimum thickness of coal included in this reserve estimate is 14 inches. The coal is divided into the following four thickness categories: 14 to 28 inches, 28 to 42 inches, 42 to 54 inches, and all over 54 inches. In practice, bituminous coal is divided into categories at 14 inch intervals from 14 to 42 inches and in 12 inch intervals beyond 42 inches in thickness.

Overburden. -- According to accepted procedure, the overburden is usually classified as 0-1000, 1000-2000, 2000-3000 feet. Coal under more than 3000 feet of overburden is not considered an economic asset. However, since nearly all of the estimated reserves of the Meigs Creek bed are 500 feet or less below the surface, no divisions in this classification are necessary. General remarks about the cover will be found in the county descriptions.

CLASSIFICATION ACCORDING TO RELIABILITY OF ESTIMATE

The estimates presented herein are also classified with regard to the distance from points of information. The greater the distance of a point from a known locality, the more uncertain is the thickness predicted at that point. Reliability classification, hence, is presented in four categories: proven, probable, strongly inferred, and weakly inferred. Figure 1 illustrates, in part, the reliability concepts described below.

Proven reserves. -- Those reserves which lie within one-half mile of definite information are proved, and the estimate is considered to be within 20% of the true tonnage. Points of definite information are measurements from outcrops, from mines, and from drill cores. Since the variation in the Meigs Creek bed thickness seldom appears to be abrupt, it is further deemed that a zone of coal around any mine for a distance of one-half mile constitutes a proven block of coal. Similarly a one-half mile circle around any well core constitutes a proven block of coal. The term "proven" is equivalent to the term "measured" of the U. S. Geological Survey and the U. S. Bureau of Mines.

Probable reserves. -- This class of reserves lies outside the proven block and extends to two miles from the point of definite information. Thus, probable reserves occupy an area extending from one-half mile from the point of actual measurement to two miles from that point; hence, it is one and one-half miles wide and extends beyond the boundary of the proven coal. This term is equivalent to the term "indicated" used by the U. S. Geological Survey and the U. S. Bureau of Mines.

Strongly inferred reserves. -- Those reserves which are estimated in an area beyond the two-mile limit (probable reserves) and extending to four miles from the point of definitely established data are classed as strongly inferred. This coal is that which lies in a band 2 miles wide, extending beyond the probable block. The degree of certainty of the actual tonnage in this block is naturally less than that of either the proven or probable categories. The "inferred reserves" used by the U. S. Geological Survey and the U. S. Bureau of Mines includes both the strongly and weakly inferred reserve categories of this report.

Weakly inferred. -- Coal estimated to lie beyond the four-mile limit of strongly inferred reserves constitutes weakly inferred reserves. It rarely happens that sufficiently well spaced data are available to insure adequate estimations; yet the general aspects of the geology indicate that the coal is present at mineable thickness. Because the information upon which the thickness is estimated lies at a moderate distance, the reliability and hence the confidence in the results is diminished, resulting in this fourth category of "weakly inferred reserve." It is interesting to note here that in the entire area of the Meigs Creek bed estimation, only 5.54 square miles which are

located in Watertown Township, Washington County, are classified in the weakly inferred reserve category.

CLASSIFICATION BY TYPES OF RESERVES

Coal reserves may be reported as original (before mining began), remaining (original reserve minus mined out and lost), or recoverable (amount available in the future), depending upon the point of view.

Original reserves. -- Original coal reserves are those that were in the ground before mining began. They are calculated by estimating all the coal which was included within the original outcrop line and which is 14 inches or more in thickness.

Remaining reserves. -- The difference between the original reserves, the coal mined out and that lost in mining constitutes remaining reserves. When coal is mined there are inherent small losses in processing and transportation, but in the underground mine as much as 40% to 50% of the coal may be untouched and unavailable to further mining and must be considered as lost.

Recoverable reserves. -- The amount of coal that may be taken from the ground from a given coal bed is called the recoverable reserves. The estimation is obtained simply by multiplying the remaining reserves figure by the known recovery rate: 50%, 40% or whatever it may be. The recovery rate is variable because of the different mining methods (underground and strip mining) and because of the continual advance in more efficient techniques of coal production. Another aspect to be considered is that coal is lost to mining because it lies beneath rivers, roads, and cities, or is penetrated by oil wells. Averitt and Berryhill (1951) consider that a recovery factor of 50% probably is a fair average for the total recovery rate on a regional scale. Certainly, variations occur that affect the recoverable estimate on a local scale. A special problem is the recovery of the upper bench. Percentage of coal recovered by strip mining is usually greater than by underground mining methods.

METHOD OF ESTIMATION FOR THIS REPORT

The preceding general ideas are embodied in the estimation of the Meigs Creek coal bed reserves. At the outset a series of work maps of 1° longitude by $1/2^{\circ}$ latitude were drawn from U.S. Topographic maps at a scale of 1/62500. On these maps were traced all of the political subdivision boundaries: sections, townships, and counties, and major streams.

The outcrop was traced, and all of the localities and file numbers of the data were accurately plotted. Several copies of the maps were then made in order that the upper and lower benches could be treated separately and the mineable reserves of each estimated.

Thickness information relating to each bench and the parting was placed on the respective maps. All partings exceeding 3/8 inch in thickness were excluded from the measurements of thickness data. After all data were properly plotted at appropriate locations, lines (isopachous lines) were drawn to connect points of equal thickness. The line values used were the 14", 28", 42", 54", 66", and 78". The average thickness for the block of coal between two isopachous lines was taken as the simple average between the two lines. Thus the coal between the 14" and 28" thickness lines averages 21 inches; that between 28" and 42" averages 35"; that between the 42" and 54" averages 48"; and that between 54" and 66" averages 60". Only small amounts of coal were found that averaged more than 60".

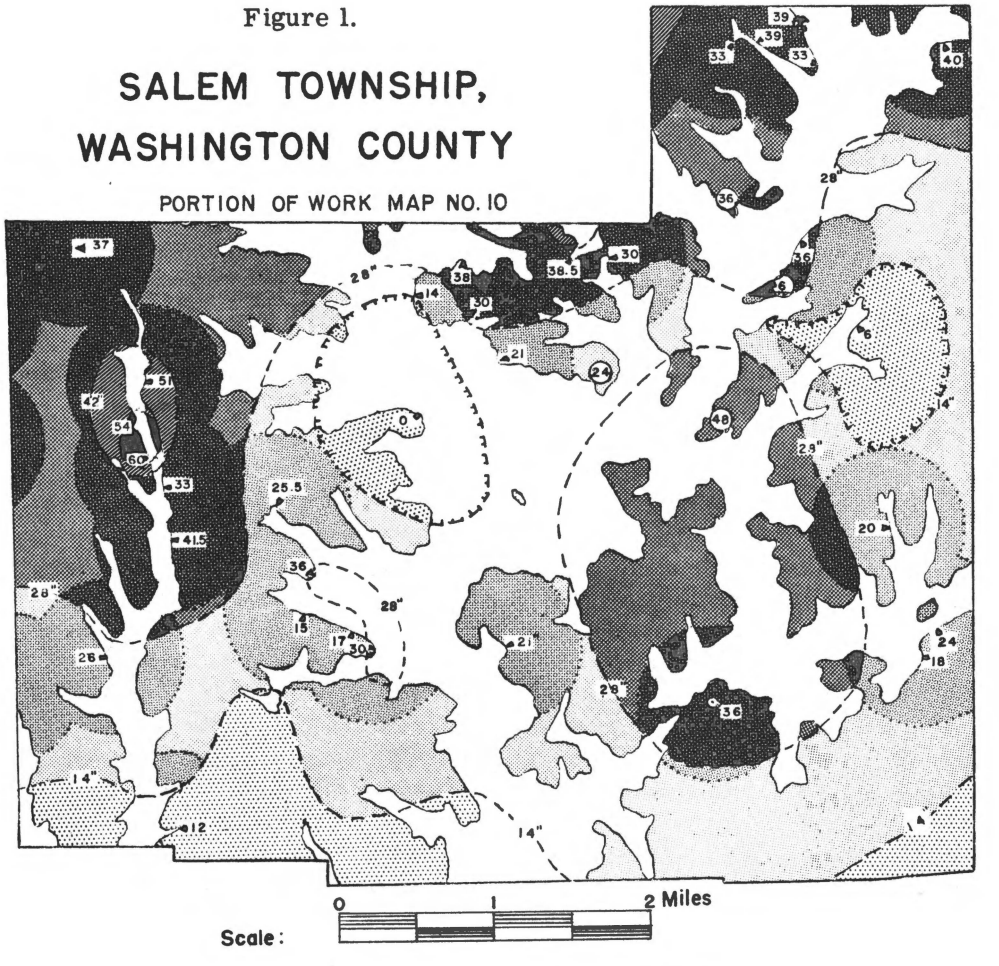
After the thickness lines were established, arcs were made around each point of definite data to determine the different categories of reliability. An arc with a 1/2 mile radius around the point and on the coal defines the proven coal; an arc with a 2 mile radius limits the probable coal; and the arc with the 4 mile radius limits the strongly inferred coal. The 14 inch thickness line forms the boundary or outer limit of weakly inferred coal except where the outcrop forms a natural limit. Certain data could not be used except to confirm, to a small extent, deductions made from other points. Such data include "reported" thickness of coal (thus not seen, and not measured) coal blossom (not definite, variation possible) and mines not reporting thickness. These could only be used in a general way in conjunction with nearby positive data.

Figure 1 is an actual sample of the map preparation described to this point. This is one township, however, and only a very small part of one of the work maps (pattern is added). It will be noted that only proven and probable categories of reliability show on this illustration. Over nearly all the Meigs Creek coal area, information is spaced so that most of the coal estimated is either in the proven or probable class. This is because the bed is exposed in outcrop over much of its extent.

Figure 1.

SALEM TOWNSHIP, WASHINGTON COUNTY

PORTION OF WORK MAP NO. 10



EXPLANATION OF MAP

This map is a copy of a portion of one of the work maps used and shows how the various classes of reserves are computed.

Numbers indicate the thickness of the coal at that point in inches. Values enclosed by rectangles indicate the exact location of coal measurements. Numbers in circles represent poor exposures of the coal or questionable information. Other data are designated by appropriate symbols, such as those shown above for mine and well records.

The solid line traces the outcrop of the coal around the stream valleys. Outcrop information was taken from previously prepared maps from the files of the Ohio Geological Survey.

The "isopach" lines, which theoretically connect all points of equal thickness in the coal bed, are interpolated from the points of known thickness on the map. (To a large degree, the measurements that are encircled were not considered reliable in this procedure.)

The last step in preparation was the setting up of the areas of reliability in order to show the relative accuracy of the estimation.

After compilation of all the geologic data on the map as described above, the various resulting areas were measured with polar planimeters. The areas thus obtained for coal of each class were then converted by calculation of tons of coal in each class and tabulated under the proper headings in Table VII.

After the various lines were plotted on the map, the area of each category of coal was determined by use of the planimeter. The data were recorded on forms by county and township and according to thickness and reliability category. The data were subsequently punched onto I.B.M. tabulation cards and the calculation and summation of results made on modern business machines.

Method of calculation. -- In order to calculate the amount of coal contained in a given bed in a given area it is necessary to find two factors, namely the volume and the density of the coal. The volume is determined by measuring the area and multiplying the result by the average thickness; the density is determined from the specific gravity and is equivalent to 96,000 tons per square mile inch.

The volume in square mile inches is multiplied by the density to determine the tons for a given area. Eighteen hundred (1800) tons per acre foot (one acre in area one foot thick) is frequently used as a convenient density factor in estimating small areas.

In calculation of the estimate, the areas of the different categories and thicknesses of the coal were measured with a planimeter and the figure placed on a special form for tabulating the data. After completion of the tabulation of the measurements by township, the data were then punched onto business machine cards. These punched cards were then used in electronic business machines to calculate, record and summarize the results. Summaries of the calculations are found in Tables III and VII.

ESTIMATE OF THE RESERVES

The table below shows that most of the estimate is in the proven or probable categories. This fact in itself is a strong indication that a large portion of the estimate may be considered accurate because of the relatively closely spaced points of information.

Table VII is a comprehensive reserve summary by county and township for the Meigs Creek bed. It is hoped that the data and results presented will be useful to both those who are interested in the broad, long-range view of coal resources and those who are interested in local areas.

Maps have been prepared which delineate the outcrop and thickness of the coal. Since these maps will be of great value to those concerned with specific details of the coal in local areas, arrangements have been made to supply reproductions of the maps prepared in connection with this study. At the end of Part I is an index map showing the areas and maps individually available and instructions for obtaining copies of these maps.

QUALITY OF THIS ESTIMATE

Although it is shown that this estimate is most detailed and comprehensive, there are areas where the indications of coal are weak. An example is in Waterford Township and adjacent lands in Washington County where the coal is deep and only one core log is available for estimating the thickness and extent of the coal. Also, in a large part of Monroe County and the southern part of Belmont County exposures of the coal, and hence accurate measurements of the coal are few, so that there is doubt regarding the actual content of the bed in some areas. Therefore, it is certain that additional information will ultimately effect a change in the present estimate in the less well known areas.

In order to show that this reserves estimation is in a large part well controlled by good information,

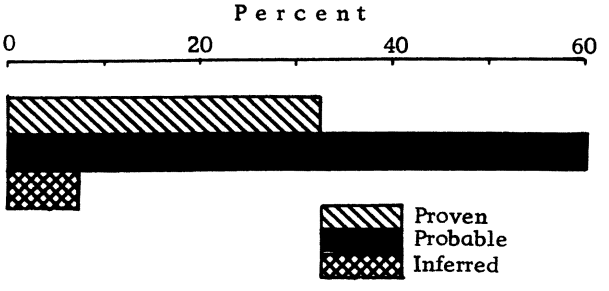
Table III. Summary of Estimated Original Reserves of Meigs Creek Coal in Ohio.
(In thousands of short tons.)

Reliability category	Thickness				
	14"-28"	28"-42"	42"-54"	Over 54"	Total
Proven	211,956	385,431	538,995	170,261	1,306,643
Probable	742,836	726,367	792,733	151,316	2,413,252
Strongly inferred	153,224	65,618	71,157	-	289,999
Weakly inferred	10,868	-	-	-	10,868
Total	1,118,884	1,177,416	1,402,885	321,577	4,020,762

the following diagram is presented.

It is apparent that a large portion of the estimate lies within 2 miles of accurate information, or within the boundaries of proven and probable coal.

Figure 2. Percent of Meigs Creek Coal Reserves by Category, Ohio, 1952.



COMPARISON WITH PREVIOUS ESTIMATES

It is believed that this is the most comprehensive estimation of the Meigs Creek coal to date. The present total is 4,020,762,000 short tons of estimated original reserves. Two published estimates have been made in the past. One is that of F. R. Clark (1917), wherein an estimate of 4,071,000,000 tons of original reserves was made for the Meigs Creek coal. Somewhat later (1929) F. A. Ray estimated 957,600,000 tons.

A summation of Clark's, Ray's, and the present estimate of reserves for the Meigs Creek bed are compared below.

It will be noted that the two previous estimates omit certain counties that are included in the present one. In some counties Clark's estimate was larger. Ray's estimate is based on only 3 counties, and considered only coal of 3-1/2 feet average thickness. It would appear that Ray took a strongly conservative approach.

The basic difference between the present estimate and the others is that the former estimates considered uniform average thickness over large areas, and the present estimate takes into account the widespread variations of the bed thickness throughout the field.

Since the three estimates are not based entirely upon the same premises, it would seem that the new one, presented here, is the most comprehensive. This is especially true since more data are now available for use in making an estimate of the coal than were available at the time of the previous estimates.

EXTENT OF MINING

Prior to 1945 very small amounts of Meigs Creek coal were mined. Most of the pre-1945 mining was confined to small underground operations. Accurate mine production statistics prior to 1945 are not available. However, the reported mine production in this seam for the years 1945 to 1951 indicate a rapid increase in the mining rate. The total mined-out coal from the Meigs Creek bed is

Table IV. Comparison of Previous and Present Estimates.
(In short tons.)

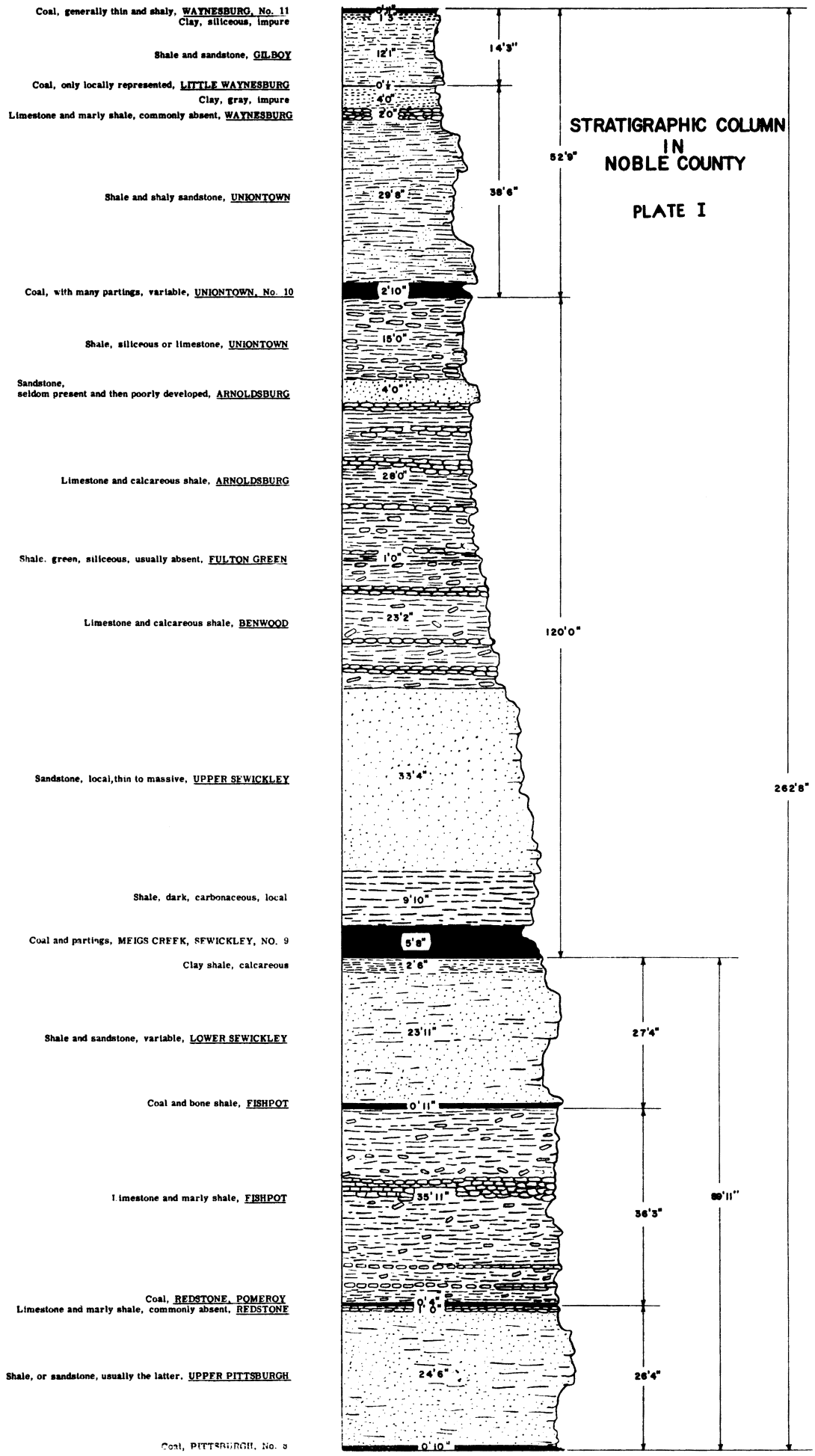
County	Present estimate	Ray estimate (1929)	Clark estimate (1917)
Athens	53,056,000	-	-
Belmont	1,639,697,000	907,200,000	1,663,000,000
Guernsey	18,362,000	-	-
Harrison	133,034,000	33,600,000	144,000,000
Jefferson	65,314,000	-	-
Monroe	276,297,000	-	670,000,000
Morgan	330,342,000	-	359,000,000
Muskingum	138,268,000	-	-
Noble	854,039,000	16,800,000	774,000,000
Washington	512,353,000	-	461,000,000
Total	4,020,762,000	957,600,000	4,071,000,000

TABLE V. EXTENT OF MEIGS CREEK COAL OUTCROP IN OHIO.*

County and Township	Linear miles of outcrop: Over 14" thick	Under 14" thick	Total	Square miles of coal over 14" thick
Athens				
Ames	-	63	63 -	-
Bern	33	41	74	9.06
Canaan	-	58	58	-
Rome	7	55	62	2.14
Total	40	217	257	11.20
Belmont				
Colerain	40	9	49	17.21
Flushing	50	-	50	9.89
Goshen	16	-	16	36.98
Kirkwood	99	-	99	9.71
Mead	19	-	19	30.58
Pease	48	7	55	18.22
Pultney	38	-	38	22.02
Richland	54	-	54	54.32
Smith	9	-	9	35.01
Somerset	25	8	33	26.45
Union	77	-	77	29.12
Warren	92	-	92	27.20
Washington	25		25	29.15
Wayne	24	1	25	33.97
Wheeling	88	-	88	18.66
York	31	1	32	19.79
Total	735	26	761	418.28
Guernsey				
Millwood	24	32	56	1.92
Oxford	2	-	2	.13
Spemcer	32	-	32	2.32
Westland	6	-	6	.38
Total	64	32	96	4.75
Harrison				
Archer	9	1	10	.57
Athens	82	1	83	12.38
Cadiz	57	-	57	4.89
Green	14	7	21	1.88
Moorefield	10	-	10	.53
Short Creek	59	3	62	11.71
Total	231	12	243	31.96
Jefferson				
Cross Creek	-	46	46	-
Island Creek	-	18	18	-
Mt. Pleasant	22	12	34	14.59
Smithfield	18	90	108	3.43
Warren	27	31	58	5.60
Wayne	-	69	69	-
Wells	-	82	82	-
Total	67	348	415	23.62
Monroe				
Adams	-	-	-	1.88
Benton	-	-	-	.25
Bethel	17	18	35	13.79
Center	5	1	6	18.70
Franklin	20	26	46	9.48
Malaga	3	15	18	11.42
Perry	7	7	14	13.28
Salem	-	-	-	4.41
Seneca	23	47	70	3.07
Summit	14	1	15	4.73
Sunsbury	-	-	-	7.63

County and Township	Linear miles of outcrop: Over 14" thick	Under 14" thick	Total	Square miles of coal over 14" thick
Monroe (cont'd)				
Switzerland	-	-	-	9.12
Washington	-	42	42	.34
Wayne	-	40	40	.75
Total	89	197	286	98.85
Morgan				
Bloom	34	5	39	2.23
Bristol	84	6	90	17.54
Center	48	2	50	29.83
Homer	-	12	12	-
Malta	3	60	63	.16
Manchester	92	-	92	13.90
Marion	-	68	68	3.48
Meigsville	81	15	96	21.34
Morgan	30	4	34	4.15
Penn	1	61	62	.38
Union	11	4	15	.48
Windsor	23	42	65	10.19
Total	407	279	686	103.68
Muskingum				
Blue Rock	34	-	34	2.10
Meigs	61	-	61	19.46
Rich Hill	90	-	90	9.08
Union	3	-	3	.14
Total	188	-	188	30.78
Noble				
Beaver	61	19	80	8.59
Brookfield	53	-	53	22.15
Center	55	1	56	4.47
Elk	85	1	86	21.63
Enoch	89	-	89	12.43
Jackson	77	-	77	29.65
Jefferson	75	-	75	15.60
Marion	94	-	94	12.70
Noble	16	-	16	1.45
Olive	69	-	69	7.49
Seneca	32		32	5.25
Sharon	44	30	74	23.11
Stock	92	-	92	12.06
Wayne	1	-	1	.53
Total	843	51	894	177.11
Washington				
Adams	51	1	52	24.71
Aurelius	58	-	58	7.52
Decatur	1	9	10	8.90
Fairfield	-	-	-	.40
Fearing	-	20	20	3.56
Independence	-	28	28	.13
Lawrence	52	22	74	12.42
Liberty	32	16	48	19.14
Ludlow	24	21	45	4.58
Muskingum	2	10	12	.44
Newport	10	40	50	1.95
Salem	83	3	86	14.48
Waterford	26	8	34	17.74
Watertown	-	-	-	10.22
Wesley	8	5	13	13.07
Total	347	183	530	139.26
State Total	3011	1345	4356	1039.49

* This table shows the miles of coal outcrop together with the area underlain by coal which serves to indicate the amount of strippable coal available in a given township. Comparison can also be made between the total extent of the coal bed and the extent of coal of mineable thickness.


Coal, generally thin and shaly, WAYNESBURG, No. 11
Clay, siliceous, impure
Shale and sandstone, GILBOY
Coal, only locally represented, LITTLE WAYNESBURG
Clay, gray, impure
Limestone and marly shale, commonly absent, WAYNESBURG
Shale and shaly sandstone, UNIONTOWN
Coal, with many partings, variable, UNIONTOWN, No. 10
Shale, siliceous or limestone, UNIONTOWN
Sandstone, seldom present and then poorly developed, ARNOLDSBURG
Limestone and calcareous shale, ARNOLDSBURG
Shale, green, siliceous, usually absent, FULTON GREEN
Limestone and calcareous shale, BENWOOD
Sandstone, local, thin to massive, UPPER SEWICKLEY
Shale, dark, carbonaceous, local
Coal and partings, MEIGS CREEK, SEWICKLEY, NO. 9
Clay shale, calcareous
Shale and sandstone, variable, LOWER SEWICKLEY
Coal and bone shale, FISHPOT
Limestone and marly shale, FISHPOT
Coal, REDSTONE, POMEROY
Limestone and marly shale, commonly absent, REDSTONE
Shale, or sandstone, usually the latter, UPPER PITTSBURGH
Coal, PITTSBURGH, No. 8
1'3"
12'1"
0'1"
4'0"
2'0"
29'8"
2'10"
15'0"
4'0"
28'0"
1'0"
23'2"
33'4"
9'10"
5'8"
2'6"
23'11"
0'11"
35'11"
0'4"
24'6"
0'10"
14'3"
38'6"
52'9"
120'0"
27'4"
36'3"
26'4"
89'11"
262'8"
STRATIGRAPHIC COLUMN
IN
NOBLE COUNTY
PLATE I

47,000,000 tons by map measurement. The discrepancy between the reported and the calculated amounts of mined coal can very likely be attributed to a number of causes. Identification of the bed is a matter of much confusion to the miner and operator, and it is known that much coal has been mined out and sold under names other than the Meigs Creek or Number 9 coal. Because of this, and because of gaps in the reported production by strip methods in the Meigs Creek coal the large discrepancies appear. The discrepancy in any given township, however, will be proportionately greater than that for the entire state. This is because most of the mining in the Meigs Creek coal has taken place in only six of the ninety townships containing mineable coal.

COUNTY DESCRIPTIONS

The following text consists of a series of county descriptions of the geology, geography, the Meigs Creek coal reserves, and mining activity. This part of the discussion is arranged geographically around two main centers of production and reserves, which are commonly referred to as the Belmont or Northern and Noble or Southern fields.

The Southern field will be considered first. It contains Noble County and adjacent parts of Washington, Athens, Morgan, Muskingum and Guernsey counties.

Table VI. Production in the Meigs Creek Coal Seam by County, Ohio, 1945 - 1951.*
(In short tons.)

County	1945	1946	1947	1948	1949	1950	1951	Total
Belmont	476,344	858,905	1,150,330	1,009,309	661,146	1,659,386	1,714,449	7,529,869
Guernsey	159,305	49,638	328,417	2,259	20,299	289,216	144,132	993,266
Harrison	418,508	963,700	925,995	1,692,943	734,184	242,530	506,732	5,484,592
Morgan	97,019	35,709	30,876	29,886	21,834	65,317	59,320	339,961
Muskingum	1,360	-	40	-	-	180,003	211,387	392,790
Noble	14,151	246,785	474,349	1,337,718	1,160,174	2,048,253	1,586,136	6,867,566
Washington	246	357	686	190,587	168,704	136,533	106,896	604,009
Total	1,166,933	2,155,094	2,910,693	4,262,702	2,766,341	4,621,238	4,329,052	22,212,053

* Based on Annual Reports of Ohio Division of Mines with adjustments and corrections made by the authors where identification of seam reported was apparently in error.

Nearly all of the coal now mined from the Meigs Creek bed is removed by stripping, and only a scattered few underground mines are presently active. It would seem that the stripping reserves are likely to last for some time. Advances in earth moving equipment together with new types of horizontal augers or "coal moles" will enlarge the amount of the more easily won reserve. However, it is presumed quite possible that the stripping coal may be depleted before refined techniques of shifting thicker overburden are developed, hence much of the estimate will form an underground mining reserve. That is, of course, the viewpoint at present.

For those who are interested in some round numbers for the amount of coal available for stripping, Table Vshows the number of miles of outcrop as well as the total area underlain by the coal.

NOBLE COUNTY

Geography and geology. - The population of Noble county in 1950 was 11,750. The principal town, Caldwell, population 1,767, is the county seat. Other towns in the county are small, less than 500 people each. The principal occupation is farming, although the mining industry employed 279 persons in 1951.

Highways form a good transportation net over the county. U.S. Route 21 traverses the county from north to south through the middle, and State route 78 from east to west. Other state roads form the rest of the main highway system, and county and township roads connect the more remote areas.

Rail transportation is available over the Marietta-Cleveland section of the Pennsylvania line which runs

north and south through Noble County. Thus, this railroad connects the Noble field with both the Ohio River and Lake Erie. East-west rail transportation is available on the Wheeling-Chicago line of the B. & O., which passes through Cambridge 25 miles north of Caldwell.

The surface of the county is marked by deeply cut valleys and varies in elevation from 650 feet to 1250 feet above sea level. The valley walls in the southern part of the county are steep and measure 40% in many places. Nearer the heads of the streams much gentler slopes are found.

Duck Creek forms the master drainage system in the southern part of the county, and Wills Creek in the northern part. Senecaville reservoir occupies a part of one of the Wills Creek tributaries in parts of Seneca Township and some of the surrounding area. It is located just outside the Meigs Creek outcrop area.

Stratigraphy: - The position of the Meigs Creek coal with respect to other coal seams and their intervening strata is shown graphically in the generalized section for Noble County (Plate I). The geology of these strata is not greatly different in the surrounding counties to which the following discussion will also apply.

Throughout the Noble field, the Meigs Creek is the principal coal in the geologic column as far as economic worth is concerned. The Pittsburgh coal which competes heavily with the Meigs Creek seam in the Belmont field is of only minor value in the Noble County area. There is a small deposit of Pittsburgh coal in central Washington County in the vicinity of Lower Salem, and a somewhat larger deposit in the Federal Creek Valley in Athens County. Elsewhere throughout the Noble County area the Pittsburgh coal is quite thin.[5]

Overlying the Meigs Creek coal are several coal seams, none of which are of more than slight economic value in comparison with the deposits in the Meigs Creek bed. The principal value of these overlying and underlying coal beds (see Plate I) is their stratigraphic value to the geologist and others concerned with the exploration for and mapping of the Meigs Creek seam. The average intervals to the other coal beds are given in the graphic section. Throughout the Noble field these are quite regular and serve as guides to the location and elevation of the Meigs Creek where its outcrop is obscured or the bed is below drainage. For example, the interval from the Meigs Creek coal to the Uniontown coal, which is the next well recognizable coal above it, is given as 120 feet in Plate I for Noble County and varies only slightly in the surrounding counties as follows: Athens, 108, Morgan, 102, Washington, 106.

In general the Meigs Creek coal in the Noble area is underlain by 5 to 10 feet of clay. This clay is generally quite sandy and intergrades with the Lower Sewickley sandstone beneath. It is noteworthy that unlike the majority of coals in the Monongahela series there is seldom a fresh water limestone underlying the Meigs Creek coal.

The overburden on the Meigs Creek coal varies considerably in the Noble field. It may consist predominantly of either massive sandstone, sandy shale, calcareous clay shale, or limestone interbedded with clay shale. In most of this area, however, the Upper Sewickley sandstone, which either directly overlies the coal or is separated from it by a few feet of dark roof shale, is present over the Meigs Creek coal in thicknesses of 15 to 50 feet. This sandstone is in turn overlain by a series of calcareous shales and limestones which fill the remaining interval to the Uniontown coal. In areas where no Sewickley sandstone was deposited, Benwood limestone strata are present directly over the coal and extend upward for 50 to 60 feet to the Arnoldsburg and Uniontown limestone members, which generally are very similar to the Benwood lithology.

The Meigs Creek coal bed. - In Noble County the Meigs Creek bed underlies an area of over 177 square miles where the coal is greater than 14 inches thick; it is present in the western and eastern borders, along the southern half of the county, and forms a rudely U-shaped area. This bed exhibits two benches in Noble County as it does over much of the area of its occurrence in Ohio. The lower bench, wherever reported, is 14 inches or more in thickness, but the upper bench is less than 14 inches in the western part of the county (see Maps II and III). Gentle variations of thickness occur in both the upper and lower benches throughout the area of occurrence. The parting is persistent, although it is quite variable over relatively short distances; its known variation in Noble County is from a mere trace or absence to 38.5 inches.

The thickest occurrence of the lower bench in Noble County is found in the northeast half of section 32, Enoch Township, where 72 inches of coal has been measured; however, over 80 inches of coal in the lower bench has been reported in this vicinity. The large amount of the coal in Noble County, averaging 60 inches or more in thickness, is found in a strip extending from northeast Jackson Township northeastward

5 *Smith, Gilbert E., The Pittsburgh Coal of the Federal Creek Field. Ohio Division of Geological Survey. Rept. of Inv. No. 14, 1952.*

Directory and Location of Active Mines in the Meigs Creek Coal, Ohio, 1952.

Map number	County	Township	Operator
1	Muskingum	Rich Hill	Geo. B. Herring and Son
2	Noble	Brookfield	Commercial Fuel Co.
3	Noble	Brookfield	Boyd and Pulmer
4	Noble	Brookfield	Moscrip Mining Corp.
5	Morgan	Manchester	Haines and Lawrence
6	Noble	Sharon	King Coal Co.
7	Noble	Jackson	Bruns Coal Co.
8	Noble	Enoch	Baker Coal Co.
9	Noble	Jefferson	Union Carbide & Carbon Corp.
10	Noble	Jefferson and Elk	Peaker Run Coal Co.
11	Noble	Elk	Koontz Coal Co.
12	Noble	Elk	Baker Coal Co.
13	Belmont	Flushing	United States Coal Co.
14	Belmont	Flushing	Crescent Valley Mining Corp.
15	Belmont	Flushing	Terra Co., Inc.
16	Belmont	Union	Monaco Coal Mining Co.
17	Belmont	Kirkwood	Eastern Ohio Coal Co.
18	Belmont	Union	Pandolfo Coal Co.
19	Belmont	Goshen	Holland Coal Co.
20	Harrison	Cadiz	Hanna Coal Co.
21	Harrison	Athens	P. & O. Construction Co.
22	Belmont	Wheeling	R. & F. Coal Co.
23	Belmont	Wheeling	Hanna Coal Co.
24	Belmont	Wheeling	Healy Bros. Coal Co.
25	Belmont	Wheeling	McConnell & Zaccagnino
26	Belmont	Wheeling	Lafferty Coal Co.
27	Belmont	Wheeling	T. & L. Coal Co.
28	Belmont	Richland	R. V. Tomer Coal Co.
29	Belmont	Pultney	Rush Run Coal Co.

MUSKINGUM RIVER

OHIO RIVER

OHIO

SCALE
0 5 10 miles
1 inch equal about 6.7 miles

DIRECTORY AND LOCATION OF ACTIVE MINES IN THE MEIGS CREEK COAL IN OHIO, 1952

MAP IV

into southern Marion Township. Further north, in Beaver Township, a separate area of coal 60 inches thick also occurs. Isolated areas of thick coal are found northwest of Jackson Township in southwestern Sharon and southeastern Brookfield Townships.

The occurrence of the upper bench, where it exceeds 14 inches in thickness, is limited to the eastern portion of the county, and is well developed from the east central part of Jackson Township and a small part of east central Sharon Township northward to Seneca Township. A small part of this bench is greater than 14 inches in thickness in southern Beaver Township.

It is noted that in the eastern part of the county where the lower bench is well developed, the upper bench also occurs, but it is never as thick as the lower bench. There are, no doubt, exceptions to this generalization. As noted above, the lower bench is usually found to be less than 14 inches thick in the western part of the county. Buffalo is the only township in Noble County devoid of the Meigs Creek coal bed.

Reserves and production of the Meigs Creek coal bed. - Prospecting and development have taken place in the areas of the thicker deposits, as is reflected by mining activity in Brookfield, Jefferson, Jackson and Sharon Townships. It should be pointed out here that this development is also near good rail transportation. The distribution of the estimated reserves of the Meigs Creek bed by thickness and reliability in Noble County are summarized in the following table.

not considered in the estimated reserves. It is estimated that there are about 850 linear miles of outcrop of the bed, and stripping has taken place along about 90 miles of it. At least 40 linear miles of this stripping has occurred in Brookfield Township.

To the beginning of 1952 approximately 7,000,000 tons of coal are reported to have been mined from the Meigs Creek bed, and this has been removed principally by strip methods. (See Table VI for annual production 1945-51.) Only a few underground mines are recorded for this bed, and none of these are large. Map IV includes a directory to the operations in the Meigs Creek coal bed in 1951.

WASHINGTON COUNTY

Geography and geology. Washington County lies south of Noble County, touches Athens and Morgan Counties on the west, and is bounded on the south by the Ohio River. In 1950 the population was 44,407, and of this number 16,006 lived in the principal city of Marietta, the county seat. None of the other towns in the county exceed 2000 in population.

The main highways in the county are Ohio-U.S. Route 21 which leads north from Marietta, Ohio-U.S. Route 50 A which traverses the county east and west from Marietta. State routes connect some of the more remote parts of the county, but because of the exceedingly

Estimated Original Meigs Creek Coal Reserves, Noble County, Ohio.*
(In thousands of short tons.)

Reliability category	Thickness				
	14"-28"	28" 42"	42"-54"	Over 54"	Total
Proven	61,851	111,716	181,818	83,467	438,852
Probable	79,663	124,238	165,317	45,969	415,187
Inferred	-	-	-	-	-
Total	141,514	235,954	347,135	129,436	854,039

* Both upper and lower bench reserves.

The total area of mineable coal for this bed measures 177.11 square miles for the lower bench. The area of occurrence of the upper bench coal greater than 14 inches is less than one-third this amount. It is recognized that in many stripping operations exceptionally thin upper bench coal will be recovered, but considering underground mining recovery, it is doubtful that the upper bench is recoverable; thus such coal (less than 14 inches) is

rough terrain good inter-connecting routes are few.

Rail transportation lines from the north, west, and south converge at Marietta. There is no rail transportation in the eastern third of Washington County, or in adjacent Monroe County. The Baltimore and Ohio follows the valley of the Muskingum River northwestward from Marietta to Zanesville; another line of the B. & O. follows the Ohio River southwestward from Marietta to Parkersburg. A large portion of

the Meigs Creek coal deposits in north central Washington and south central Noble Counties can be carried over the Pennsylvania line which follows Duck Creek from Caldwell to Marietta.

The range in elevation in Washington County is greater than that in the counties immediately to the north, and is about 450 feet. The elevation of the valley bottoms near Marietta is about 600 feet, and the general upland level is approximately 900 feet. The slopes of the valley walls are generally steep ranging from about 15 to 65 percent.

The upper drainage areas of the smaller streams show gentler slopes which range from 5 to 10 percent. The surface in most of the region is marked by very deeply cut stream valleys. The upland surface as elsewhere is of gentle sags and swells.

The major streams are the Ohio River, Muskingum River, and Duck Creek. The Muskingum River is the main stream in the eastern part of the county. (See Noble County for a description of the rock column.)

The Meigs Creek coal bed. -- Most of Washington County is underlain with the Meigs Dreek coal bed; however, much of it is too thin to consider mineable. The best development of the bed is found in the northern and northeastern parts of the county. From this area the bed generally becomes thinner to the west and south. Particularly well developed parts of the bed in Washington County are found in the northern part of Aurelius Township, where it is persistently 39 to 48 inches thick. Elsewhere thick areas are present, as in the NE 1/4 section 33, Salem Township, where a 60 inch thickness of the bed occurs. In Adams Township 51 inches of coal were measured in the South 1/2 of section 15, and in section 21, Lawrence Township, 52 inches of coal occurs. These areas of thick coal are related to those in adjacent Noble County, and thinning takes place to the east, west, and south and only a few inches of coal are present 2 to 3 miles away in those directions. Two small isolated areas of mineable lower bench coal, 21 inches average thickness, are also found in Washington County; one is in easternmost Newport Township, and the other is in northwest Decatur and western Wesley Township.

The upper bench occupies an even smaller area than the lower bench and is thickest in the northern part of the county. Thicknesses of over 28 inches are recorded for Aurelius and Adams Townships, and the coal is possibly as much as 54 inches thick in section 23 of Adams Township. This bench thins and disappears to the south of these areas in Salem Township. In the eastern part of Washington County, the upper bench is over 28 inches thick in Liberty and Lawrence Townships, one measurement being 44 inches in section 20 of Lawrence Township. An isolated block of mineable coal of 28 inches thickness is also found in Decatur Township near the Washington-Athens County border.

The parting appears to be persistent, but where observed in the county it varies from 40 inches thick to a complete absence in some places. As in other areas, the parting is apparently quite variable and subject to rapid change.

Reserves and production of the Meigs Creek bed. The table below shows the total estimated Meigs

Estimated Original Meigs Creek Coal Reserves, Washington County, Ohio.*
(In thousands of short tons.)

Reliability category	Thickness				
	14"-28"	28"-42"	42"-54"	Over 54"	Total
Proven	57,416	55,711	24,169	2,130	139,426
Probable	150,789	88,176	43,359	2,354	284,678
Strongly inferred	68,835	7,291	1,255	-	77,381
Weakly inferred	10,868	-	-	-	10,868
Total	287,908	151,178	68,783	4,484	512,353

* Both upper and lower bench reserves

Creek coal reserves. A comprehensive classification of the estimate is found in the summary table at the end of this report (Table VII).

The total area of mineable coal of the lower bench in the county amounts to 139 square miles, and the extent of the upper bench is much less than this amount. Mining activity has taken place in this bed principally in the northern part of the county, in Aurelius Township.

As nearly as can be determined, only about 600,000 tons of coal have been mined from the Meigs Creek bed. Table VI lists the production figures from 1945 through 1951. Nearly all of this production is from strip mines. Underground mines operate only on a very small scale. There are approximately 347 linear miles of outcrop of the Meigs Creek bed where the coal is thicker than 14 inches. Map IV includes a directory to the mines that operated in the Meigs Creek bed in Washington County in 1951.

ATHENS COUNTY

Because Athens County contains only very modest reserves of the Meigs Creek coal only a short description will follow.

Geography and geology. Athens County is in the extreme southwest part of the Meigs Creek coal field and touches Washington County on the east and Morgan County on the north. Its population in 1950 was 45,839, and the principal city and county seat of Athens contained 11,660 persons. Farming is the principal industry of the area.

The county has a fairly good network of highways. Those that serve the Meigs Creek coal area are Ohio-U.S. Route 50 A for east-west traffic and other state highways and county roads for north- and south- bound traffic. Excellent rail facilities are available over the Chesapeake and Ohio, Baltimore and Ohio, and the Pennsylvania lines which serve the county and form a net leading away in many directions from the city of Athens. The Meigs Creek coal area is served by a spur of the Pennsylvania Railroad line leading from Bur Oak in Trimble Township to Lathrop in Bern Township.

The relief in the Meigs Creek coal area is about 400 feet, ranging from about 600 feet to slightly over 1000 feet above sea level. The Hocking River, Federal Creek, and their tributaries have cut deep valleys into the upland surface. The general level of the hilltops in the area is somewhat over 1000 feet. Slopes of the valleys are similar to those found in the other counties to the east and range up to 45 percent.

The Meigs Creek coal bed, reserves, and production. -- The lower bench is found only in northeast Rome and southeast Bern Townships, where data indicate possibly as much as 60 inches of coal present. The upper bench ranges from 18 to 24 inches in thickness, and it is found in the same area as the lower bench. The parting is persistent with a thickness of about 24 inches. There are 11.2 square miles of the Meigs Creek coal of mineable thickness in Athens County; however 40 linear miles of outcrop are indicated on coal more than 14 inches thick. No figures for production are recorded, but it is entirely possible that local mining in the bed has taken place. (See table below.)

MORGAN COUNTY

Geography and geology. -- Morgan County lies on the western border of the Meigs Creek coal bed area,

Estimated Original Meigs Creek Coal Reserves, Athens County, Ohio.*
(In thousands of short tons.)

Reliability category	Thickness				
	14"-28"	28"-42"	42"-54"	Over 54"	Total
Proven	824	817	673	2,287	4,601
Probable	9,906	4,185	6,412	2,971	23,474
Inferred**	16,144	7,716	1,121	-	24,981
Total	26,874	12,718	8,206	5,258	53,056

* Both upper and lower bench reserves.

** Strongly inferred.

bounded on the south by Washington and Athens counties, on the east by Noble County and on the north by Muskingum County. The population in 1950 was 12,836. The village of McConnelsville, population 1,941, the county seat, is located in the center of the county and on the margin of the Meigs Creek coal bed area. Other towns in the area are small and do not exceed 1,000 population. The economy of the area is mainly agricultural.

State routes form a good network for highway transportation in the county; Ohio State Routes 76 and 78 are the main roads in the Meigs Creek coal area. The more remote parts are served by county roads.

Although there is not a well developed rail network in the county, the Baltimore and Ohio Railroad traverses the county from the southeast through the north central part of the county, following the valley of the Muskingum River. This service would appear to be close enough to the Meigs Creek coal bed area to adequately serve future development.

Most of the county is moderately rugged and similar to the other counties in the region in this respect. The relief is about 400 feet; elevations range from about 600 feet in the Muskingum River valley to about 1,000 feet on the hilltops. Steep slopes characterize the area and range from 20 to 100 percent; slopes are more gentle in the upper tributary valleys. The Muskingum River is the main drainage of the area.

The Meigs Creek coal bed, reserves, and production. -- The thickest Meigs Creek coal in Morgan County is east and north of the Muskingum River, although minor amounts of coal occur at mineable thickness in hilltops to the west of the river. Generally speaking the coal is too thin to mine south and west of the Muskingum River.

The lower bench is thickest in the northeastern part of Morgan County, and in section 29, Manchester Township a thickness of 60 inches occurs. The lower bench thins in all directions from this point at a fairly regular but persistent rate. To the west it thins to less than 14 inches near the Muskingum River. In Malta, Penn, and Marion Townships the bed is only on the order of an inch in thickness; however, in the western parts of these townships deposits of as much as 36 inches of coal are found in some of the hilltops.

Section 5, Manchester Township, contains the only known place where the upper bench is thicker than 14 inches; one measurement shows 18" of coal present in this bench.

The parting is persistent in Morgan County and is found to be about 12 inches thick along the northeastern border. A thick occurrence, possibly as much as 80 inches, is found in southern Manchester Township; however, it thins to the south and west very rapidly.

The county summary of the estimated reserves of the Meigs Creek coal in Morgan County is found in the table below. For a complete classification of the reserves of the county by township see Table VII at the end of this report.

The total estimated reserves of the Meigs Creek bed amount to 330,342,000 tons, and the amount of mined out and lost is 684,000 tons. It can be readily seen that there is still a substantial amount of the Meigs Creek reserve remaining in the ground. A total of about 690 linear miles of outcrop in the Meigs Creek bed occur, of which about 2 miles have been stripped.

Mining on a moderately large scale in the bed has taken place only in recent years, principally by

Estimated Original Meigs Creek Coal Reserves, Morgan County, Ohio.*
(In thousands of short tons.)

Reliability category	Thickness				
	14"-28"	28"-42"	42"-54"	Over 54"	Total
Proven	14,556	38,088	42,551	9,584	104,779
Probable	53,160	74,674	89,406	6,950	224,190
Inferred**	1,373	-	-	-	1,373
Total	69,089	112,762	131,957	16,534	330,342

* Both upper and lower bench reserves.

** Strongly inferred.

strip methods. It would seem that the strippable deposits will be worked somewhat more in the future. Table VI summarize known production from this bed for the period 1945-51. A directory to operations in the Meigs Creek bed in 1951 is found on Map IV.

MUSKINGUM COUNTY

Because only a small part of the Meigs Creek coal bed lies in Muskingum County, description will be shortened to include the more important facts regarding that area.

Geography and geology. -- Muskingum County shares with Guernsey County (to the east) the northwestern most extent of the Meigs Creek coal bed. The county is also bounded on the east by Noble County and on the south by Morgan County. The population in 1950 was 74,535, and 40,517 lived in Zanesville, the county seat. The town closest to the Muskingum County reserve of Meigs Creek coal is Cumberland, which lies just east of the county line in Guernsey County.

Ohio route 146 is the only hard-surfaced road in the Meigs Creek coal-bearing part of the county, and it serves east-west traffic from Zanesville to Cumberland. Other roads that serve the area are dirt or graveled.

Although Muskingum County has good rail transportation by lines of the Baltimore and Ohio, Nickel Plate, and Pennsylvania Railroads, none cross the Meigs Creek coal area. Lines of the Baltimore and Ohio do come within about six miles of the area, and a spur line which serves the town of Cumberland in Guernsey County, also serves this producing area.

The topography is much gentler than is found in most of the rest of the Meigs Creek coal region. The range of relief in the county is about 400 feet. Elevations vary from 600 to slightly over 1000 feet above sea level. Slopes are more gentle than those found in the other counties containing Meigs Creek coal. The range of relief in the Meigs Creek coal area is much less than that of the rest of the county; 150-200 feet.

The Meigs Creek coal bed, reserves, and production. -- The Meigs Creek coal bed underlies parts of Blue Rock, Meigs, Rich Hill, and Union Townships in the southeastern part of the county.

The lower bench in most of its extent ranges between 35 and 48 inches in thickness. The thickest exposure is in section 26, Meigs Township, where 55 inches of coal occur. A slight thinning is noted to the north and west. The upper bench is of mineable thickness only in Rich Hill Township where about 36 inches are reported. The parting is persistently about 12 to 18 inches thick in the Muskingum County area.

The total of 138, 268,000 tons of estimated reserves, although modest in amount, is interesting because of the general persistence of moderately thick coal. The table below is a summary of the estimated Meigs Creek coal reserve in the county. A complete summary is found in Table VII. The total area of occurrence is only 30.78 square miles; however, there are approximately 188 linear miles of outcrop on this bed. Strip mining has progressed along six miles of the outcrop in Rich Hill Township and has covered about one third of a square mile in area.

The record of mining to date shows that 400,000 tons of coal have been removed from the bed, up to 1952.

Estimated Original Meigs Creek Coal Reserves, Muskingum County, Ohio.*
(In thousands of short tons.)

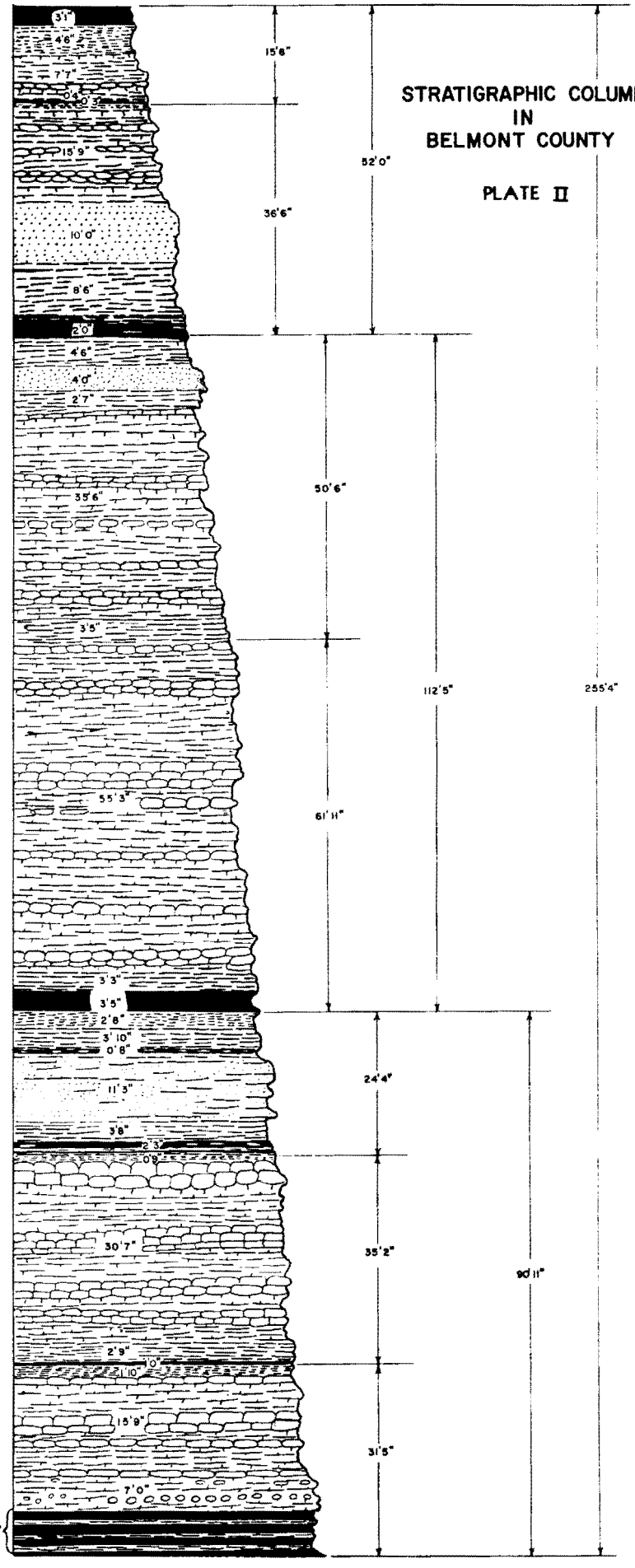
Reliability category	Thickness				
	14"-28"	28"-42"	42"-54"	Over 54"	Total
Proven	1,314	12,718	15,872	4,764	34,668
Probable	3,885	21,513	62,953	8,295	96,646
Inferred**	59	752	6,143	-	6,954
Total	5,258	34,983	84,968	13,059	138,268

* Both upper and lower bench reserves.

** Strongly inferred

STRATIGRAPHIC COLUMN IN BELMONT COUNTY

PLATE II



Coal, with irregular partings, WAYNESBURG

Clay, impure

Shale and shaly sandstone

Shale, bony; Coal, poor } LITTLE WAYNESBURG

Clay, impure

Limestone and calcareous shale, WAYNESBURG

Sandstone, local, UNIONTOWN

Shale, bony; Coal, good; Shale, bony; Coal, good; Shale, bony; Coal, good; Shale, coaly } UNIONTOWN: Shale, siliceous; Clay, impure; Shale, siliceous

Sandstone, local, (BIG RUN)

Shale, siliceous

Limestone and calcareous shale, UNIONTOWN

Shale, siliceous, greenish, FULTON

Limestone and calcareous shale, BENWOOD

Shale, calcareous, usual roof of coal
Sandstone, seldom present, SEWICKLEY
Shale, dark, siliceous, very local
Coal, SEWICKLEY, MEIGS CREEK
Clay, impure

Shale, generally siliceous
Coal, bony and bone shale, unsteady

Limestone, occasionally present

Shale or sandstone, LOWER SEWICKLEY

Shale, siliceous
Shale, with thin coal bands; Coal, with thin partings; Shale, coaly } FISHPOT: Clay, impure

Limestone and calcareous shale, FISHPOT

Shale, coaly; Coal, good } Shale, calcareous
REDSTONE, POMEROY
Clay, impure

Limestone and marly shale, REDSTONE

Sandstone, generally wanting, UPPER PITTSBURGH

Shale, calcareous with balls and thin layers of limestone

Coal, irregular, roof bench
Shale, calcareous
Coal, breast bench
Shale, carbonaceous
Coal, bearing-in-bench
Shale, carbonaceous
Coal, brick bench
Shale with pyrite, copper band
Coal, bottom bench } PITTSBURGH

GUERNSEY COUNTY

Geography and geology. -- Guernsey County is similar to Muskingum County in that only a very small amount of Meigs Creek coal is present as outliers from the main bed extending from the counties to the south. This county is bounded on the west by Muskingum County, on the south by Noble County, and it touches Belmont and Harrison Counties on the east.

The population in 1950 was 38,452, and the chief center of trading is Cambridge with a population of 14, 739. The principal town in the southwestern Meigs Creek coal area is Cumberland, and Salesville is the main town in the southeastern portion.

A good highway system serves the county, and Ohio routes 76 and 146 carry traffic in the southwestern part of the county converging at Cumberland. Ohio route 265 is the main route in the Salesville area. Lines of the Pennsylvania carry north and south rail traffic in the county. The Baltimore and Ohio railroad serves east-west traffic and has a spur that serves the Cumberland area.

The surface of the Meigs Creek coal area in the county is somewhat less rugged than other parts of the field and is marked by a hilly terrain that is cut fairly deeply by rivers and streams. Elevations in the area range from 800 to 1300 feet.

The Meigs Creek coal, reserves and production. The Meigs Creek coal deposits lie in the southwestern and southeastern parts of the county, in Spencer and Westland Townships and in Millwood and Oxford Townships. The coal underlies small areas in the hilltops in these areas. The upper bench is possibly present, but no reliable information is available regarding the thickness. The parting is apparently present at thicknesses up to 18 inches.

The coal reserves are estimated at 18,362,000 tons, and a complete summary may be found in Table VII. A total of 4.75 square miles and approximately 64 linear miles of outcrop are exposed in the parts of the bed that exceed 14 inches. (See Table V.)

Less than 1,000,000 tons of coal are reportedly mined (See Table VI) from the Meigs Creek bed in Guernsey County, which represents only a relatively small portion of the total original reserve. Nearly all of the mining has been by strip methods.

BELMONT COUNTY

Geography and geology. -- Belmont County lies on the eastern edge of the Meigs Creek coal region in Ohio. It is bounded on the north by Harrison and Jefferson Counties, on the west by Noble and Guernsey Counties, on the south by Monroe County, and on the east by the Ohio River and West Virginia. In 1950 the county had a population of 87,740, nearly on third of this number lived in the main cities and towns: Martins Ferry, Bellaire, St. Clairsville, and Barnesville. This county is the most highly industrial area in the Meigs Creek coal region.

A good system of state and federal highways covers the county, with county roads serving the more remote areas. U. S. Route 40 is the principal road leading east and west through the north central part.

Rail facilities of the Baltimore and Ohio, Pennsylvania, and the Nickel Plate lines serve most of the northern and eastern parts of the county; the parts immediately adjacent to Monroe County are rather poorly

Estimated Original Meigs Creek Coal Reserves, Guernsey County, Ohio.*
(In thousands of short tons.)

Reliability category	Thickness				
	14"-28"	28"-42"	42"-54"	Over 54"	Total
Proven	314	2,452	4,843	-	7,609
Probable	2,334	2,582	5,739	-	10,655
Inferred**	98	-	-	-	98
Total	2,746	5,034	10,582	-	18,362

* Both upper and lower bench reserves.

** Strongly inferred.

covered, probably a reflection of the weaker development of the coal beds in that area. The main lines of the Pennsylvania and Nickel Plate Railroads follow the Ohio River north and south. Westward from the Ohio River in the Bellaire-Martins Ferry area, transportation is furnished via Baltimore and Ohio Railroad. Several spur lines of the B. & O. interconnect the eastern coal producing part of Belmont County.

Much of Belmont County is characterized by deeply cut valleys with steep walls. Elevations range from 650 feet in the valleys to 1300 feet on the upland surface. The master drainage of the area is the Ohio River, with the streams of Captina Creek, McMahan Creek, and Wheeling Creek as the main tributaries.

Stratigraphy. -- In the northern or Belmont field, which includes eastern Guernsey, Belmont, the southern parts of Harrison and Jefferson Counties, and Monroe County, the exposed bedrock ranges in age from middle Conemaugh to the upper part of the Dunkard. The Conemaugh strata are exposed only in the western part of the county and in the valley bottoms in the northeastern part near the Ohio River. The rocks consist principally of red clay shales and thin freshwater limestone. In the Monongahela series which includes all strata between the Pittsburgh and Waynesburg coals, there are large amounts of freshwater limestone and calcareous shale together with sandstone shale, clay and coal. The Dunkard strata consist of an alternate series of sandstone and shale, with numerous thin coals and clays. There are no deposits of glacial drift in the area such as are found in other Ohio coal fields to the north and northwest.

The several mineable coals present in this area are the Pittsburgh, Meigs Creek, and Uniontown beds, all of the Monongahela formation, and the younger Waynesburg and Washington coal beds of Dunkard age. Only the Pittsburgh and Meigs Creek coal beds are important resources, extending in good thickness over wide areas. Intervals between the coal beds are : Pittsburgh to Meigs Creek, 80 to 90 feet; Meigs Creek to Uniontown, 110 feet; and Uniontown to Waynesburg, 52 feet.

The Meigs Creek bed is found near the middle of the Monongahela formation. The rocks below the coal are principally shales and limestones. Those above it are: roof shale, the Sewickley sandstone of from 10 to 35 feet in thickness, and the Benwood limestone. Two benches of the Meigs Creek are present in a number of places, but in most of the field the upper bench appears to be absent. The upper bench, however, is not generally of sufficient thickness to be valuable in most places.

Strip mining has been extensively carried on along the western and northern margins of the Belmont field where the coal is near the surface. In a few places both the Meigs Creek and Pittsburgh coals are stripped together by removing the 80 feet or so of overburden between them.

The overburden generally encountered in strip mines in the Belmont field consists of a few feet of gray roof shale followed by limestone in 1 to 3 feet beds separated by soft limey shale. In eastern Guernsey County and southern Harrison County the Sewickley sandstone is often encountered in the overburden. This sandstone is not generally so thick nor so massive here as it is in the Noble field. In southern Harrison County where the coal is extensively strip mined the lower part of the overburden is generally sandy shale or thin sandstone and is overlain in turn by the Benwood limestone. Sandy beds are occasionally found above the coal in Belmont County but are usually not very massive and are restricted to the first 10 to 25 feet above the coal. These sandy beds diminish to the east, and along the Ohio River in eastern Belmont County the overburden consists almost entirely of limestone beds separated by thin clay partings.

The Meigs Creek coal bed. -- The total area of Meigs Creek coal in Belmont County amounts to somewhat more than 450 square miles. Both the upper and lower benches are well developed, as is the parting. Only in the northwestern corner of the county, in part of Flushing and Kirkwood Townships, is the coal absent. (See Maps II and III).

The lower bench is found in thicknesses exceeding 14 inches in nearly all of the county. In most of central Belmont County the bed is 60 inches or greater in thickness, and in northwestern Goshen Township 66 inches have been measured. From this area gentle thinning takes place, however locally thick coal is found in northeast Wheeling Township where coal thicknesses of 54 to 58 inches have been measured. In sections 20 and 25 of Warren Township thicknesses of 54 to 61 inches of coal are recorded. In the eastern part of Flushing Township the thickness measures from 48 to 54 inches, and in Richland Township to the southeast in section 26, 57 inches of coal are found. In the eastern border of the county in sections 17 and 30 of Pultney Township, 57 inches of coal are found. Well cores reveal 55 inches of coal in section 16 of Richland Township, and to the southwest of this area in Goshen Township exposures of the coal show 36 to 42 inches of thickness. The coal thins to the north and east and locally shows less than 14 inches of thickness as in the southeast part of Colerain and south central Pease

Townships. Local thinnings are observed in small parts of Wheeling, Wayne, and Somerset Townships. A general thinning of the lower bench is also found to the southwestward, where it is 36 inches or less near the Guernsey County line. Near the Monroe County line the thickness averages 20 inches or less.

The upper bench is found only in small areas at thicknesses greater than 14 inches. It occurs in thicknesses of 24 to 30 inches in the southwestern parts of Wayne, southwestern Union, and northwestern Goshen Townships.

The parting is found, as a rule, about 12 inches thick. However, local thickenings occur, but the bed seldom exceeds 24 inches. Maps II and III show the distribution of the lower and upper benches and the parting.

Reserves and production of the Meigs Creek coal bed. -- A total of 1,628,581,000 tons of estimated reserves underlie 418 square miles of Belmont county. This estimate is summarized in the table below, and a complete summary by county and township may be found in Table VII at the end of this report.

Estimated Original Meigs Creek Coal Reserves, Belmont County, Ohio.*
(In thousands of short tons.)

Reliability category	Thickness				
	14"-28"	28"-42"	42"-54"	Over 54"	Total
Proven	33,702	121,590	216,609	54,914	426,815
Probable	270,218	339,989	389,595	71,158	1,070,960
Inferred**	29,425	49,859	62,638	-	141,922
Total	333,345	511,438	668,842	126,072	1,639,697

* Both upper and lower bench reserves.

** Strongly inferred

Records indicate that over 7,500,000 tons of coal have been mined from this bed since mining began. Since 1945 production has been increasing rapidly year by year. Table VI shows the annual production from this bed for the years 1945 through 1951. Nearly all of the production has been by strip mining. Belmont County has produced more coal from the Meigs Creek bed than has any of the other counties. There are about 735 linear miles of outcrop in Belmont County, and strip mining has progressed along 37 linear miles. Most of this has taken place in Wheeling Township.

HARRISON COUNTY

Geography and geology. -- Harrison County shares with Jefferson County the northwest extent of the Meigs Creek bed. The county is bounded on the south by Belmont and Guernsey Counties and on the west by Tuscarawas County.

In 1950 the population of the county was 19,054 and the county seat and principal town of Cadiz had a population of 3,020. Only a few of the other towns number more than 1,000 persons.

Ohio routes 9 and 519 and Ohio-U.S. route 250 are the main roads in the Meigs Creek coal area; county roads connect the outlying areas. The rest of the county is also well provided with a good highway network. A connecting line of the Baltimore and Ohio railroad passes through the Meigs Creek coal area, and this makes good connection with other lines in Harrison and Jefferson Counties.

The county has a more or less rolling surface, but it is well dissected by the stream valley of Brushy Fork and its tributaries in the Meigs Creek coal area. Surface elevation in that area ranges from 900 to 1300 feet above sea level and the general hilltop level is 1200 feet.

The Meigs Creek Coal bed, reserves, and resources. -- The main body of the coal is found in Athens, Enoch, and Short Creek Townships, with outliers in Archer, Cadiz and Green Townships.

In the lower bench best development is found in the southern half of Athens and Archer Townships in the southeastern part of the county, where the coal maintains a persistent thickness of 48 inches. This bed thins rapidly northward to less than 14 inches in Archer and Green Townships. An upper bench greater

than 14 inches is known only in sections 4 and 10 in Athens Township where about 22 inches occur. The parting is quite variable, from 12 inches to 21 inches, in the southeast part of the county. Local absence of the parting is noted in part of Short Creek and central Athens Townships. The total estimated coal reserve of the Meigs Creek bed in Harrison county is 133,034,000 tons and is classified in the table below. Complete classification by township is listed in Table VII.

The total reported production is about 5,500,000 tons, nearly all of which has been since 1945. Previous to this date, production figures by individual seam are not available, but it is known that mining prior to 1945 in the Meigs Creek bed is negligible. Table VI shows annual production for the years 1945 through 1951. All of the mines active in 1951 were strip mines, and the history and trend of mining here as elsewhere in the Meigs Creek bed has been one of stripping methods. Table V shows the coal area by township as well as the amount of outcrop. Over thirty miles have been stripped along the outcrop in Athens and Short Creek Townships.

Estimated Original Meigs Creek Coal Reserves, Harrison County, Ohio.*
(In thousands of short tons.)

Reliability category	Thickness				
	14"-28"	28"-42"	42"-54"	Over 54"	Total
Proven	5,905	17,459	46,317	13,115	82,796
Probable	3,611	13,862	19,146	13,619	50,238
Inferred	-	-	-	-	-
Total	9,516	31,321	65,463	26,734	133,034

* Both upper and lower bench reserves.

JEFFERSON COUNTY

Jefferson County lies east of Harrison County and is bounded on the north by Belmont County and on the east by the Ohio River and West Virginia. Production in Jefferson County has been almost nil because of only very modest reserves of coal greater than 14 inches thickness (See Maps II and III). The lower bench coal is found, however, in most of Mt. Pleasant and in part of the northern half of Warren Township where thicknesses of the bed range from 36 to 48 inches; rapid thinning of the bed is found to the north and northeast. The upper bench and parting appear to be absent or obscure in identification in the county. The original reserves of the Meigs Creek coal bed in Jefferson County total 65,314,000 tons. See Table VII for complete tabulation of the Meigs Creek coal reserves. (See also Jefferson County table on page 23.)

MONROE COUNTY

Geography and geology. -- This county lies south of Belmont County and east of Washington County. It is bordered on the east and south by the Ohio River. The population of the county totals 15,362. The county seat and principal city is Woodsfield with a population of 2,410.

Ohio Routes 8 and 78 carry north to south and east to west traffic respectively and intersect at Woodsfield. Other roads connect other parts of the county; however, because of rugged terrain and generally poor development of known geologic resources, no railroads traverse this county.

The surface of Monroe County is quite rugged, and the range of elevation is from 600 feet to 1200 feet above sea level. Steep slopes characterize the surface of the county.

Meigs Creek bed, reserves and production. -- Although there is comparatively little information relating to the Meigs Creek bed in Monroe County, it may be concluded that there is not a large reserve of the bed present.

The lower bench is found developed in the western and northernmost parts of the county, and apparently in a locally developed elongate area in the central part of the county. The areas of better development of thickness in this bed are found in Bethel Township, where much of the bed is 35 inches thick, and in Franklin Township where 48 inches of

Estimated Original Meigs Creek Coal Reserves, Jefferson County, Ohio.*
(In thousands of short tons.)

Reliability category	Thickness				
	14"-28"	28"-42"	42"-54"	Over 54"	Total
Proven	4,021	2,714	3,542	-	10,277
Probable	16,536	35,407	3,094	-	55,037
Inferred	-	-	-	-	-
Total	20,557	38,121	6,636	-	65,314

* Both upper and lower bench reserves.

thickness are found. The bed thickens to the north and west from this area. An apparently isolated area of thick coal is also found in Perry Township near and around the town of Mechanicsburg. The coal in this area is reported tc be as much as 4 to 5 feet thick, and it was mined during the Civil War. Well records indicate 2 to 3 feet of thickness in the northeastern part of Monroe County.

The upper bench is present with a thickness of as much as 35 inches, and thinning rapidly takes place to the east. A well record from SW 1/4 of Sec. 10, Switzerland Township at Mechanicsburg, reveals 6 to 12 inches of the upper bench.

Estimated reserves of the Meigs Creek coal of Monroe County total 276,297,000 tons and is classified in the table below. Complete listing by townships is embodied in Table VII.

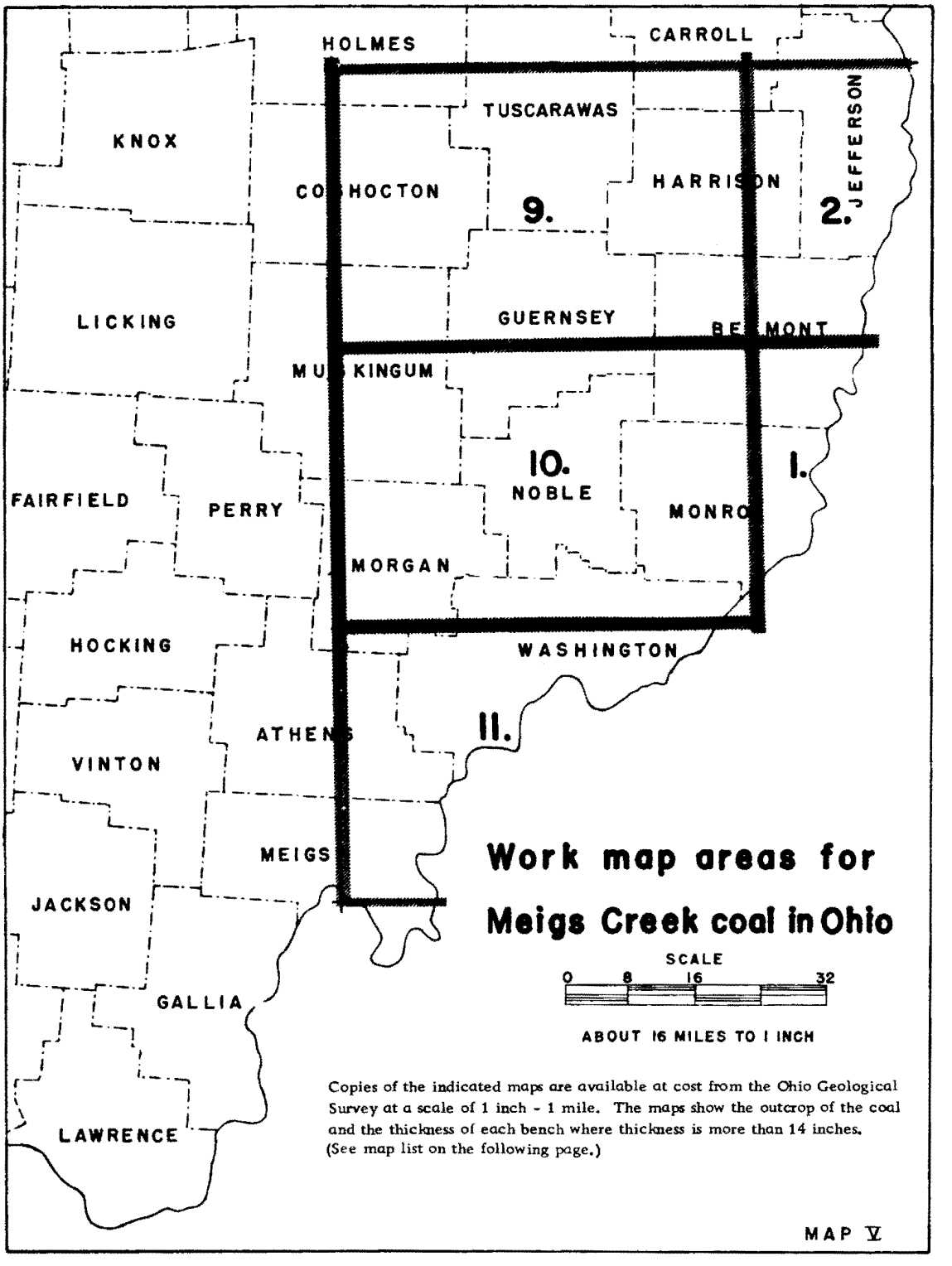
Production statistics do not include any yield from Monroe County. However, it is known that several very small mines have operated at one time or another in the past. This production was apparently insignificant and will not affect seriously the validity of the remaining reserve figures.

Estimated Original Meigs Creek Coal Reserves, Monroe County, Ohio.*
(In thousands of short tons.)

Reliability category	Thickness				
	14"-28"	28"-42"	42"-54"	Over 54"	Total
Proven	32,053	22,166	2,601	-	56,820
Probable	152,734	21,741	7,712	-	182,187
Inferred**	37,290	-	-	-	37,290
Total	222,077	43,907	10,313	-	276,297

* Both upper and lower bench reserves.

** Strongly inferred.


HOLMES
CARROLL
TUSCARAWAS
KNOX
HOCTON
HARRISON
JEFFERSON
9.
2.
LICKING
GUERNSEY
BELMONT
MUSKINGUM
10.
NOBLE
1.
FAIRFIELD
PERRY
MONROE
MORGAN
WASHINGTON
HOCKING
ATHENS
11.
VINTON
MEIGS
JACKSON
GALLIA
LAWRENCE
Work map areas for
Meigs Creek coal in Ohio
SCALE
0 8 16 32
ABOUT 16 MILES TO 1 INCH
Copies of the indicated maps are available at cost from the Ohio Geological Survey at a scale of 1 inch - 1 mile. The maps show the outcrop of the coal and the thickness of each bench where thickness is more than 14 inches. (See map list on the following page.)
MAP V

COAL RESERVE MAPS

Blue-line copies of work maps (scale: 1" - 1 mile) prepared for the Meigs Creek resources studies will be made available at cost for each of the areas numbered on the index map at left.

These maps will be useful to persons requiring detailed information regarding the coal in specific areas. On them is shown the outcrop, extent, and thickness of the coal bed; location of mines and points of coal sampling; and much other data relative to the coal which was compiled in connection with the estimation of the coal reserves.

A detailed list of the maps together with instructions for ordering reproductions may be obtained from the Ohio Division of Geological Survey, Room 106, Orton Hall, Ohio State University, Columbus 10, Ohio.

TABLE VII.

SUMMARY OF MEIGS CREEK COAL RESERVES, OHIO, 1952.

(In thousands of short tons. To obtain total tonnage add three zeros to end of each figure.)

Township	Original resources																Coal mined and lost in mining	Remaining reserves January 1, 1952
	Proven coal					Probable coal					Strongly inferred coal					Total		
	14"-28"	28" 42"	42"-54"	Over 54"	Total	14"-28"	28"-42"	42"-54"	Over 54"	Total	14"-28"	28"-42"	42"-54"	Over 54"	Total			
ATHENS COUNTY																		
UPPER BENCH																		
Bern	-	-	-	-	-	3,021	-	-	-	3,021	5,100	-	-	-	5,100	8,121	-	8,121
Rome	412	-	-	-	412	4,904	-	-	-	4,904	4,512	-	-	-	4,512	9,828	-	9,828
Total	412	-	-	-	412	7,925	-	-	-	7,925	9,612	-	-	-	9,612	17,949	-	17,949
LOWER BENCH																		
Bern	-	-	359	2,287	2,646	294	2,125	6,188	2,971	11,578	6,395	7,716	1,121	-	15,232	29,456	-	29,456
Rome	412	817	314	-	1,543	1,687	2,060	224	-	3,971	137	-	-	-	137	5,651	-	5,651
Total	412	817	673	2,287	4,189	1,981	4,185	6,412	2,971	15,549	6,532	7,716	1,121	-	15,369	35,107	-	35,107
County total	824	817	673	2,287	4,601	9,906	4,185	6,412	2,971	23,474	16,144	7,716	1,121	-	24,981	53,056	-	53,056
BELMONT COUNTY																		
UPPER BENCH																		
Flushing	1,648	-	-	-	1,648	3,296	-	-	-	3,296	-	-	-	-	-	4,944	294	4,650
Goshen	3,374	1,374	-	-	4,748	31,838	261	-	-	32,099	9,416	-	-	-	9,416	46,263	-	46,263
Somerset	-	915	-	-	915	17,282	3,662	-	-	20,944	2,413	-	-	-	2,413	24,272	-	24,272
Union	2,158	-	-	-	2,158	8,553	425	-	-	8,978	-	-	-	-	-	11,136	59	11,077
Warren	-	-	-	-	-	11,613	163	-	-	11,776	8,200	-	-	-	8,200	19,976	-	19,976
Wayne	1,609	3,433	-	-	5,042	38,586	2,844	-	-	41,430	-	-	-	-	-	46,472	-	46,472
Wheeling	5,356	-	-	-	5,356	2,393	-	-	-	2,393	-	-	-	-	-	7,749	941	6,808
Total	14,145	5,722	-	-	19,867	113,561	7,355	-	-	120,916	20,029	-	-	-	20,029	160,812	1,294	159,518
LOWER BENCH																		
Colerain	1,138	6,179	5,425	-	12,742	13,732	19,388	2,601	-	35,721	-	65	-	-	65	48,528	-	48,528
Flushing	-	2,256	11,837	2,242	16,335	98	2,583	23,091	953	26,725	-	-	-	-	-	43,060	1,146	41,914
Goshen	-	4,871	17,307	10,660	32,838	-	29,621	67,347	31,779	128,747	-	131	-	-	131	161,716	224	161,492
Kirkwood	-	5,493	7,264	4,260	17,017	-	6,800	15,873	168	22,841	-	-	-	-	-	39,858	163	39,695
Meade	981	6,539	5,156	1,457	14,133	8,808	43,353	14,572	-	66,733	-	18,538	-	-	18,538	99,404	-	99,404
Pease	1,942	3,073	1,076	-	6,091	16,027	21,644	2,197	-	39,868	942	948	-	-	1,890	47,849	-	47,849
Pultney	608	7,062	15,379	1,345	24,394	2,354	24,978	23,674	1,625	52,631	-	4,806	-	-	4,806	81,831	45	81,786
Richland	804	25,796	41,924	1,345	69,869	1,373	42,012	88,599	-	131,984	-	1,962	11,299	-	13,261	215,114	289	214,825
Smith	-	3,662	4,169	-	7,831	-	36,618	16,814	-	53,432	-	23,409	48,649	-	72,058	133,321	-	133,321
Somerset	4,178	3,498	807	-	8,483	34,741	15,432	448	-	50,621	1,059	-	-	-	1,059	60,163	-	60,163
Union	-	2,975	39,278	10,952	53,205	-	1,569	71,292	8,519	81,380	-	-	2,690	-	2,690	137,275	2,079	135,196
Warren	961	6,245	17,711	9,180	34,097	1,981	15,988	46,318	12,869	77,156	-	-	-	-	-	111,253	-	111,253
Washington	255	14,909	7,533	-	22,697	19,126	32,008	2,287	-	53,421	5,355	-	-	-	5,355	81,473	-	81,473
Wayne	5,198	4,871	3,228	-	13,297	44,941	16,511	493	-	61,945	2,040	-	-	-	2,040	77,282	-	77,282
Wheeling	687	10,658	33,628	13,473	58,446	39	2,714	7,308	15,245	25,306	-	-	-	-	-	83,752	5,876	77,876
York	2,805	7,781	4,887	-	15,473	13,437	21,415	6,681	-	41,533	-	-	-	-	-	57,006	-	57,006
Total	19,557	115,868	216,609	54,914	406,948	156,657	332,634	389,595	71,158	950,044	9,396	49,859	62,638	-	121,893	1,478,885	9,822	1,469,063
County total	33,702	121,590	216,609	54,914	426,815	270,218	339,989	389,595	71,158	1,070,960	29,425	49,859	62,638	-	141,922	1,639,697	11,116	1,628,581

GUERNSEY COUNTY

UPPER BENCH

Spencer	-	-	-	-	-	373	-	-	-	373	-	-	-	-	-	373	-	373
Westland	20	262	-	-	282	490	65	-	-	555	-	-	-	-	-	837	-	837
Total	20	262	-	-	282	863	65	-	-	928	-	-	-	-	-	1,210	-	1,210
Millwood	39	1,144	90	-	1,273	1,334	2,288	448	-	4,070	98	-	-	-	98	5,441	-	5,441
Oxford	-	-	-	-	-	137	196	-	-	333	-	-	-	-	-	333	-	333
Spencer	255	1,046	4,394	-	5,695	-	33	3,946	-	3,979	-	-	-	-	-	9,674	807	8,867
Westland	-	-	359	-	359	-	-	1,345	-	1,345	-	-	-	-	-	1,704	-	1,704
Total	294	2,190	4,843	-	7,327	1,471	2,517	5,739	-	9,727	98	-	-	-	98	17,152	807	16,345
County total	314	2,452	4,843	-	7,609	2,334	2,582	5,739	-	10,655	98	-	-	-	98	18,362	807	17,555

HARRISON COUNTY

UPPER BENCH

Athens	3,178	-	-	-	3,178	255	-	-	-	255	-	-	-	-	-	3,433	216	3,217

LOWER BENCH

Archer	373	850	493	-	1,716	20	-	-	-	20	-	-	-	-	-	1,736	33	1,703
Athens	373	5,460	27,037	-	32,870	-	7,356	10,447	-	17,803	-	-	-	-	-	50,673	3,669	47,004
Cadiz	628	7,814	2,466	-	10,908	981	2,844	1,166	-	4,991	-	-	-	-	-	15,899	1,530	14,369
Green	765	1,210	-	-	1,975	1,609	981	-	-	2,590	-	-	-	-	-	4,565	-	4,565
Moorefield	-	327	986	-	1,313	275	229	-	-	504	-	-	-	-	-	1,817	224	1,593
Short Creek	588	1,798	15,335	13,115	30,836	471	2,452	7,533	13,619	24,075	-	-	-	-	-	54,911	4,077	50,834
Total	2,727	17,459	46,317	13,115	79,618	3,356	13,862	19,146	13,619	49,983	-	-	-	-	-	129,601	9,533	120,068
County total	5,905	17,459	46,317	13,115	82,796	3,611	13,862	19,146	13,619	50,238	-	-	-	-	-	133,034	9,749	123,285

JEFFERSON COUNTY

LOWER BENCH

Mt. Pleasant	628	2,583	3,542	-	6,753	7,140	27,332	3,094	-	37,566	-	-	-	-	-	44,319	45	44,274
Smithfield	1,883	131	-	-	2,014	4,767	-	-	-	4,767	-	-	-	-	-	6,781	39	6,742
Warren	1,510	-	-	-	1,510	4,629	8,075	-	-	12,704	-	-	-	-	-	14,214	-	14,214
County total	4,021	2,714	3,542	-	10,277	16,536	35,407	3,094	-	55,037	-	-	-	-	-	65,314	84	65,230

MONROE COUNTY

UPPER BENCH

Adams	-	-	-	-	-	1,922	-	-	-	1,922	1,765	-	-	-	1,765	3,687	-	3,687
Bethel	7,278	2,027	-	-	9,305	13,594	4,643	-	-	18,237	-	-	-	-	-	27,542	-	27,542
Franklin	1,040	-	-	-	1,040	7,866	1,569	-	-	9,435	-	-	-	-	-	10,475	-	10,475
Perry	78	-	-	-	78	-	-	-	-	-	-	-	-	-	-	78	-	78
Salem	-	-	-	-	-	1,059	-	-	-	1,059	-	-	-	-	-	1,059	-	1,059
Sunsbury	-	-	-	-	-	2,452	-	-	-	2,452	1,255	-	-	-	1,255	3,707	-	3,707
Switzerland	1,471	-	-	-	1,471	16,125	-	-	-	16,125	294	-	-	-	294	17,890	-	17,890
Total	9,867	2,027	-	-	11,894	43,018	6,212	-	-	49,230	3,314	-	-	-	3,314	64,438	-	64,438

SUMMARY OF MEIGS CREEK COAL RESERVES, OHIO, 1952. Cont'd.

(In thousands of short tons. To obtain total tonnage add three zeros to end of each figure.)

Township	Original resources																Coal mined and lost in mining	Remaining reserves January 1, 1952
	Proven coal					Probable coal					Strongly inferred coal					Total		
	14"-28"	28" 42"	42"-54"	Over 54"	Total	14"-28"	28"-42"	42"-54"	Over 54"	Total	14"-28"	28"-42"	42"-54"	Over 54"	Total			
LOWER BENCH																		
Adams	-	-	-	-	-	2,295	-	-	-	2,295	-	-	-	-	-	2,295	-	2,295
Benton	-	-	-	-	-	490	-	-	-	490	-	-	-	-	-	490	-	490
Bethel	3,237	9,645	-	-	12,882	14,438	5,983	-	-	20,421	-	-	-	-	-	33,303	-	33,303
Center	1,059	-	-	-	1,059	8,847	-	-	-	8,847	26,777	-	-	-	26,777	36,683	-	36,683
Franklin	3,727	2,648	2,197	-	8,572	6,022	5,198	7,712	-	18,932	-	-	-	-	-	27,504	-	27,504
Malaga	3,119	752	-	-	3,871	17,714	-	-	-	17,714	1,118	-	-	-	1,118	22,703	-	22,703
Perry	902	3,825	-	-	4,727	20,597	817	-	-	21,414	1,765	-	-	-	1,765	27,906	-	27,906
Salem	-	-	-	-	-	8,651	-	-	-	8,651	-	-	-	-	-	8,651	-	8,651
Seneca	1,569	654	-	-	2,223	3,708	588	-	-	4,296	-	-	-	-	-	6,519	-	6,519
Summit	3,296	621	-	-	3,917	4,257	2,256	-	-	6,513	-	-	-	-	-	10,430	-	10,430
Sunsbury	-	-	-	-	-	10,652	-	-	-	10,652	4,316	-	-	-	4,316	14,968	-	14,968
Switzerland	4,335	1,994	404	-	6,733	10,848	687	-	-	11,535	-	-	-	-	-	18,268	-	18,268
Washington	667	-	-	-	667	-	-	-	-	-	-	-	-	-	-	667	-	667
Wayne	275	-	-	-	275	1,197	-	-	-	1,197	-	-	-	-	-	1,472	-	1,472
Total	22,186	20,139	2,601	-	44,926	109,716	15,529	7,712	-	132,957	33,976	-	-	-	33,976	211,859	-	211,859
County total	32,053	22,166	2,601	-	56,820	152,734	21,741	7,712	-	182,187	37,290	-	-	-	37,290	276,297	-	276,297
MORGAN COUNTY																		
UPPER BENCH																		
Manchester	333	-	-	-	333	-	-	-	-	-	-	-	-	-	-	333	-	333
LOWER BENCH																		
Bloom	137	1,242	448	-	1,827	1,844	2,256	224	-	4,324	-	-	-	-	-	6,151	-	6,151
Bristol	628	5,231	14,438	841	21,138	4,394	16,412	21,791	729	43,326	-	-	-	-	-	64,464	-	64,464
Center	2,060	16,838	9,147	-	28,045	1,746	32,727	47,573	448	82,494	-	-	-	-	-	110,539	-	110,539
Malta	-	-	-	-	-	314	-	-	-	314	-	-	-	-	-	314	-	314
Manchester	-	2,419	16,366	8,463	27,248	392	8,239	19,056	5,773	33,460	-	-	-	-	-	60,708	684	60,024
Marion	1,079	-	-	-	1,079	2,334	-	-	-	2,334	-	-	-	-	-	3,413	-	3,413
Meigsville	5,473	7,258	2,107	280	15,118	25,031	9,416	762	-	35,209	-	-	-	-	-	50,327	-	50,327
Morgan	1,138	3,727	-	-	4,865	1,412	5,591	-	-	7,003	-	-	-	-	-	11,868	-	11,868
Penn	-	-	-	-	-	745	-	-	-	745	-	-	-	-	-	745	-	745
Union	216	654	45	-	915	255	33	-	-	288	-	-	-	-	-	1,203	-	1,203
Windsor	3,492	719	-	-	4,211	14,693	-	-	-	14,693	1,373	-	-	-	1,373	20,277	-	20,277
Total	14,223	38,088	42,551	9,584	104,446	53,160	74,674	89,406	6,950	224,190	1,373	-	-	-	1,373	330,009	684	329,325
County total	14,556	38,088	42,551	9,584	104,779	53,160	74,674	89,406	6,950	224,190	1,373	-	-	-	1,373	330,342	684	329,658
MUSKINGUM COUNTY																		
UPPER BENCH																		
Rich Hill	1,314	3,237	-	-	4,551	3,315	1,079	-	-	4,394	-	-	-	-	-	8,945	-	8,945
Union	-	-	-	-	-	275	-	-	-	275	-	-	-	-	-	275	-	275
Total	1,314	3,237	-	-	4,551	3,590	1,079	-	-	4,669	-	-	-	-	-	9,220	-	9,220

LOWER BENCH																		
Blue Rock	-	229	2,152	-	2,381	98	3,269	2,242	-	5,609	-	294	-	-	294	8,284	-	8,284
Meigs	-	1,340	8,788	4,764	14,892	20	3,368	54,747	8,295	66,430	-	458	6,143	-	6,601	87,923	45	87,878
Rich Hill	-	7,912	4,932	-	12,844	157	13,666	5,605	-	19,428	59	-	-	-	59	32,331	1,300	31,031
Union	-	-	-	-	-	20	131	359	-	510	-	-	-	-	-	510	-	510
Total	-	9,481	15,872	4,764	30,117	295	20,434	62,953	8,295	91,977	59	752	6,143	-	6,954	129,048	1,345	127,703
County total	1,314	12,718	15,872	4,764	34,668	3,885	21,513	62,953	8,295	96,646	59	752	6,143	-	6,954	138,268	1,345	136,923

NOBLE COUNTY

UPPER BENCH																		
Beaver	706	-	-	-	706	196	-	-	-	196	-	-	-	-	-	902	-	902
Center	4,473	-	-	-	4,473	3,551	-	-	-	3,551	-	-	-	-	-	8,024	-	8,024
Elk	25,090	-	-	-	25,090	17,341	-	-	-	17,341	-	-	-	-	-	42,431	216	42,215
Enoch	6,552	7,945	3,991	-	18,488	4,119	8,010	1,031	-	13,160	-	-	-	-	-	31,648	1,130	30,518
Jackson	1,118	229	-	-	1,347	1,432	33	-	-	1,465	-	-	-	-	-	2,812	157	2,655
Jefferson	4,629	17,328	1,928	-	23,885	5,140	9,351	1,794	-	16,285	-	-	-	-	-	40,170	985	39,185
Marion	4,335	-	-	-	4,335	6,473	-	-	-	6,473	-	-	-	-	-	10,808	-	10,808
Olive	883	98	-	-	981	1,765	98	-	-	1,863	-	-	-	-	-	2,844	39	2,805
Seneca	2,884	-	-	-	2,884	2,884	-	-	-	2,884	-	-	-	-	-	5,768	137	5,631
Stock	5,041	2,419	-	-	7,460	13,241	1,242	-	-	14,483	-	-	-	-	-	21,943	118	21,825
Total	55,711	28,019	5,919	-	89,649	56,142	18,734	2,825	-	77,701	-	-	-	-	-	167,350	2,782	164,568
LOWER BENCH																		
Beaver	196	1,831	7,084	2,802	11,913	3,845	7,585	6,726	1,121	19,277	-	-	-	-	-	31,190	112	31,078
Brookfield	-	8,468	49,053	12,162	69,683	-	4,348	21,208	2,186	27,742	-	-	-	-	-	97,425	11,317	86,108
Center	-	5,002	3,766	560	9,328	255	4,152	2,242	560	7,209	-	-	-	-	-	16,537	-	16,537
Elk	1,981	18,472	21,657	3,195	45,305	922	11,018	20,312	-	32,252	-	-	-	-	-	77,557	694	76,863
Enoch	-	1,014	14,393	22,408	37,815	-	294	8,429	17,094	25,817	-	-	-	-	-	63,632	2,081	61,551
Jackson	2,452	7,945	13,003	15,156	38,556	4,414	27,398	30,669	7,745	70,226	-	-	-	-	-	108,782	1,364	107,418
Jefferson	-	13,535	4,887	10,761	29,183	-	10,103	10,940	224	21,267	-	-	-	-	-	50,450	2,481	47,969
Marion	59	621	13,362	3,251	17,293	3,590	11,639	11,120	3,587	29,936	-	-	-	-	-	47,229	90	47,139
Noble	-	1,144	986	-	2,130	-	2,583	404	-	2,987	-	-	-	-	-	5,117	-	5,117
Olive	785	2,517	5,246	953	9,501	1,648	5,100	8,116	4,316	19,180	-	-	-	-	-	28,681	177	28,504
Seneca	-	2,387	9,371	617	12,375	255	2,321	3,183	5,437	11,196	-	-	-	-	-	23,571	266	23,305
Sharon	628	15,857	16,994	729	34,208	5,355	15,922	27,530	1,569	50,376	-	-	-	-	-	84,584	1,240	83,344
Stock	-	3,858	15,873	10,873	30,604	3,237	2,583	11,613	2,130	19,563	-	-	-	-	-	50,167	471	49,696
Wayne	39	1,046	224	-	1,309	-	458	-	-	458	-	-	-	-	-	1,767	-	1,767
Total	6,140	83,697	175,899	83,467	349,203	23,521	105,504	162,492	45,969	337,486	-	-	-	-	-	686,689	20,293	666,396
County total	61,851	111,716	181,818	83,467	438,852	79,663	124,238	165,317	45,969	415,187	-	-	-	-	-	854,039	23,075	830,964

SUMMARY OF MEIGS CREEK COAL RESERVES, OHIO, 1952. Cont'd.

(In thousands of short tons. To obtain total tonnage add three zeros to end of each figure.)

Township	Original resources																Coal mined and lost in mining	Remaining reserves January 1, 1952
	Proven coal					Probable coal					Strongly inferred coal					Total		
	14"-28"	28"-42"	42"-54"	Over 54"	Total	14"-28"	28"-42"	42"-54"	Over 54"	Total	14"-28"	28"-42"	42"-54"	Over 54"	Total			
WASHINGTON COUNTY																		
UPPER BENCH																		
Adams	3,629	2,289	1,031	-	6,949	8,062	3,204	135	-	11,401	-	-	-	-	-	18,350	-	18,350
Aurelius	2,668	5,231	-	-	7,899	4,453	3,139	-	-	7,592	-	-	-	-	-	15,491	163	15,328
Decatur	1,765	-	-	-	1,765	9,082	-	-	-	9,082	6,611	-	-	-	6,611	17,458	-	17,458
Fairfield	-	-	-	-	-	-	-	-	-	-	785	-	-	-	785	785	-	785
Independence	255	-	-	-	255	-	-	-	-	-	-	-	-	-	-	255	-	255
Lawrence	3,060	3,662	359	-	7,081	9,652	13,927	-	-	23,579	137	-	-	-	137	30,797	20	30,777
Liberty	12,201	1,144	-	-	13,345	18,165	5,885	-	-	24,050	-	-	-	-	-	37,395	-	37,395
Ludlow	2,982	-	-	-	2,982	4,276	-	-	-	4,276	-	-	-	-	-	7,258	-	7,258
Newport	294	-	-	-	294	490	-	-	-	490	2,079	-	-	-	2,079	2,863	-	2,863
Salem	1,589	5,950	1,480	-	9,019	5,650	5,493	314	-	11,457	-	-	-	-	-	20,476	-	20,476
Wesley	39	-	-	-	39	5,728	-	-	-	5,728	8,004	-	-	-	8,004	13,771	-	13,771
Total	28,482	18,276	2,870	-	49,628	65,558	31,648	449	-	97,655	17,616	-	-	-	17,616	164,899	183	164,716
LOWER BENCH																		
Adams	3,197	12,456	3,453	-	19,106	16,105	11,247	7,174	-	34,526	12,260	-	-	-	12,260	65,892	-	65,892
Aurelius	-	4,381	10,088	841	15,310	353	7,225	6,143	280	14,001	-	-	-	-	-	29,311	355	28,956
Decatur	216	327	45	-	588	78	-	-	-	78	-	-	-	-	-	666	-	666
Fearing	-	-	-	-	-	1,196	262	-	-	1,458	5,630	-	-	-	5,630	7,088	-	7,088
Independence	118	-	-	-	118	78	-	-	-	78	-	-	-	-	-	196	-	196
Lawrence	3,609	1,308	3,632	-	8,549	12,927	8,108	762	-	21,797	255	-	-	-	255	30,601	33	30,568
Liberty	7,494	4,218	-	-	11,712	22,520	8,337	-	-	30,857	-	-	-	-	-	42,569	-	42,569
Ludlow	2,550	-	-	-	2,550	6,434	-	-	-	6,434	-	-	-	-	-	8,984	-	8,984
Muskingum	-	-	-	-	-	745	-	-	-	745	118	-	-	-	118	863	-	863
Newport	2,550	-	-	-	2,550	1,275	-	-	-	1,275	-	-	-	-	-	3,825	-	3,825
Salem	7,101	12,980	1,704	392	22,177	6,630	10,004	-	-	16,634	-	-	-	-	-	38,811	-	38,811
Waterford	490	1,700	1,973	-	4,163	8,121	8,893	24,840	-	41,854	17,910	-	-	-	17,910 *	63,927	-	63,927
Watertown	-	-	-	-	-	-	-	-	-	-	20,049	-	-	-	20,049	20,049	-	20,049
Wesley	1,609	65	404	897	2,975	8,769	2,452	3,991	2,074	17,286	5,865	7,291	1,255	-	14,411	34,672	-	34,672
Total	28,934	37,435	21,299	2,130	89,798	85,231	56,528	42,910	2,354	187,023	62,087	7,291	1,255	-	70,633	347,454	388	347,066
County total	57,416	55,711	24,169	2,130	139,426	150,789	88,176	43,359	2,354	284,678	79,703	7,291	1,255	-	88,249	512,353	571	511,782
STATE TOTAL																		
Upper bench	113,462	57,543	8,789	-	179,794	290,912	65,093	3,274	-	359,279	50,571	-	-	-	50,571	589,644	4,475	585,169
Lower bench	98,494	327,888	530,206	170,261	1,126,849	451,924	661,274	789,459	151,316	2,053,973	113,521	65,618	71,157	-	250,296	3,431,118	42,956	3,388,162
Total	211,956	385,431	538,995	170,261	1,306,643	742,836	726,367	792,733	151,316	2,413,252	164,092	65,618	71,157	-	300,867	4,020,762	47,431	3,973,331

* Includes weakly inferred coal.

SELECTED BIBLIOGRAPHY

Arkle, Thomas, Jr., Economic Geology and Stratigraphy of Switzerland Township and Immediate Environs. Unpublished Master's Thesis, Ohio State University, 103 p., app., 12 pls., 1950.

Bartlett, John D. The Geology of Union Township, Morgan County, Ohio. Unpublished Master's Thesis, Ohio State University, 83 p., app., 13 pls., 1950.

Bell, Gerald L., The Geology of Salem Township, Washington County, Ohio. Unpublished Master's Thesis, Ohio State University, 110 p., app., 15 pls., 2 figs., 1950.

Bownocker, John A. and Dean, Ethel S., Analyses of the Coals of Ohio. Ohio Geol. Survey Bull. 34, p. 248-273, 323, 336, map, 1929.

Bownocker, John A.,, The Coal Fields of Ohio. U. S. Geol. Survey, Prof. Paper 100, p. 35, 72-80, 90, 1917.

Bownocker, John A. and Lord, N.W., and Somermeier, E.E., Coal. Ohio Geol. Survey Bull. 9, p. 125-170, 2 maps, 1908.

Brown, C. Newton, The Meigs Creek Coal Seam in Morgan, Muskingum, Guernsey, and Noble Counties. Ohio Geol. Survey vol. 5, p. 1059-1086, map, 1884.

Clark, F.R., Original Coal Content of the Fields, in The Coal Fields of Ohio, by J.W. Bownocker. Geological Survey, Prof. Paper 100, p. 88-96, 1917.

Condit, D. Dale, Economic Geology of the Summerfield and Woodsfield Quadrangles, Ohio, with Descriptions of Coal and Other Mineral Resources Except Oil and Gas. U.S. Geol. Survey Bull. 720, 156p., 1923.

Eberle, R.F., The Geology of Wheeling and Flushing Townships, Belmont County, Ohio, Unpublished Master's Thesis, Ohio State University, 114 p., 12 figs., 1936.

Fieldner, A. C. and others, Analyses of Ohio Coals. U. S. Bureau of Mines, Bull. 499, 93 p., 5 figs., 14 tables, 1952.

Frye, John C., Geology of a Portion of the Lower Muskingum Valley. Unpublished Master's Thesis, University of Iowa, 58 p., app., 5 pls., 14 figs., 1937.

Lamborn, R.E., Geology of Jefferson County. Ohio Geol. Survey Bull. 35, p. 236-239, 1930.

Ray, F. A., Ohio Coal Supply and its Exhaustion, in Analyses of the Coals of Ohio, by J.A. Bownocker and E.S. Dean. Ohio Geol. Survey Bull. 34, p. 329-341, 1929.

Smith, William H., Geology of Newport Township, Washington County, Ohio. Unpublished Master's Thesis, Ohio State University, 112 p., app., 5 figs., 4 pls., 1948.

Stevenson, J.J., Geology of Harrison, Guernsey and Belmont Counties. Ohio Geol. Survey, vol. 3, p. 200-236, 261-287, 1878.

Stout, Wilber E., The Monongahela Series in Eastern Ohio. W. Va. Acad. Sci. Proc., vol. 3, p. 118-133 (Univ. Bull., Ser. 30, No. 1), map, 1930.

SELECTED BIBLIOGRAPHY (Cont'd)

Stout, Wilbur E., The Monongahela Series of Eastern Ohio. Ohio Geol. Survey, Open File Report Series, No. 1, in preparation.

Thiessen, Reinhardt, and Staud, J.N., Correlation of Coal Beds in the Monongahela Formation of Ohio, Pennsylvania, and West Virginia. Coal-Mining Investigations, Bull. 9, p. 13, 14, 1 fig., Carnegie Inst. Tech., Pittsburgh, 1923.

White, George W., Maps of Meigs Creek Coal in Caldwell Quadrangle, Ohio (parts of Noble, Washington and Morgan Counties) and in Cumberland Quadrangle, Ohio (parts of Guernsey, Noble, Muskingum and Morgan Counties) accompanied by sheet of sections.

In addition to the published reports, data for the geologic maps used to prepare this report were compiled, in part, from the unpublished field notes of the following men: E. B. Andrews, J. A. Bownocker, C. N. Brown, D. D. Condit, A. T. Cross, B. A. Eisenlohr, N. K. Flint, J. E. Hyde, R. E. Lamborn, E. Lovejoy, D. L. Norling, A. W. Seabright, G. E. Smith, W. H. Smith, W. E. Stout, and G. W. White.

L. L. Knudsen and P. H. Struthers, of the Ohio Agricultural Experiment Station, loaned maps of the strip mined areas which had been traced off aerial photographs.

PART II. - WASHABILITY CHARACTERISTICS AND OTHER PROPERTIES

By Peter O. Krumin

Blank Page

WASHABILITY CHARACTERISTICS AND OTHER PROPERTIES

SUMMARY

In the Introduction, the great importance of coal in our industrial civilization is stressed; also, the trend in methods of mining, loading, and cleaning of coal in the United States is concisely outlined. As an example of a modern coal cleaning plant, the new Georgetown Preparation Plant built by Hanna Coal Company in Ohio, is briefly reviewed.

In the experimental part, the results of study of 24 coal samples (representing various sections of Meigs Creek No. 9 coal bed in Ohio in six different locations) are reported. The basic analyses include determination of moisture, volatile matter, fixed carbon, ash, sulfur, and gross heating value; also included are low-temperature carbonization assays. The properties of the coal samples were determined by A.S.T.M. Standard Methods or other commonly accepted tests and are presented in summary tables. Part of the low-temperature carbonization assays were performed in a new electrically heated closed-system carbonization assay, as developed by the author. The results of these assays show a complete material balance of carbonization products versus charge. Since the Meigs Creek No. 9 coal bed contains one of the largest coal reserves in Ohio and has not been used in the past to any great extent because of its relatively high ash content (varying from 7.10 to 25.00 per cent in separate sections investigated and reported in this paper), the major emphasis has been placed on study of ash reduction, and other washability characteristics.

From the 24 sections collected separately, seven composite samples have been prepared which represent the whole cross section of the coal bed at six sampling sites. These composite samples have been screen-sized, analyzed, and used for float-and-sink tests. The results of the float-and-sink tests are presented on data sheets in tabular and graphical form. The basic set of washability curves is as follows: "Float Ash," "Elementary Ash," "Sink Ash," "Float Sulfur," "Specific Gravity," and "±0.05 Specific Gravity Distribution."

To show the effect of crushing on ash reduction (or yield of float coal), "Float Ash" curves for various screen sizes (as obtained by a step-by-step crushing and floating of the same coal sample) are presented on separate data sheets for each of seven composite samples. Similar curves show the effect of crushing on sulfur reduction for five composite samples.

In addition to these basic washability curves, heating values in all float-and-sink products (of several screen sizes) were determined and reported in separate data sheets.

The results of investigation of Meigs Creek No. 9 coal are presented in 18 tables, 84 data sheets, and the report is illustrated by 11 figures.

INTRODUCTION

In our industrial civilization, too much stress cannot be laid on the primary importance of fuel to the national economy. Fuel is the backbone of all industrial prosperity, and the use of heat and power is a basic index of a nation's degree of advancement. In the United States, approximately half of the total energy generated and harnessed is obtained from coal, and the great preponderance of known mineral fuel resources is in coal.

The percentage distribution of American mineral fuel reserves (excluding atomic power elements) is given by Dr. Arno Fieldner, Chief Fuel Technologist, U. S. Bureau of Mines,[8*] as follows:

	(%)
Recoverable coal (one-half of coal reserves)	95.4
Recoverable oil from oil shale	3.6
Proved natural gas	0.5
Proved petroleum	0.5
	100.0

He estimated that, in terms of 13,000-Btu. coal, recoverable fuel reserves would be 1299 billion tons at the beginning of 1949. The total life expectancy of all fuel reserves, based on (1) the 1948 rate of production of oil, natural gas and coal, and (2) the existing methods of mining and fuel technology, is estimated to be 653 years. The oil and gas would be made exclusively from coal after proven petroleum natural gas and oil shale resources are exhausted.

TRENDS IN METHODS OF MINING AND LOADING COAL

In recent years a significant trend toward labor-saving devices has been noted in mine management, i.e., elimination wherever possible of the arduous, expensive, and hazardous hand-work in

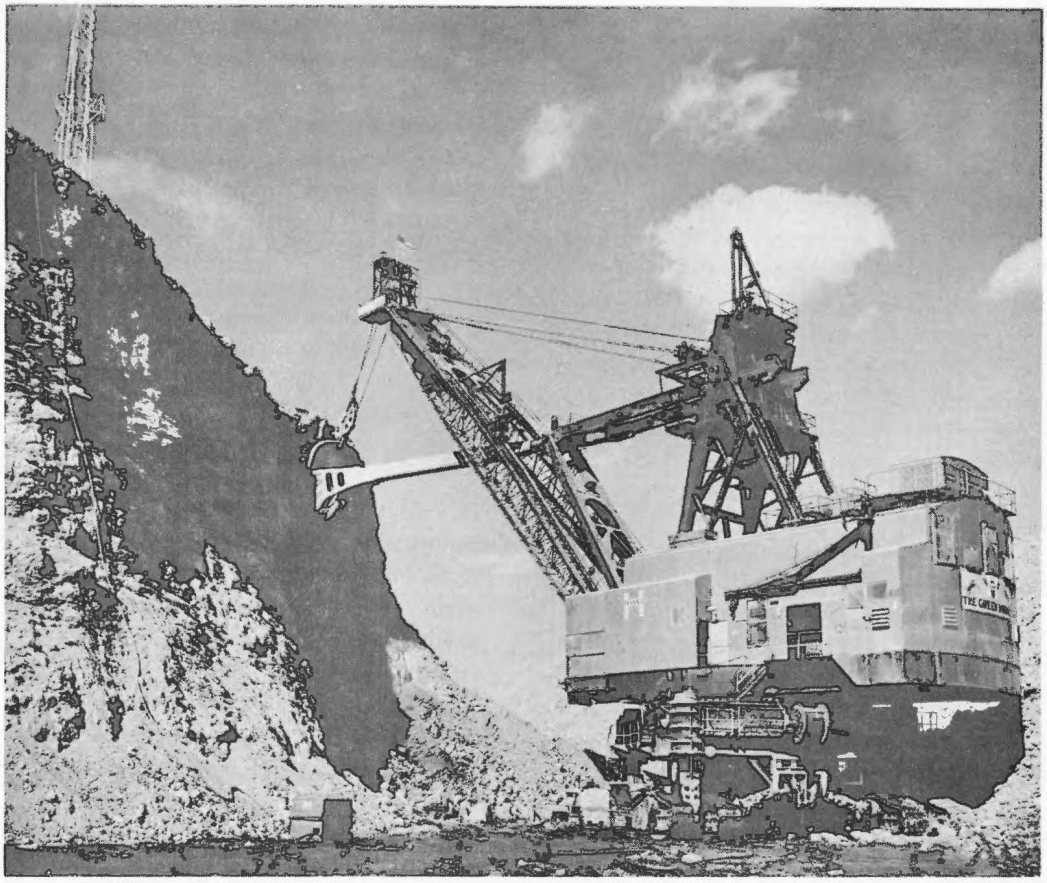
* *Number refers to Bibliography at end of Part II.*

the coal mining industry and the mechanization of coal extracting, loading, and cleaning.

In 1948 (in the United States), 74.6 per cent of the total coal production was mechanically mined underground, 23.3 per cent surface mined, and only 2.1 per cent was mined by hand. The latter method is used in the small family-operated "mines", producing coal for selling to local or neighborhood markets. In mechanized underground mining the coal is undercut, top-cut, or sheared and then blasted. Loading can be accomplished by hand or machine. If hand loaded, the larger visible impurities are hand-picked in the mine; no such removal of impurities is possible in the mine, if coal is mechanically loaded. The trend toward mechanical loading began in the early 1920's.

The data compiled by the U. S. Bureau of Mines show that, in 1945, of all mines having 90 per cent and more of their production mechanically loaded, the output per man-day averaged 6.49 tons, as compared with 4 tons per man-day in mines where production was all hand loaded.[8] Of great promise is the "continuous mining machine"; its sponsors claim that it will revolutionize coal mining and will replace the cyclical step-by-step sequence with a single, co-ordinated operation at the working place underground.[4]

The extracting of coal by "stripping" or open-cut surface mining is found to be most practical, if coal seams of sufficient thickness and value are not buried too deeply. This type of coal mining becomes practical and economical through the use of giant mechanical shovels and dragline excavators; such equipment can remove the heavy overburdens of earth



Courtesy of the Hanna Coal Company

Fig. 1. --- Large stripping shovel used by the Hanna Coal Company in Ohio coal mines. After overburden is loosened by blasting with liquid oxygen, this shovel can remove the material to an average height of 80 ft.; its dipper capacity is 50 cu. yds., its boom is 120 ft. long, its length of dipper handle is 60 ft., and its approximate weight is 4,000,000 lbs. Operation of each shovel requires four men, and the average tonnage uncovered per month is 80,000 tons per shovel.

which cover the coal (Fig. 1).

After the overburden is removed, a bulldozer scrapes off the rocky impurities on top of the coal seam, and a mechanical broom removes the finer impurities. If the coal is hard, the exposed coal bed is often drilled and blasted, and the coal is systematically removed by a smaller shovel. It is then usually loaded directly into railroad cars at the pit or into trucks for taking it to the preparation plants (Fig. 2). In strip mines, almost all of the coal is removed and there is little waste of the natural resources.

CLEANING

In the early days, only the best seams were selected for production. The coal was mined by hand and hand loaded. Cleaning operations were limited to hand-picking of visual impurities that might appear objectionable to the buyer. In the United States today, only about two per cent of the total production continues to be mined by hand. The trend toward the application of new methods of loading is illustrated by the comparison in the following tabulation:[8]

	1935-39 (%)	1949 (%)
Mechanically loaded coal underground	19.7	51.9
Strip mined	7.6	22.8
Hand loaded	72.7	25.3

Courtesy of the Hanna Coal Company

Fig. 2. --- Electric shovel loading coal into trucks in an Ohio coal mine. When the highwall or overburden is removed, the coal top is mechanically cleaned by scrapers and revolving brooms. Loading shovels, equipped with 9-cu.yd. dippers, then load the coal into 15-ton trucks which haul the raw coal to the Georgetown Preparation Plant for processing.

INTRODUCTION

Inevitably, the modern mining and loading practices, employing more and more mechanization, produce a "run-of-mine" coal which contains a larger percentage of impurities than coal from the same seam loaded by hand and hand picked. In addition, many collieries over most of the world have exhausted their best seams, leaving plentiful reserves of lower grade coal beds. These seams, especially if mechanically-loaded, cannot meet present consumer requirements, unless increased attention is paid to the removal of undesirable impurities. Specifications for coal to be used as raw material for metallurgical or foundry coke, production of synthetic liquid fuels, or coal chemicals call for a high degree of cleaning and separation of undesirable components. In all cases where coal is used as fuel, the most important consideration in estimating the true "use value" of the fuel is the number of heating units per unit of cost. For example, the effect of high ash content on plant performance (in an industry using coal) varies greatly with such factors as load, type of equipment, and basic plant design. The consumer demands a uniformly prepared coal which produces tangible results in his particular utilization equipment and under particular conditions specified by him.[23] In addition, the increased competition with other primary energy sources makes the production of more efficiently usable, carefully cleaned, and specifically sized coal a necessity.

According to H. F. Yancey[26] (in 1941), the 460 cleaning plants in the United States produced over 117 million tons of cleaned bituminous coal (or about 23 per cent of the entire output). In 1948, there were 502 mechanical cleaning plants in operation, which produced 181 million tons of cleaned bituminous coal (or 30.2 per cent of the total production, a production which totaled 599.5 million tons).[8] The proportion of the annual coal production cleaned mechanically is increasing steadily. Many of the new coal preparation plants will handle the entire run-of-mine output. They have been designed for the utmost flexibility, and are able to produce a great variety of sizes and mixtures in order that the plant may supply the demand of a changing market. The new Georgetown Preparation Plant[1,2,3] in Ohio is an excellent example of such a processing plant, or unit. This plant, using run-of-mine coal with large variations in impurities and moisture content, can produce a uniform end product of almost any desired size or combination of sizes.

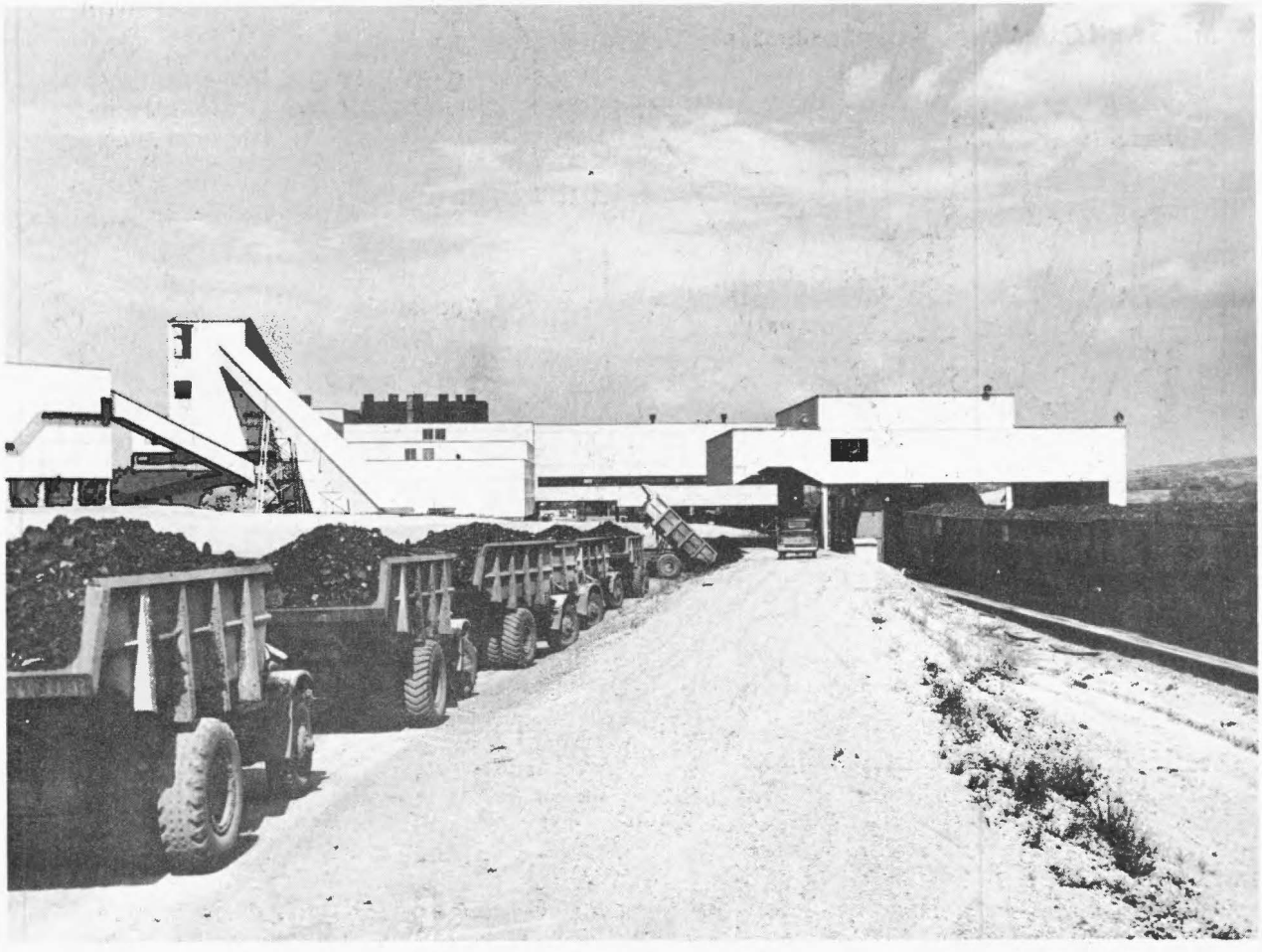
The run-of-mine coal from the Hanna Coal Company large strip mines in Harrison, Jefferson, and Belmont counties, and from some of the Company's underground mines in Ohio, is received at the Georgetown Preparation Plant by railroad cars or large trucks and dumped into the 1500-ton below-ground bin. From there the raw coal travels up a 641-ft. conveyor belt to the shaker screens at the top of the plant. The new plant is designed with three types of coal-cleaning equipment; after the coal is screened according to size, it flows through the plant in three separate circuits. Small sizes (1/4 to 0) are cleaned by a battery of 30 Deister vibrating tables, having a combined throughput capacity of 300 tons per hour. The coal arrives at the Deister tables containing between 12 and 20 per cent ash, which content is reduced to 7 per cent or less by the cleaning process. The moisture content of the clean-coal slurry is reduced by a progressive drying treatment (involving a settling tank, six centrifugal Reineveld dryers, and thermal Raymond flash dryers served by flue gases) to about 2 1/2 per cent in the final product. Intermediate sizes (1/4 to 1 1/2 inches) pass through a 16 1/2-ft. Chance cone circuit which has a capacity of 500 tons per hour. Float material from the cone is desanded, and the de-watering screens split the product into three size fractions: 1/4 to 3/8, 3/8 to 1, and 1 to 1 1/2 inches. The two smaller-sized fractions of this process are thermally dried on three woven-wire belt conveyors to below 2 per cent moisture content; the 1- to 1 1/2-in. fraction is stored in one of the blending bins without drying. In the third circuit, the large sizes (1 1/2 to 7 inches) move to two McNally Baum jigs, with a circuit capacity of 700 tons per hour. These jigs have an upward pulsating water current which separates the feed into layers corresponding to the specific gravity of the material. The impurities with the higher specific gravity go to the bottom and are discharged automatically. Clean coal from the jigs can be loaded directly or crushed and mixed with other sizes. The clean coal from all three circuits (totaling 1275 tons per hour) flows into the blending bins, and the mixing conveyor makes it possible to load the various sizes or combination of sizes on any of the five loading tracks. Efficient loading equipment permits 2-min. loading of railroad cars, and each car is automatically weighed. The refuse from the plant is crushed and disposed of in the worked-out strip pit. (Fig. 3)

JOINT PROJECT

The reserves of Meigs Creek No. 9 coal in Ohio, estimated by F. A. Ray from data available in 1929, amounted to 957,600,000 tons.[9] According to most recent investigations, however, carried out by the Division of Geological Survey (of the Ohio Department of Natural Resources) and reported in Part I of this publication, the reserves of this coal now total 3,973,331,000 tons.

These huge reserves have not been used in the past to any great extent because of the relatively high ash content in the run-of-mine production (especially the mechanically-mined and mechanically-loaded coal), which cannot compete with the freight rates on the lower-ash-content coal. Therefore, the Meigs Creek coal was considered as a reserve for future needs. But in recent years, as outlined in Part I of this publication, the strip mining of this coal has been rapidly increasing, and production from the seam has gained such prominence that it now ranks fourth among Ohio coals in annual tonnage produced.[22]

In 1949, Harry E. Nold, Professor of Mining, The Ohio State University, supported by John H. Melvin, Chief of the Division of Geological Survey, proposed to carry out an investigation of the Meigs Creek No. 9 coal bed in Ohio. They, with others, believed that



Courtesy of the Hanna Coal Company

Fig. 3. --- External view of the new Georgetown Preparation Plant located two miles southeast of Cadiz, Ohio. It is the largest coal cleaning plant of its kind ever built for the commercial bituminous coal industry having a capacity of 1,500 tons per hour of raw coal or 1,275 tons per hour of clean coal. It cost more than five million dollars and required two years to build. It was opened July 31, 1951 by the Hanna Coal Company, Division of Pittsburgh Consolidation Coal Company.

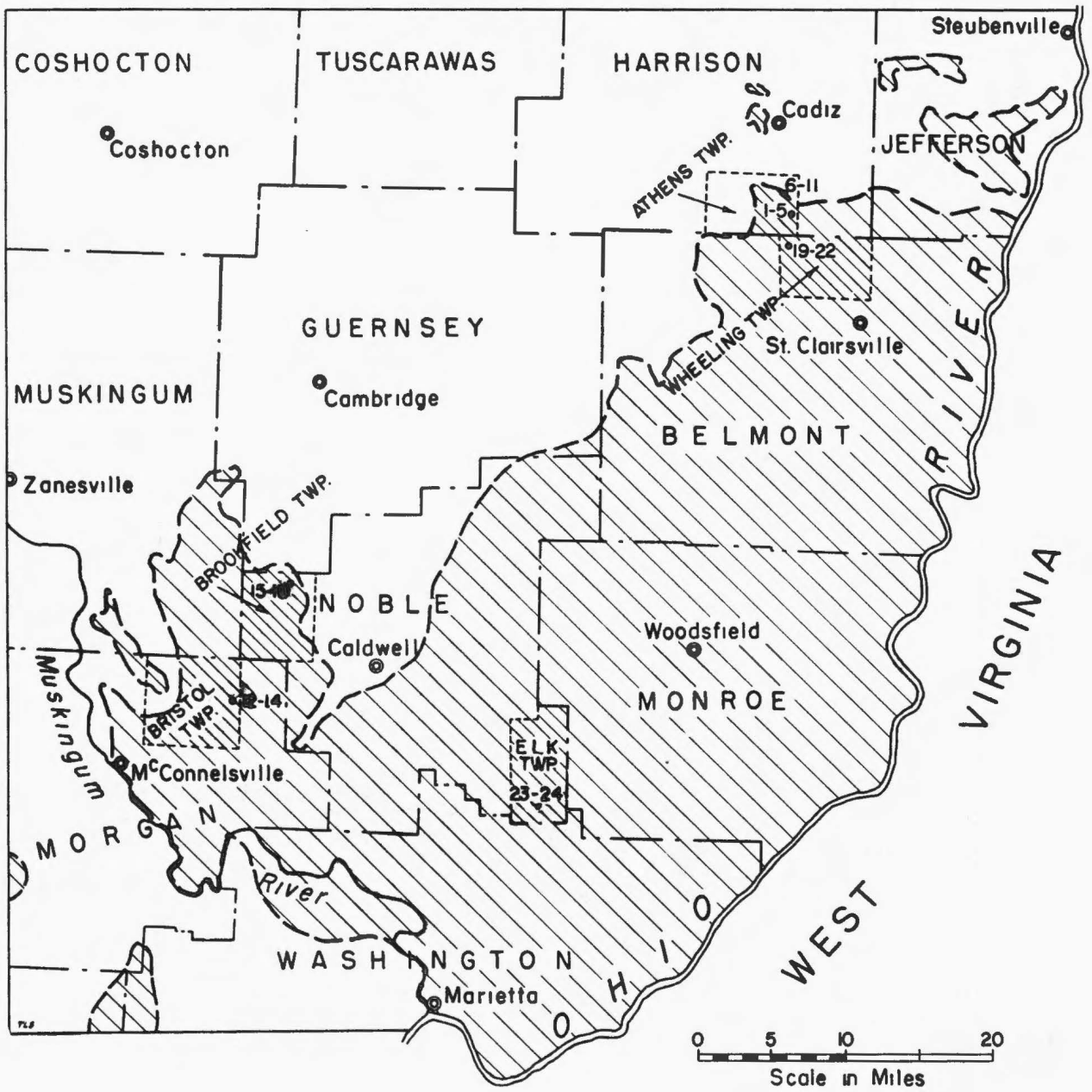


Fig. 4.-Southeastern portion of Ohio, with Meigs Creek coal area; identification numbers indicate samples (Ref. No. 1 to 24) locations investigated and reported in this paper.

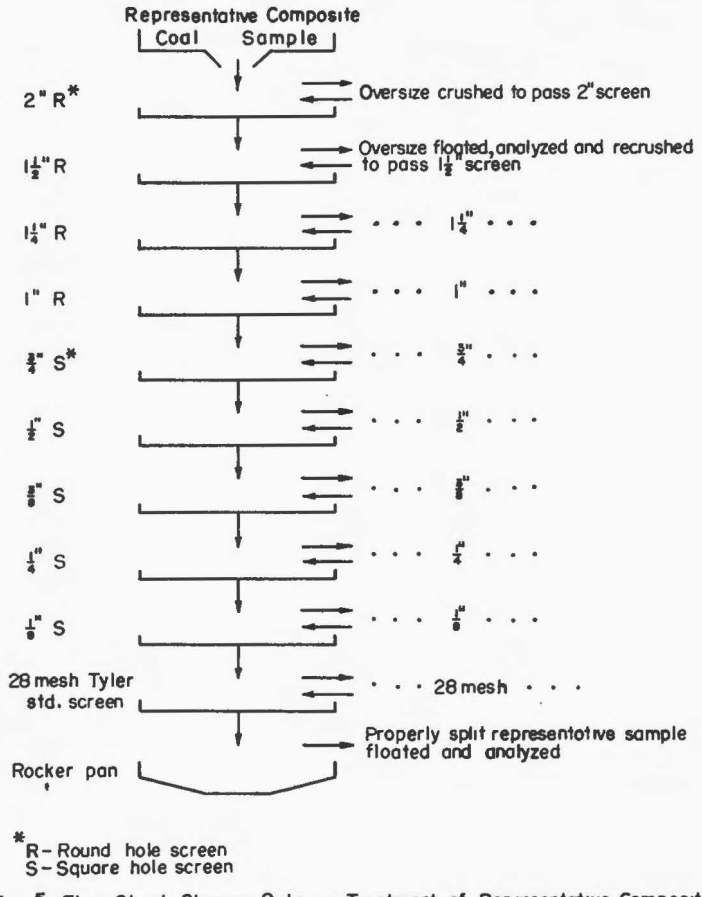


Fig. 5.-Flow Sheet Showing Ordinary Treatment of Representative Composite Coal Sample for Float-and-Sink Tests.

relatively low-cost beneficiation might produce (1) a sizeable proportion of low-ash-content coal, leaving the portion of higher-ash-content coal for special use (e.g., power generation at or near the mine), or (2) a marketable, uniform coal with a comparatively small percentage of refuse.

C. E. MacQuigg, late Dean of the College of Engineering and Director of the Engineering Experiment Station, The Ohio State University, called a conference of representatives of the Department of Mining, the Division of Geological Survey, and the Station to consider the above proposal and plan a course of action. The conferees unanimously recognized the importance and necessity of investigating the Meigs Creek coal and of establishing the investigation as a joint project. They decided that the Division of Geological Survey should carry out a comprehensive study of the reserves in the Meigs Creek coal bed in all counties of Ohio in which it is present in minable amounts and with the Engineering Experiment Station should publish the results in a joint bulletin. Further, they decided that the locations from which the coal samples were to be taken for laboratory investigations should be selected by the University's Department of Mining and the Ohio Division of Geological Survey, that the sampling should be carried out by geologists of the Survey and the Station, and that the laboratory investigation should be carried out by the Fuels Research Laboratory of the Station.

OBJECT AND SCOPE OF LABORATORY INVESTIGATIONS

One of the principal purposes of that part of the joint project assigned to the Fuels Research Laboratory was a study of the fundamental facts about the Meigs Creek No. 9 coal. Upon consideration of recent trends in coal mining, loading, and cleaning practice (as briefly outlined in the Introduction above), the assumption was made that screen-sizing and float-and-sink tests (supplemented by chemical analyses) would be of immediate service to the industry. Taking into account the lack of funds for immediate purchase of a complete set of laboratory equipment for full-scale investigations, it was decided that in the first stage of the work (1) the number of determinations should depend on equipment available, and (2) the float-and-sink test separations should be limited to a series of four specific gravities.

Since the area to be covered is large, and promptness in publishing the results was desirable, the conferees further decided to limit the scope of work for this report to sampling and investigation of samples from six localities of Meigs Creek No. 9 coal bed in Ohio. The sampling and further investigation of samples of Meigs Creek No. 9 coal will be continued and a progress report will follow.

EXPERIMENTAL PROCEDURE, TESTS AND RESULTS

SAMPLING

All samples reported in this Bulletin, except No. 12 to 14 (243A to 243B) were taken at working faces in the strip mines. These samples were taken substantially in the manner prescribed by the U. S. Bureau of Mines unless otherwise stated. At each selected site, the face (considered to be typical as to width, embedded impurities, roof and floor, and general physical characteristics) was cleared of dirt and loose coal, insecure fragments of the roof were taken down, and the floor was cleaned. From this thoroughly cleaned face, a channel of uniform cross section across the entire width of the working face of the seam was cut at right angles to the walls. In accordance with the usual mining practice, all partings and impurities in the portion of the seam usually mined were included in the samples.

The material excavated in cutting the channel was carefully collected on a canvas, spread out in front of the face, and these collected cuttings constituted the sample. Individual sections were sampled separately and the entire yield of broken coal was sent to the Fuels Research Laboratory of the Engineering Experiment Station constitute the tests lot.

Samples 12 to 14 (243A to 243B) were collected systematically from strip mined and ordinarily crushed coal. Equal increments were taken at regular intervals, while the coal was in motion on the conveyor, being loaded from the conveyor into 8 trucks for washery test, and going through the washery test. The location of samples is shown in Fig. 4, and additional data are given in Table I. Cross sections of coal beds at sampling face and measurements of the coal beds

Table I. Location of Mines from which Samples of Meigs Creek No. 9 Coal Reported in th is Paper were Collected.

Reference number			
E.E.S. Laboratory	G.S.O. Locality	Producer and mine	Samples collected by:
1/195 to 5/199	521	Hanna Coal Company, Georgetown No. 12 Strip Mine (550 pit), SE Sec. 36, Athens Township, Harrison County, Ohio	W.H. Smith, C.H. Bowen and Anita S. Bowen
6/200 to 11/205	523	Hanna Coal Company, Georgetown No. 12 Strip Mine (300 E pit), Central Sec. 31, Athens Township, Harrison County, Ohio	W.H. Smith, C.H. Bowen, and Anita S. Bowen
12/243A to 14/243B	542	Janes Coal Sales Inc., Strip Mine in Bristol Township, Morgan County, Ohio	F.H. Westlake, W.H.Smith, and P.O. Krumin
15/209 to 18/206	543	Central Ohio Coal Company Strip Mine, SE SW Sec. 4, Brookfield Township, Noble County, Ohio	C.H. Bowen, P.O. Krumin, and T. Wilson Section measured by A.S. Bowen and C.H. Bowen
19/216 to 22/213	585	Hanna Coal Company, Barton No. 1 Strip Mine, SW SE Sec. 33, Wheeling Township, Belmont County, Ohio	C.H. Bowen and P.O. Krumin Section measured by A.S. Bowen
23/250 to 24/251	572	Koontz Coal Company Strip Mine near Harriettsville, SE 1/4 SE 1/4 Sec. 25, Elk Township, Noble County, Ohio	W.H. Smith, P.O. Krumin, and L. Sprout

at the points where samples were taken are given in Figs. 7 to 11. In all cross sections, average ash and sulfur contents, calculated on moisture-free basis, are shown separately for each section sampled.

LABORATORY STUDY

The object of the experimental work was to extend the laboratory study to (1) proximate analysis, including sulfur, (2) determination of gross heating value and low-temperature carbonization assays of the representative samples from each location sampled, and (3) distribution of ash and sulfur in different screen sizes and different specific-gravity fractions of the float-and-sink tests. It was believed that such float-and-sink tests would indicate: (a) the approximate efficiency of the cleaning process in removing impurities, i.e., to what extent the coal can be benefited by washing, and (b) the proper size to which the coal should be crushed in order to obtain the optimum degree of beneficiation.

All samples of individual sections arrived in the Fuel Research Laboratory packed in separate cloth bags. In the cutting of the channel samples, the coal was roughly crushed in different sizes. From each separately sampled section a representative sample was properly split for analyses, which sample was further crushed in a jaw or roll crusher for reducing the material to pass No. 8 (2380-micron) Tyler sieve, and then was split in two parts for (1) proximate analyses and other analytical determinations, and (2) low-temperature carbonization assays. The first part was still further crushed in a ball mill in order to reduce the material passing No. 8 sieve to a size which could pass a 250-micron (No. 60) standard Tyler sieve. Usually some particles remained on the sieve. These particles, often consisting largely of ash-forming substances, were reduced with mortar and pestle to pass a No. 60 sieve, and added to what had already passed through the sieve. The samples passing the No. 60 sieve were placed in airtight glass bottles, protected against change of moisture, and used for all the analytical determinations. The same procedure was used for preparation of samples for analyses which were split from different float-and-sink tests fractions. All analytical determinations and calculations reported throughout this paper were conducted according to A.S.T.M. Standard Methods (D 271-48), except where otherwise noted.

The low-temperature carbonization assay (determination of amount of tar and other yields which can be obtained from a sample in an assay under certain specified conditions) was carried out in U.S. Bureau of Mines assembly [21] (as shown in Fig. 1, page 8 of the Station's Bulletin No. 143). To show a complete material balance sheet of a carbonization assay, samples Ref. No. 12/243A, 23/250 and 24/251 were carbonized in electrically heated Krumin retort assembly (Fig. 6) as described by C. H. Breithaupt[10] and M. O. Abdullah. (A detailed report about this new, closed system carbonization retort assembly will follow in another paper).

SCREEN SIZING *

After a definite proportionate weight (by percentage) from each separately sampled section was properly split for analytical determinations and carbonization assays, as described above, a proportionate quantity of each sample cut from one cross section (for example, sections numbered 1 to 5, 6 to 11, etc.) was combined to form a composite sample representing the total thickness of the coal bed at the point where samples were taken. Each composite sample was first used for a sizing test. The entire composite sample, containing all sizes as obtained by cutting the channel sample, was carefully screened by hand on a series of sieves (16x12x4 inches square wood frames) with standard 2-inch, 1 1/2-inch, 1 1/4-inch, and 1-inch round-hole steel plate screens and 3/4-inch, 1/2-inch, 3/8-inch, 1/4-inch, and 1/8-inch woven wire cloth square-hole screens and 28-mesh Tyler standard screen.

The oversize on 2-inch round-hole screen was crushed to make the coarse fraction small enough to pass through a 2-inch round-hole screen. The particles passing the 28-mesh Tyler sieve were collected in a rocker pan.

METHOD OF REPORTING

An effort has been made to report the experimental results obtained in the most concise form possible, in uniform self-explanatory tabular summaries and data sheets, illustrated by figues, which would require only a few supplementary remarks. Since coal samples have been taken from six different locations,

---

* *The term "sized coal" indicates a grade of coal whose size-consist is that fraction which passes through one screen and is retained upon another.*

all data referring to a sample from the six localities (listed in Table I) are compiled in uniform order in six separate sections as follows: at the beginning of every section of this report (except Section Ref. No. 12/243A to 14/243B) a cross section of the coal bed at sampling face is given (Figs. 7, 8, 9, 10, and 11); all analytical and screen-sizing data are compiled in two or more summary tables, these being followed by float-and-sink test data sheets.

For example, referring to the first locality investigated, a cross section of the coal bed (Fig. 7) at sampling face (Ref. No. 1/195 to 5/199) is given, and the respective analytical and screen-sizing data are presented in Tables III and IV. In the first vertical column of the tables, an identification number is given for each separately collected sample starting with No. 1 in Table III and ending with No. 24 in Table XV. The same identification number is used to locate the sample on the map (Fig. 4). In the second column the "Locality Reference Number" of the Geological Survey of Ohio is listed. In the third column, thickness of the sample measured at the sampling face, and in the fourth column, the condition of the sample are given. In the five columns of the next section, the proximate analysis (moisture, volatile matter, fixed carbon, ash) and sulfur content are reported. In the next section of the table is reported the gross heating value, expressed in Btu./lb. and kg.-cal./kg.; in the last section of this table, results of low-temperature carbonization (as obtained by Bureau of Mines

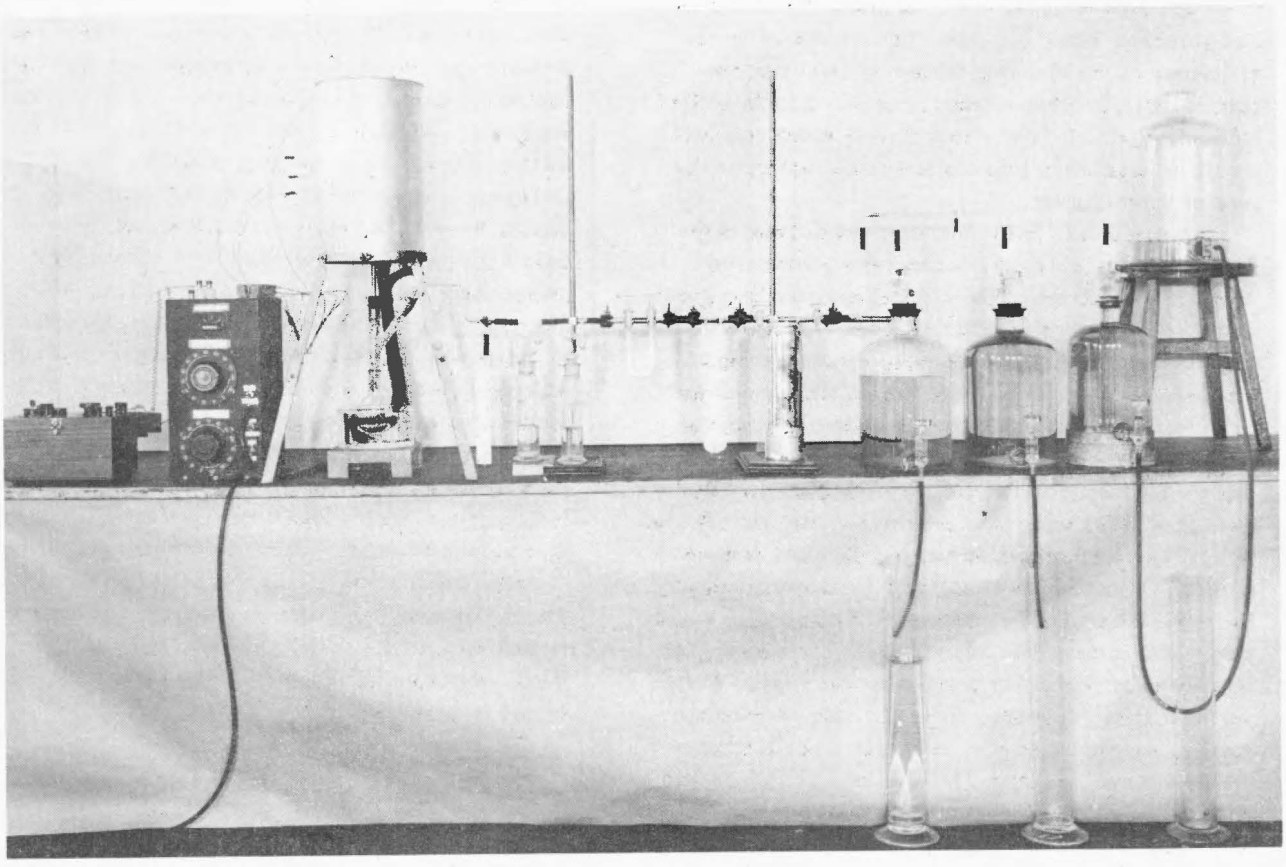


Fig. 6. --- A new closed-system carbonization-assay retort assembly, as developed by the author. The retort itself is made from stainless steel and is electrically heated; by means of "Variacs" (autotransformers), heat supply to the retort can be controlled and varied at will; thermocouples are used to determine the temperature at various points on the retort. (C.E. Breithaupt[10] investigated the Krumin retort and found that: (1) carbonization temperature could be reached at 10 minutes; (2) the rate of distillation could be closely controlled; (3) the carbonization conditions of a given run could be reproduced accurately in subsequent runs; and (4) a complete material balance could be made on the products of carbonization: yield of tar, liquor, hydrogen sulfide, light oil fractions, gas and coke versus charge.)

assay) are compiled in 7 columns: charge is reported in grams; yield of tar and liquor (water) is reported in cubic centimeters per 100 grams of charge and in gallons per short ton; and yield of coke and gas and losses are reported in per cent by weight.

The procedure for the carbonization assay (using the Bureau of Mines assay retort assembly) and the manner of arranging the data are the same as described in detail in the Station's Bulletin 143 and require no explanation here.[21]

It should be noted that all analytical figures compiled in summary table and data sheets throughout this report are an average of two duplicate determinations. In Table IV screen sizing data are compiled; in this particular case (as well as in Table VI) the data are limited to weight in grams and to elementary and cumulative weight per cent of various screen sizes of the composite sample (Ref. No. 1/195 to 5/199). Tables containing analytical, low-temperature carbonization and screen-sizing data are followed by float-and-sink tests data; the latter are presented in separate data sheets for each screen size (Data Sheets 1 to 9), according to decreasing screen size.

Although this order of presenting data is used for all other tabulations throughout this paper, some deviations as to content of tables were inevitable, because in some cases additional determinations were made, or different testing methods used. For example, in Table VII fusion of ash is reported, and carbonization assays of samples from two localities (Ref. No. 12/243A to 12/243B and 23/250 to 24/251) were completed in closed system Krumin retort assembly (Fig. 6). Therefore, in Tables VII and XV the yields of tar, liquor, coke and gas are reported (in four columns) in weight per cent; tar and liquor are reported in gallons per short ton, yield of gas is in cubic feet, and sulfur is in pounds per short ton. In addition to these data, composition of gas and H_2S content in gas, expressed in grains per 100 cubic feet, are also reported in separate Tables VIII and XVI.

To show the distribution of ash and sulfur in various screen sizes (i.e., in each screen size resulting from screen-sizing tests of samples with Ref. No. 12/243 to 24/251), the determination of moisture, of ash, and of sulfur was made; in screen sizes obtained from sample No. 12/243, the gross heating value was also determined.

Because of these additional determinations, Tables IX, XII, XIV, XVII, and XVIII (containing screen-sizing tests data) are considerably expanded as compared with corresponding Tables IV and VI. Nevertheless, the general order of reporting experimental results is the same as used in the first section and described above.

FLOAT-AND-SINK TESTS

Steadily increasing production of mechanically cleaned coal makes it necessary to study washability qualities of coal reserves. Before a coal preparation plant can be designed and built, washability studies must be made of the coal or coals that are to be treated. Plant control as well as an eventual change in conditions after the plant is in operation requires further washability studies.

The impurities with which coal is associated are removable only to the extent that they are present in the form of discrete particles physically detached from the coal and of particle size amenable to cleaning. Finely divided impurities, disseminated throughout the coal substance itself, are not liberated to an appreciable extent in sizes suitable for cleaning. As each coal differs in the nature and quantity of both removable and unremovable impurities, each coal has individual cleaning characteristics.

All removable impurities associated with coal are higher in specific gravity than the coal substance; this fact is utilized by nearly all coal-cleaning processes as a means of separating coal and impurity.

For determination of cleaning qualities of coals (frequently designated as washability characteristics), a laboratory technique called "float-and-sink test," or "specific-gravity analysis," was long ago developed. This analysis is recognized as the best way to determine the cleaning quality of a coal, since the most important single characteristic of both coal and associated impurities is specific gravity (this characteristic is directly proportional to the ash content of coal, i.e., specific gravity of coal increases with increasing ash content). The float-and-sink test is generally performed by: (1) immersing the weighed sample of crushed and sized coal in a liquid bath of such specific gravity that the test sample is separated into "float" and "sink" specific gravity fractions; and (2) skimming of the light particles that float in liquid, and recovering separately the heavy particles that have sunk to the bottom. In this operation, the coal is separated from the refuse according to the difference in specific gravity of the particles: the "float" consists of all the particles lighter than

the liquid, and the "sink" consists of all particles heavier than the liquid. The "float" represents the washed coal (assuming that washing the coal achieves a perfect separation exactly at the test gravity), and the "sink" represents perfect refuse. Since at the beginning of a float-and-sink study it is not known what gravity or gravities would be most suitable for washing any given coal, a series of baths of increasing specific gravity must be used to break down the sample into a series of specific-gravity fractions varying from the very lightest particles (with low ash content) through a certain gravity range of uniform steps to the category of heavy pure-refuse particles. Such a series of separations is made in one continuous operation by using a series of vessels of test liquids.

Selection of Adequate Solutions. Although the float-and-sinktest is very widely used and is accepted as necessary for examination of washability properties of coal reserves (as well as for the control of coal washing plants), there is no generally agreed-upon standard method for its performance. To obtain the desired specific gravities, heavy organic liquids (as commonly recommended) and coal samples in air-dried condition have been used in all tests reported in this paper. It will be noted that, according to the statement of the British Coke Research Association,[11] based upon experimental evidence, the amount of sink using moist coal is decreased when in organic liquids and increased when in aqueous solutions.

The liquids used for testing of Meigs Creek coal were mixtures of carbon tetrachloride ($CC1_4$) having specific gravity 1.584 at 20°C, with benzene (C_6H_6, sp. gr. 0.878 at 20°C) to obtain lower specific gravities, or bromoform ($CH Br_3$, sp. gr. 2.904 at 20°C) to obtain higher specific gravities.

The liquids used for testing of the screen size -2 to +1 1/2-inches of the composite sample of Meigs Creek No. 9 coal (with reference numbers of individual samples 1/195 to 5/199) were mixtures of carbon tetrachloride with benzene or bromoform in such proportions as to obtain the following series: 1.35, 1.55, and 1.70 specific gravity.

The sample was first introduced into the lightest liquid (1.35 specific gravity) and stirred. After the sample had separated and come to an equilibrium condition, which requires only a few minutes, the float particles were skimmed off with a sieve, drained, dried in the air, and weighed. This material constitutes the lightest fraction (designated float at 1.35). The sink particles were recovered from the liquid, drained, and transferred to the next heavier liquid (1.45 specific gravity) where the separation was repeated in exactly the same manner. All of the float fraction obtained in this operation was intermediate in specific gravity (between 1.35 and 1.45). This float fraction was dried in air and weighed to form the second finished fraction, while the sink was transferred to the next heavier and final liquid, of 1.70 specific gravity. This final separation yields two finished fractions, the particles between 1.45 and 1.70 specific gravity and the 1.70 sink (Data Sheet No. 1). From all "float" fractions and the final "sink" fraction (1.70 sp. gr.) a proportionate quantity was carefully split for analysis; after the splitting, specific gravity fractions were combined and then crushed so that all would pass through the 1 1/2-inch screen on which this screen size was originally collected. Each of the smaller sizes resulting from this crushing was added to the corresponding screen sizes obtained from the original crushing (see Flow Sheet, Fig. 5).

Since the screen size -1 1/2 to +1 1/4-inch fraction was too small for float-and-sink tests, it was added to the +1 inch size and designated -1 1/2 to +1-inch screen size.

For the float-and-sink tests of this screen size of the same sample, the following series of solutions was used: 1.35, 1.45, 1.55, and 1.70 specific gravities. (See Data Sheet No. 2) For testing of all other sizes of the composite sample (Ref. No. 1/195 to 5/199), as well as for all screen sizes of the composite sample (Ref. No. 6/200 to 11/205), the liquids used were: 1.30, 1.45, 1.55 and 1.70 specific gravities (see Data Sheets No. 3 to 9 and 11 to 19).

When the Engineering Experiment Station's Project F 18, "Investigation of the Meigs Creek No. 9 Coal in Ohio" was approved, assumption was made that float-and-sink tests in liquids of specific gravities 1.30, 1.45, 1.55, and 1.70 would provide sufficient points for drawing washability curves to show the characteristics of the coal investigated. Composite samples obtained from No. 1 to 5 (except screen sizes -2 to +1 1/2-inches and -1 1/2 to +1-inches), and composite samples No. 6 to 11, were investigated using specific gravities as given above. The results of investigation compiled in the Data Sheets No. 1 to 20 indicate 3 out of the 4 experimental points are so near that a characteristic and smooth washability curve cannot be drawn, except by using a number of points obtained by calculation.

To find which specific gravities of solutions would furnish uniformly distributed experimental

points for washability curves, the float-and-sink separations (using screen size -3/4 to +1/2 inch, taken from the sample Ref. No. 12/243A) were made in benzene-tetrachloride-bromoform mixtures tested at frequent intervals with precision spindle hydrometers (graduated to read to four places 0.0005). A total of 43 liquids of different specific gravities, starting with a specific gravity of 1.28 and increasing 0.01 specific gravity units to 1.70, were used for this experiment.

Results of these tests are compiled in Table IX. Since cumulative float coal in solutions 1.28 to 1.45 was found to be 83.4 per cent by weight and the amount of float coal in each successive solution was relatively small, the yield of float coal from 5 successive solutions is given as one figure; for example: 1.45 to 1.46, 1.46 to 1.47, 1.47 to 1.48, 1.48 to 1.49 and 1.49 to 1.50 are given in one single group, namely 1.45 to 1.50. All float coal in heavier solutions was handled in a similar manner (see Data Sheet 21).

Based upon these results for the further routine float-and-sink tests, mixtures of carbon tetrachloride with benzene or bromoform were selected with the following specific gravities: 1.30, 1.35, 1.40, 1.45, 1.50, 1.55 and 1.70. The data obtained by using these liquids are compiled in Data Sheets No.22 to 84.

Step-by-Step Crushing. The cross sections of the investigated and reported locations show that the coal bed contains many layers of impurities and that these impurities are not distributed uniformly throughout the mass (Figs. 7 to 11).

Theoretically, to make a clean separation in such a case, the raw coal should be sized and, in many cases, crushed to small pieces in order to break the bond between coal and adhering impurities. Inasmuch as the separation of the clean coal from its associated impurities by washing depends upon differences in specific gravities, a bed containing clean coal and heavy impurities can be expected to wash easily.

To make possible a determination of the impurities distribution in the different sizes obtained by subsequent crushing, i.e., to show the effect of crushing on the ash and sulfur reduction in float coal, the following procedure was accepted upon the proposal of Professor Harry E. Nold, and used in float-and-sink tests reported in this paper.

After a composite sample (representing the total thickness of the sampled coal bed) was sized in screen fractions as described above, and the float-and-sink tests completed with the coarsest screen fraction, (e.g., -2 to +1 1/2 inches), this fraction was crushed so that it passed through the 1 1/2-inch screen. Each of the smaller sizes resulting from this crushing was added to the corresponding sizes obtained from the screen sizing of the original sample. Each successive screen-sized fraction was treated in the same manner until all fractions (including -1/8-inch to +28-mesh fractions) were floated and recrushed to pass through the screen on which they were originally collected. When the -1/8-inch to +28-mesh fraction was floated, recrushed to pass the 28-mesh screen, and added to the -28 to 0-mesh fraction (accumulated from all previous screen sizing and recrushing operations), this final screen fraction represented the original composite coal sample which, in turn, represented the total thickness of the coal bed at the point of sampling. A flow-sheet, showing ordinary treatment of a representative coal sample used for float-and-sink tests, is given in Fig. 5.

Method of Reporting. The products resulting from the float-and-sink separations (after they have been air-dried) were weighed and analyzed. The experimental data obtained are set in tabular and graphical form. For reader convenience, both forms are presented on the same page and designated "Data Sheet."

In Data Sheets No.1 to 9 and 11 to 19, all data are compiled in ten vertical columns. In the first column are listed specific gravity fractions obtained in experiments, and in four columns headed "Elementary Data" are recorded the observed values: weight in grams of each specific gravity fraction recovered, and percentages of weight, moisture and ash, the latter being calculated on moisture-free basis. The values in the section headed "Computed Cumulative Data, Per Cent" are derived by calculation from the experimental values. For example, the weight values headed "Float Cumulative" are in each instance the sum of all the preceding weight percentages. Since the weight column is accumulated, the last line should show a value of 100 per cent. The values of cumulative ash, headed "Float Cumulative" have been computed from the individual values for weight and ash at different specific gravities and represent, in each instance, the ash content of the total float coal at the corresponding specific gravity.

The figures listed in the section "Sink Cumulative" are obtained by accumulation of the products of the experimental results (reported in section headed "Elementary Data") from the bottom of the table. For example, the first value from the bottom in the "Sink Cumulative" weight column is the same as the

first value in the "Elementary Data" weight column, the second value is the sum of the first two "Elementary" weight percentages, and so on. The values of ash column, headed "Sink Cumulative," have been computed from the individual values for weight and ash of "sink" material at different specific gravities and represent in each instance the ash content of the total sink coal (or refuse) at the corresponding specific gravity.

The values in the last vertical column, headed "Near Gravity ± 0.05 per cent," are obtained by determining the fractional yield within ± 0.05 specific gravity of the point being considered.

The composite samples obtained from four localities (Ref. No. 12/243A to 24/251) in float-and-sink tests, were separated in eight specific gravity fractions and in each fraction the determination of sulfur was also made; therefore all respective data sheets were expanded, with additional specific gravity fractions and with three more vertical columns for the reporting of sulfur. Sulfur content is calculated and reported in the same manner as ash content, therefore no additional explanation is required. Except those tables which contain data referring to one definite screen size the tables of Data Sheets 10, 20, 35, 48, 59, 71 and 83 each contain compiled cumulative weight and the corresponding cumulative ash percentages in float coal of different screen sizes, as obtained by step-by-step crushing of the same coal sample.

In the tables of Data Sheets No. 36, 49, 60, 72 and 84 the compiled data show the effect of crushing on the sulfur reduction in float coal.

In Data Sheets No. 23, 26, 32, 45, 56, 68 and 80 the given data refer to the gross heating value of the different specific gravity fractions. In Data Sheet No. 37 is shown the effect of crushing on heating value; the gross heating values of three different screen sizes (as obtained from the same coal sample by step-by-step crushing and floating) are reported in tabular and graphical form.

WASHABILITY CURVES

The experimental data obtained and the calculated cumulative data (set in tabular form, as stated above) show the data corresponding to the specific gravities used in the float-and-sink tests. To facilitate interpolation (in case it is desirable to consider separation at any intermediate gravity not actually used in the tests), the data obtained from the float-and-sink tests and tabulated on the data sheets are also presented on each respective page in graphical form; these graphs are commonly designated as "Washability Curves."

Each set of basic washability curves presented in Data Sheets No. 1 to 9 and 11 to 19 consists of five curves as follows: (1) "Float Ash", (2) "Elementary Ash," (3) "Sink Ash," (4) "Specific Gravity ," and (5) the " ± 0.05 Specific Gravity Distribution."

The "Float Ash" or cumulative float curve is obtained by plotting the cumulative weight percentage or yield of float coal as ordinate (shown at left of the figure), against cumulative ash per cent as abscissa (shown at the bottom of the figure.) The respective numerical values for plotting a "Float Ash" curve are reported in the tables of data sheets in the columns headed "Float Cumulative." A float ash curve shows the theoretical possible yield of float coal at any selected cumulative or average ash percentage.

The "Elementary Ash" curve, sometimes referred to as "Fractional Float" or "Instantaneous" curve, is obtained by plotting the fractional float results, as ordinate, against the observed ash per cent (reported in the tables of data sheets in the section headed "Elementary Data") as abscissa. Since the material between two specific gravity limits contains material varying in ash content, it is assumed that half of the material will be above and half below the average value of ash content determined. The fractional float values of the ordinate are obtained by solving the following expression:

$$A + \frac{B}{2} = C$$

where A is the cumulative weight per cent of all float material of lower specific gravity (equal to 0 for the lightest specific gravity fraction being determined), B is the weight per cent of the specific gravity interval involved, and C is the ordinate value plottedagainst the ash content (not cumulative ash) of the specific gravity interval involved. It will be observed that, for the lightest specific gravity fraction being determined, A is equal to 0, and the first point is placed against the half-of-weight value for the ordinate (or yield) and the elementary ash for the abscissa (or ash content).

An elementary ash curve relates any given percentage yield to the ash content of the heaviest particle in the float or of the lightest particle in the sink. The elementary ash curve should be smooth. If it is not, then there is an error in the cumulative float

curve. The slope of the elementary ash curve serves as an indication of the possible ease or difficulty of separation. A steep slope represents relatively small ash differences for a wide difference in yield, indicating difficult separation; a flat slope indicates an easy separation.

A "Sink Ash" curve, the reverse of a "Float Ash" curve, is plotted not from the raw coal fractions which float at different specific gravities but rather from those which sink. Like the "Float Ash" curve, it is constructed by plotting cumulative weight percentages (of sink material) as ordinates (shown at right of the diagram) against the cumulative ash percentage (sink) as abscissas. The numerical values used for plotting the curves are listed in each corresponding table in the section headed "Sink Cumulative." The uppermost point of the "Sink Ash" curve corresponds to the use of a liquid in which all the raw coal sinks. A "Sink Ash" curve shows the average ash content of sink material removed to leave a float product of the ash content indicated by the "Float Ash" curve.

The "Specific Gravity" curve is constructed by marking an additional scale on the top of the diagram and plotting the cumulative float weight values against the upper value of specific gravity given in the tables of the respective data sheets. The specific gravity curve indicates the yield of float coal and the amount of sink material or refuse theoretically possible at any specific gravity point of separation.

The " ± 0.05 Specific Gravity Distribution" curve is constructed by plotting the fractional yield per cent (within ± 0.05 specific gravity of the point being considered) against the specific gravity shown on the top of the diagram, and then drawing a smooth curve through the points. This curve shows the percentage by weight of the raw coal that lies within plus 0.05 and minus 0.05 specific-gravity unit at any selected specific gravity, and indicates the difficulty or ease of a washing problem when a washed coal of a certain ash percentage is required. The scale of values in Table II below indicates roughly the difficulty of the washing problem.

Since in all float-and-sink products obtained from samples with Ref. No. 12/243A to 24/251 the determination of sulfur was also made, each corresponding set of basic washability curves (in addition to the five curves as described above) contains a "Float Sulfur" curve. The "Float Sulfur" curve is obtained by plotting the cumulative weight percentage of the float coal (as ordinate) against the cumulative sulfur per cent (as abscissa). A "Float Sulfur" curve shows the theoretical possible yield of float coal at any selected cumulative or average sulfur content.

Although data required for construction of "Sink Sulfur" curve are reported in respective columns of the data sheets, the plotting of this curve was omitted to avoid overcrowding of the diagram. If desired, a "Sink Sulfur" curve can easily be constructed in the

TABLE II. Scale of Values of Near Gravity Material.[6]

Quantity within ±0.10 sp. gr. range (%)	Degree of difficulty	Preparation
0 to 7	Simple	Almost any process; high tonnages
7 to 10	Moderately difficult	Efficient processes; high tonnages
10 to 15	Difficult	Efficient processes; medium tonnages; good operation
15 to 20	Very difficult	Efficient processes; low tonnages; expert operation
20 to 25	Exceedingly difficult	Very efficient processes; low tonnages; expert operation
Above 25	Formidable	Limited to a few exceptionally efficient processes; expert operation

same way as a "Sink Ash" curve.

To show the effect of crushing on ash reduction in float coal (in Data Sheets No. 10, 20, 35, 48, 59, 71 and 83), a set of "Float Ash" curves is given for various screen sizes (as obtained by a step-by-step crushing of the same coal sample). To show in similar manner the effect of crushing on sulfur reduction in float coal (in Data Sheets No. 36, 49, 60, 72 and 84), a set of "Float Sulfur" curves is given for various screen sizes obtained by a step-by-step crushing of the same coal sample.

To gain greater accuracy in the construction and reading of these curves, a larger scale of abscissas for plotting of ash (as well as for sulfur values) was selected.

In addition to the data sheets and curves described above, seven separate data sheets (No. 23, 26, 32, 45, 56, 68 and 80), each containing a set of three curves, are included which show the relation between the heating value and the products of float-and-sink tests:

(1) The "Float Btu." curve, obtained by plotting cumulative weight percentage or yield of float coal as ordinate (shown on left on the diagram) against cumulative Btu. value as abscissa (shown at the bottom of the diagram), shows the theoretical possible yield of float coal at any selected cumulative or average Btu. calculated on moisture-free basis.

(2) The "Sink Btu." curve, constructed by plotting the cumulative weight percentages of sink material as ordinate (shown at right of the diagram) against the cumulative Btu. as abscissa (shown at the bottom of the diagram), shows the average heating value of the sink material or refuse, and enables one to determine the theoretical heating value of the refuse with any given percentage recovery of the raw coal.

(3) The "Dry, Mineral-Matter-Free" curve, for which the points are obtained by plotting the fractional float results as ordinate against the determined Btu., recalculated on dry, mineral-matter-free basis, as abscissa (the respective points are plotted in the same way as they are for the construction of "Elementary Ash" curve), is intended to show the trend, if any, in the change of heating value of mineral-matter-free coal in relation to the different specific gravity fractions of raw coal.

It should be noted, that because of high ash content in the heaviest float-and-sink test products (exceeding in some cases 60 or even 65 per cent by weight), the Btu. value of mineral-matter-free coal (obtained by calculation according to Parr formula) is not reliable and therefore not shown for "sink" fractions in liquid of 1.70 specific gravity. (In addition, the determination of heating value, especially of coal sample reported in Data Sheet No. 45, was made after a rather long storage time; the sample may be affected by weathering and therefore the absolute heating value determined should be considered critically.)

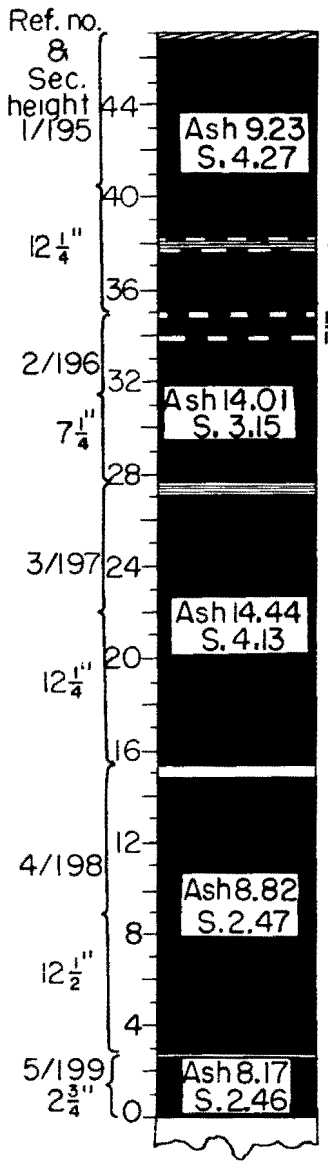
All analytical as well as carbonization data reported in summary tables and data sheets throughout this paper are an average of two duplicate determinations. In the construction of all data-sheet washability curves, a common yield scale is used which runs from 0 at the top to 100 at the bottom for "Float" and is situated on the left side of the diagram; for "Sink" curves, the scale is reversed and is situated on the right of the diagram. Thus, corresponding yields of float and sink material have the same ordinate and are read on the left and right scales, respectively.

All plotted points on washability curves which represent actual experimental data are encircled, except a few points whose values are not reported in tables and which are marked with x.

In drawing the curves (especially those presented on Data Sheets No. 1 to 20) a great many calculated points, not shown on the curves, were used. For example, the position of a cumulative curve between the plotted points was always checked by means of an elementary curve. In general, where the cumulative curve changes direction slowly or not at all, the yields selected for calculation were at 10-per cent intervals; but in those ranges where the cumulative curve changes direction rapidly, smaller increments than 10 per cent (5 to 2.5 per cent) were used.

All basic calculations of float-and-sink tests data, as well as construction of the basic washability curves, were conducted according to common practice; the practice is described in detail by G. D. Coe [14] and reported in several other publications. (See Bibliography.)

INVESTIGATION RESULTS OF COAL SAMPLES FROM HANNA COAL COMPANY GEORGETOWN NO. 12 STRIP MINE (550-B PIT).



$\frac{1}{16}$ Top of coal. Roadway in pit on coal surface.
Shale, pyritic, persistent parting

$9\frac{1}{4}$ Coal, bright, blocky, med. to thick banded, some finely disseminated pyrite.

Coal, shaly, pyritic.
$\frac{1}{2}$ Coal, bright, blocky, thick banded.
$\frac{1}{16}$ Coal, bony, pyritic, persistent parting.
$2\frac{5}{16}$ Coal, bright, blocky, med. to thick banded.
$\frac{1}{16}$ Coal, fusain parting, persistent.
$\frac{15}{16}$ Coal, bright, med. to fine banded.
$\frac{1}{8}$ Coal, shaly, with much fusain.

$6\frac{1}{8}$ Coal, med. bright, very blocky, med. to thin banded.

$\frac{9}{16}$ Coal, bony, persistent parting.

$11\frac{11}{16}$ Coal, bright, blocky, thin to thick banded.

$\frac{1}{4}$ Coal, shaly to bony, varies up to $\frac{3}{4}$" thick

12 Coal, bright, not so blocky, thin to thick banded, more tender than coal above.

$2\frac{3}{4}$ Coal, bright, abundant pyrite films on bedding planes in upper part.

Note: Bottom 4" to 6" laterally contains abundant pyrite nodules up to 3" thick. (Lower 6" not taken up in this pit in present mining operations.)

Fig. 7.–Cross section of coal bed at sampling face (Ref. No. 1/195 to 5/199) in SE Sec. 36, Athens Township, Harrison County, Ohio, of the Hanna Coal Company Georgetown No. 12 strip mine (550-B pit).

TABLE III. Analysis and carbonization assay data of coal samples (Ref. No. 1/195 to 5/199) from Hanna Coal Company, Georgetown No. 12 strip mine (550-B pit), SE Sec. 36, Athens Township, Harrison County, Ohio.

Sample				Proximate analysis (% by wt.)					Gross heating value		Carbonization assay **						
												Yields					
Reference number												cc./100 gm. charge		% by wt.		gal./ton	
E.E.S. Laboratory	G.S.O. Locality	Thickness (in.)	Condition *	Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Btu./lb.	kg.-cal./kg.	Charge (gm.)	Tar	Liquor	Coke	Gas & loss	Tar	Liquor
1/195	521-1	12¼	a	1.93	39.13	49.89	9.05	4.19	12,733	7074	150.0	12.7	6.0	69.3	12.0	30.4	14.4
			b	0.00	39.90	50.87	9.23	4.27	12,983	7213	147.1	13.0	4.1	70.7	12.2	31.1	9.8
2/196	521-2	7¼	a	1.73	36.98	47.53	13.76	3.10	12,259	6810	150.0	13.3	5.0	69.4	12.3	31.9	12.0
			b	0.00	37.63	48.36	14.01	3.15	12,475	6930	147.4	13.5	3.3	70.6	12.6	32.3	7.9
3/197	521-3	12¼	a	1.93	34.70	49.21	14.16	4.05	12,126	6737	150.0	13.2	5.5	69.7	11.6	31.6	13.2
			b	0.00	35.38	50.18	14.44	4.13	12,365	6869	147.1	13.5	3.6	71.1	11.8	32.3	8.6
4/198	521-4	12½	a	1.86	37.34	52.14	8.66	2.42	12,966	7203	150.0	13.3	5.3	68.7	12.7	31.9	12.7
			b	0.00	38.05	53.13	8.82	2.47	13,212	7340	147.2	13.5	3.5	70.0	13.0	32.3	8.4
5/199	521-5	2¾	a	1.72	39.38	50.87	8.03	2.42	13,151	7306	150.0	15.0	6.3	66.0	12.7	35.9	15.1
			b	0.00	40.07	51.76	8.17	2.46	13,381	7434	147.4	15.3	4.7	67.1	12.9	36.7	11.3
Total or average (Calculated upon thickness)		47	a	1.87	37.18	50.00	10.95	3.41	12,588	6993	150.0	13.2	5.5	69.1	12.2	31.6	13.2
			b	0.00	37.89	50.95	11.16	3.47	12,828	7126	147.2	13.5	3.6	70.5	12.4	32.3	8.6

* Condition a refers to the air-dry sample; condition b refers to moisture-free sample.

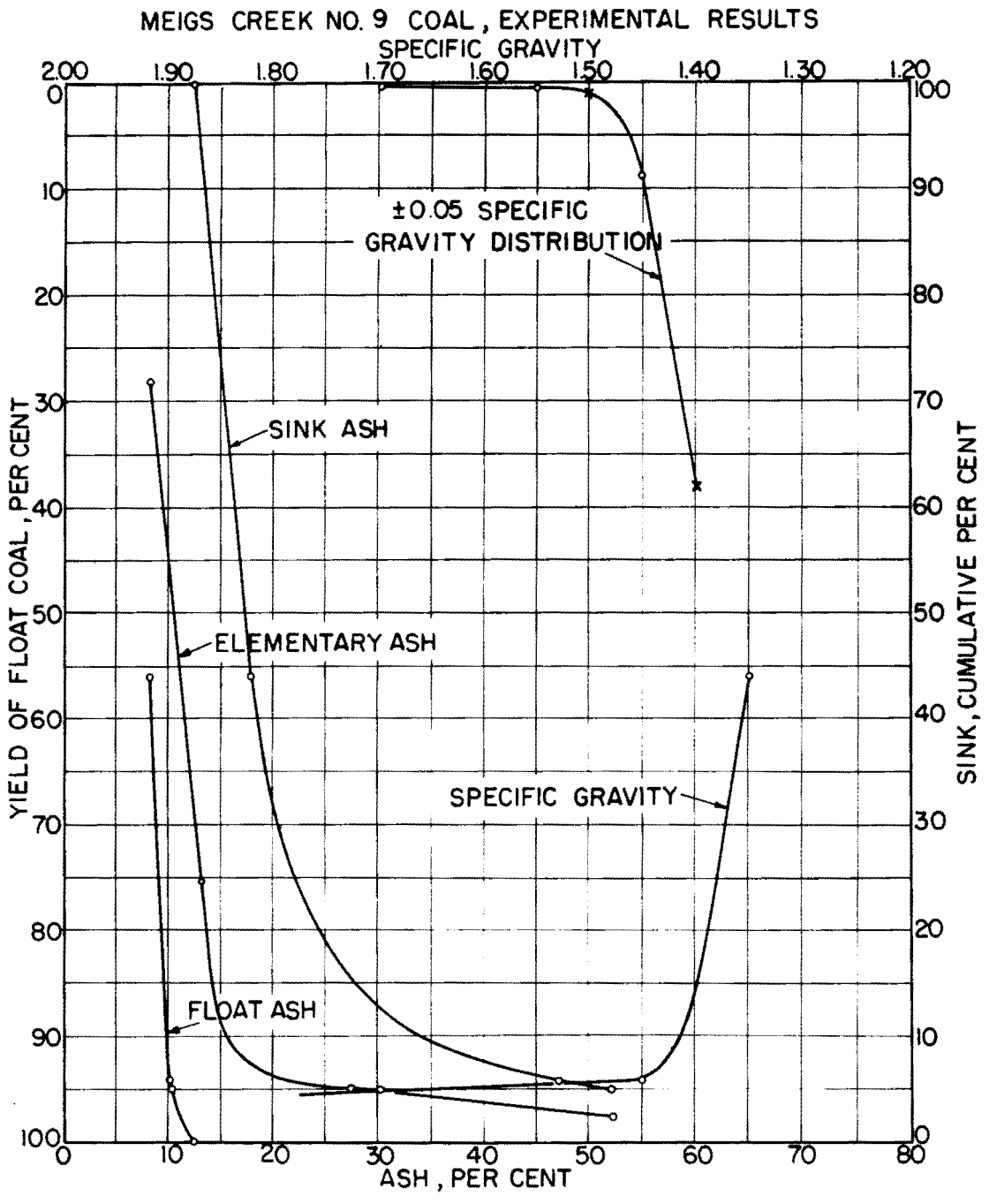
** All carbonization assays reported throughout this paper were directed according to conventional specifications for low-temperature carbonization assays and the residue, designated in the Tables as "coke", actually is a "semi-coke".

TABLE IV. Weight, elementary and cumulative weight per cent of various screen sizes of the composite sample (Ref. No. 1/195 to 5/199) from Hanna Coal Company Georgetown No. 12 strip mine (550 B pit) SE Sec. 36, Athens Township, Harrison County, Ohio.

Reference number		Screen size, (in.) *	Condition**	Elementary data		Computed cumulative wt. %
E.E.S. Laboratory	G.S.O. Locality			wt. gm.	wt. %	
1/195 to 5/199	521, 1-5	−2 to +1½	a	9326	25.5	25.5
(Composite Sample)		−1½ to +1	a	8278	22.7	48.2
		−1 to +¾	a	3035	8.3	56.5
		−¾ to +½	a	3316	9.1	65.6
		−½ to +⅜	a	2721	7.4	73.0
		−⅜ to +¼	a	3003	8.2	81.2
		−¼ to +⅛	a	1814	5.0	86.2
		−⅛ inches to +28 mesh	a	3683	10.1	96.3
		−28 mesh to 0	a	1361	3.7	100.0
Total		−2 to 0		36,537	100.0	

* Throughout this paper a minus sign (−) before the given screen size indicates the material passes through the given screen; a plus (+) indicates oversize.

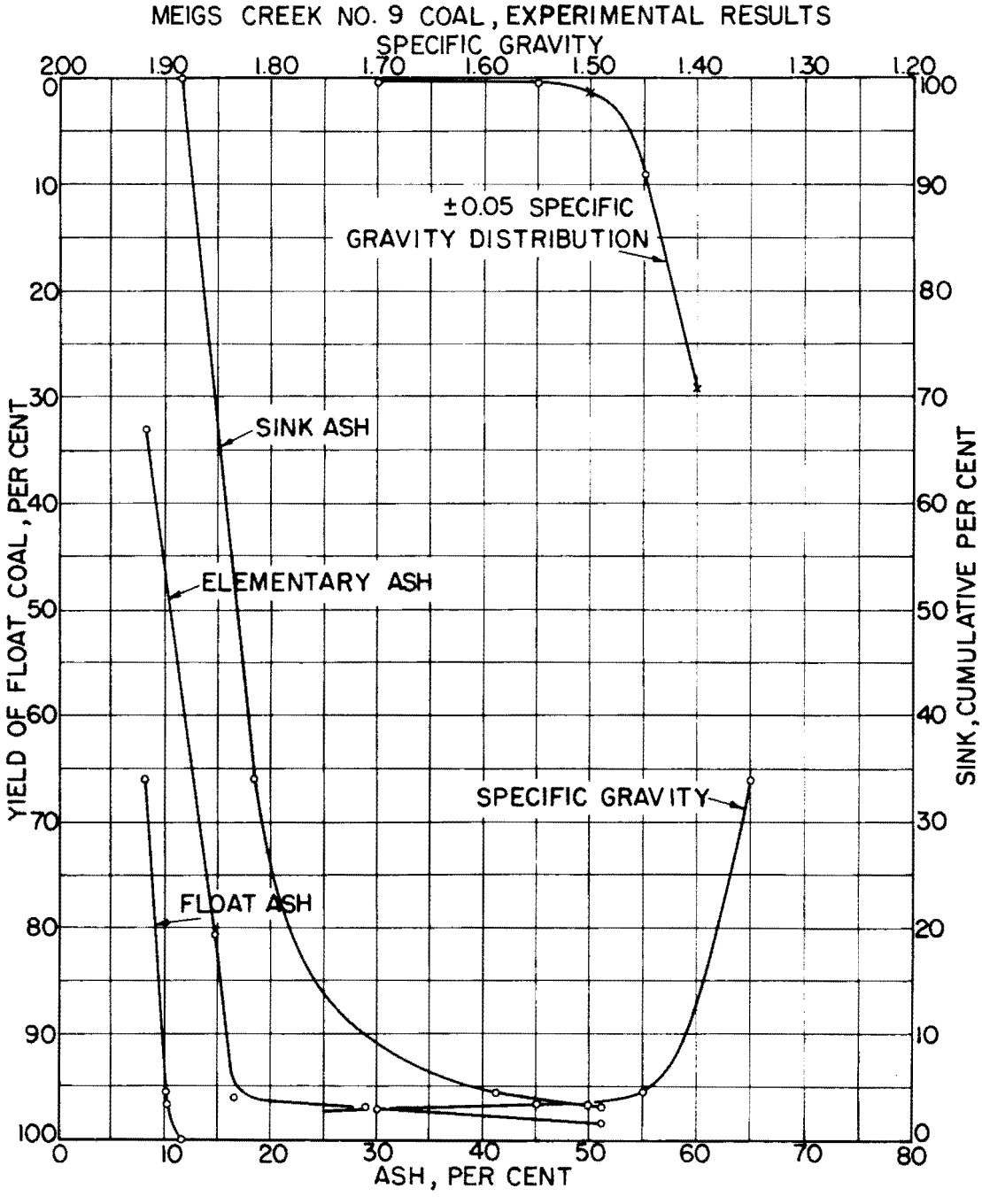
** Condition refers to the air-dry sample; throughout this paper in all float-and-sink tests data sheets, weight is given on air-dried basis, except where otherwise noted.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight†	Moisture	Ash*	Weight†	Ash*	Weight†	Ash*	
Float 1.35	5193	56.0	2.69	8.10	56.0	8.10	100.0	12.28	
1.35-1.45	3574	38.5	2.36	13.04	94.5	10.14	44.0	17.60	8.8
1.45-1.70	59	0.6	1.91	27.38	95.1	10.22	5.5	49.05	0.3
Sink 1.70	454	4.9	2.00	52.18	100.0	12.28	4.9	52.18	
Totals	9280	100.0							

* Moisture free basis.
† Throughout this paper, in all float-and-sink tests data sheets, weight is reported on air-dried basis, ash and sulfur on the moisture-free basis, except where otherwise noted.

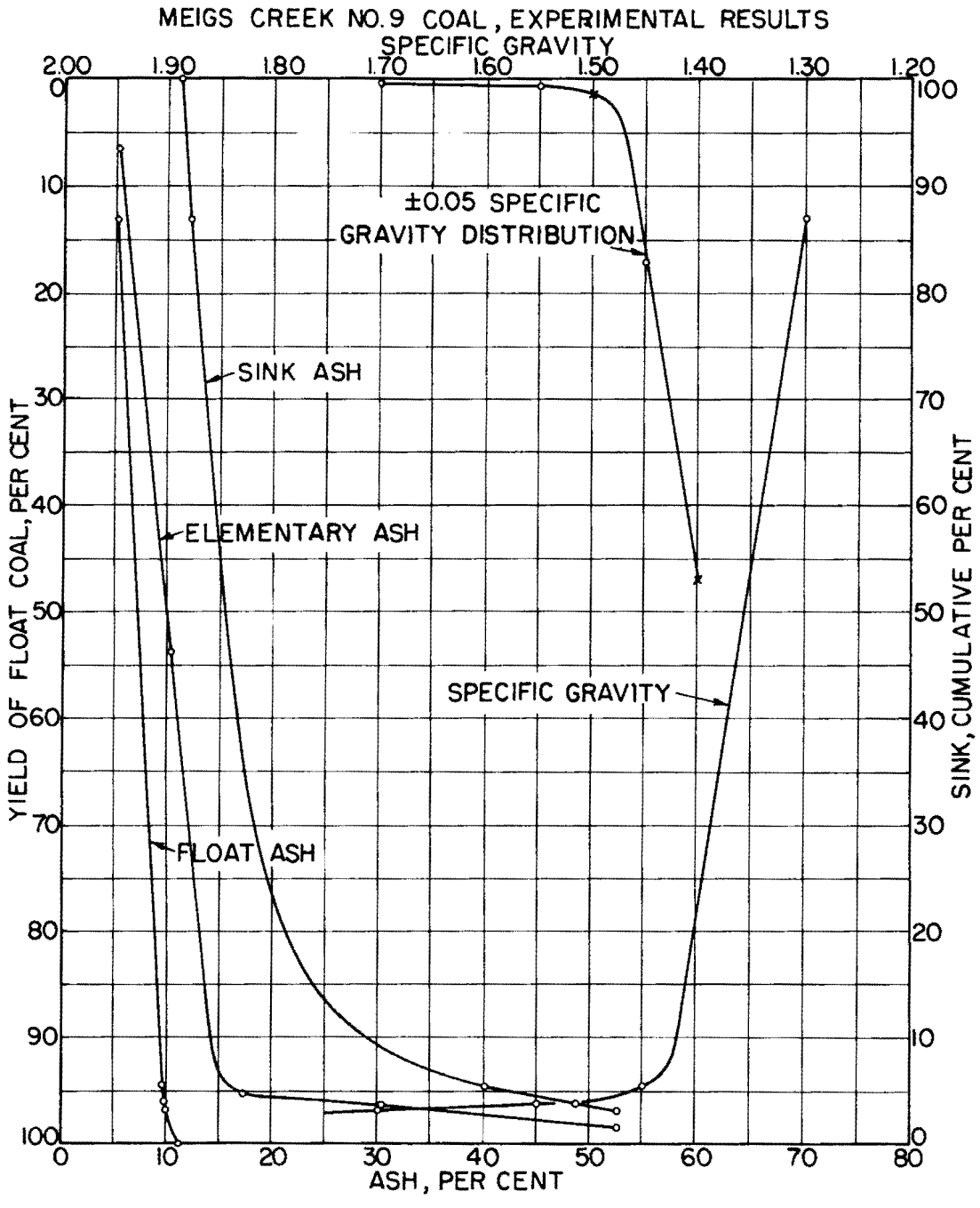
DATA SHEET 1. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (550 B Pit) SE sec. 36, Athens Township, Harrison County, Ohio. Screen size: - 2 to + 1½ inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.35	8278	66.0	1.48	8.11	66.0	8.11	100.0	11.59	
1.35-1.45	3688	29.4	1.11	14.77	95.4	10.16	34.0	18.35	9.2
1.45-1.55	145	1.2	1.12	16.54	96.6	10.24	4.6	41.25	0.3
1.55-1.70	27	0.2	0.77	29.00	96.8	10.28	3.4	49.95	0.2
Sink 1.70	399	3.2	0.57	51.08	100.0	11.59	3.2	51.08	
Totals	12,537	100.0							

* Moisture-free basis.

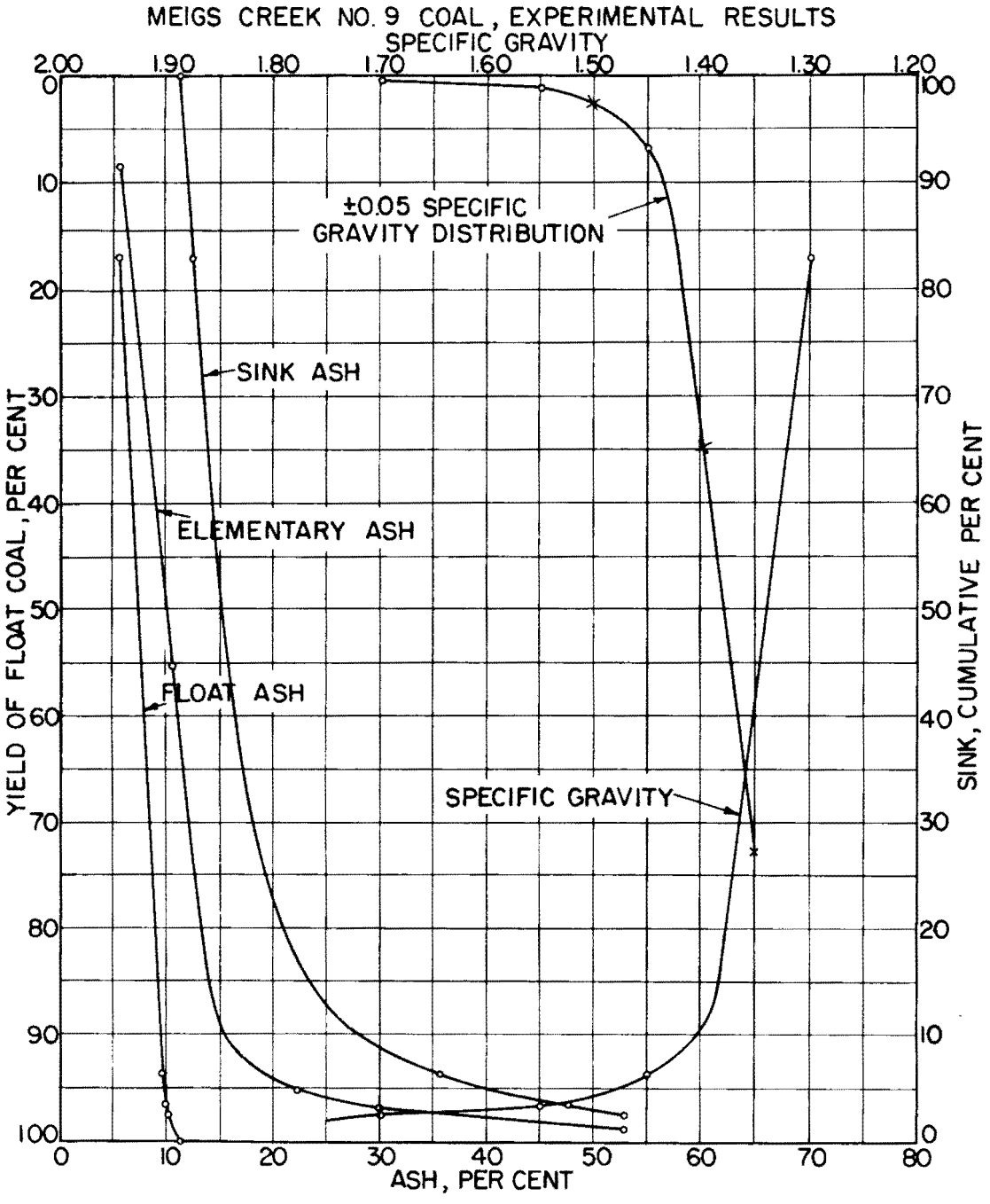
DATA SHEET 2. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (550 B pit) SE sec. 36, Athens Twp., Harrison Co., Ohio. Screen size: - $1\frac{1}{2}$ to + 1 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	1021	13.2	1.59	5.32	13.2	5.32	100.0	11.27	
1.30 - 1.45	6296	81.3	1.24	10.28	94.5	9.59	86.8	12.17	17.2
1.45 - 1.55	113	1.5	1.00	17.29	96.0	9.71	5.5	40.13	0.6
1.55 - 1.70	54	0.7	0.87	30.38	96.7	9.86	4.0	48.71	0.4
Sink 1.70	254	3.3	0.29	52.62	100.0	11.27	3.3	52.62	
Totals	7738	100.0							

* Moisture-free basis.

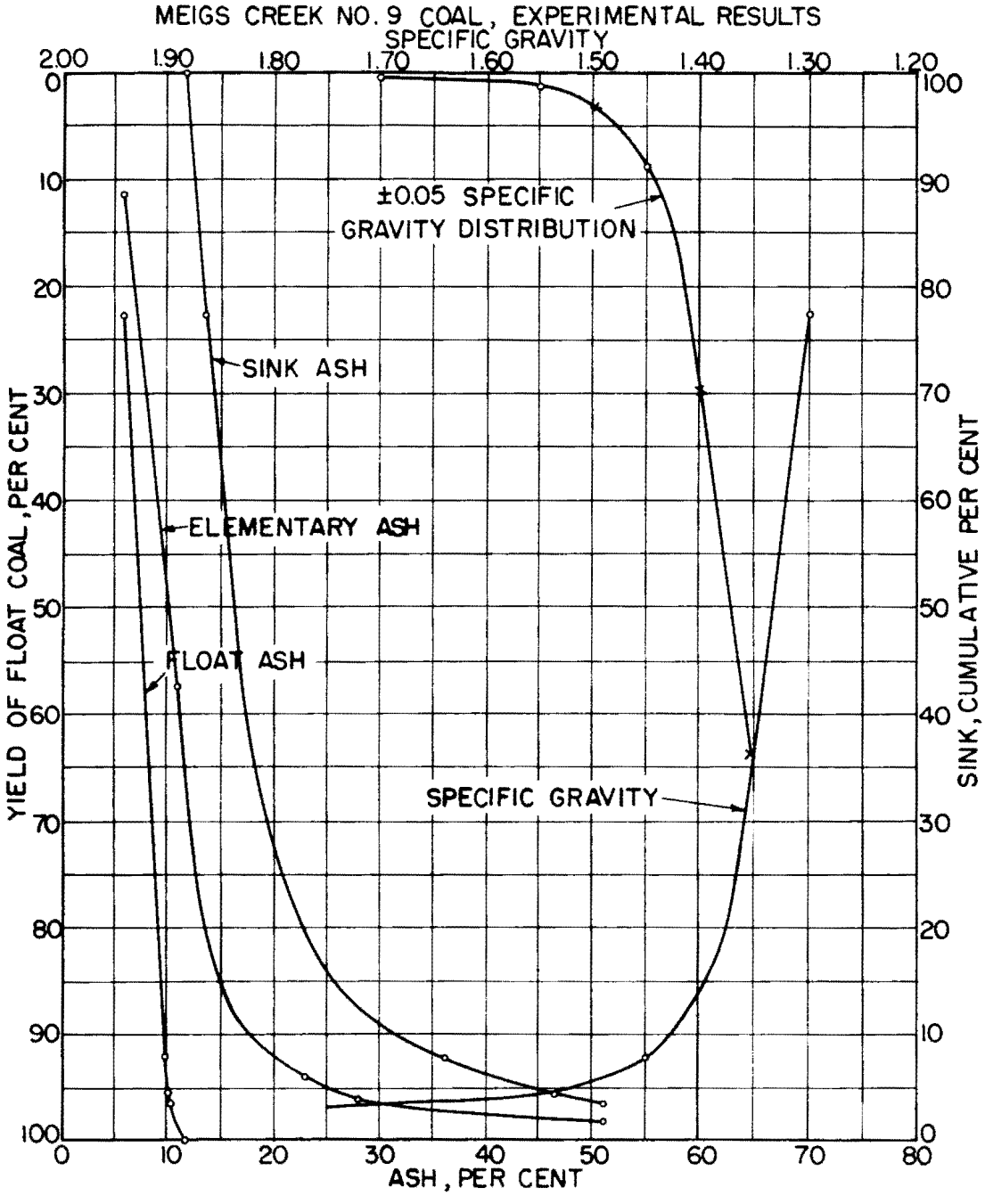
DATA SHEET 3. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (550 B pit) SE sec. 36, Athens Township, Harrison County, Ohio. Screen size: -1 to +3/4 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	2041	17.0	1.05	5.49	17.0	5.49	100.0	11.20	
1.30 - 1.45	9185	76.6	0.87	10.43	93.6	9.53	83.0	12.37	6.6
1.45 - 1.55	363	3.0	0.84	22.07	96.6	9.92	6.4	35.62	1.1
1.55 - 1.70	91	0.8	0.94	29.78	97.4	10.09	3.4	47.57	0.5
Sink 1.70	318	2.6	0.72	52.90	100.0	11.20	2.6	52.90	
Totals	11,998	100.0							

* Moisture-free basis.

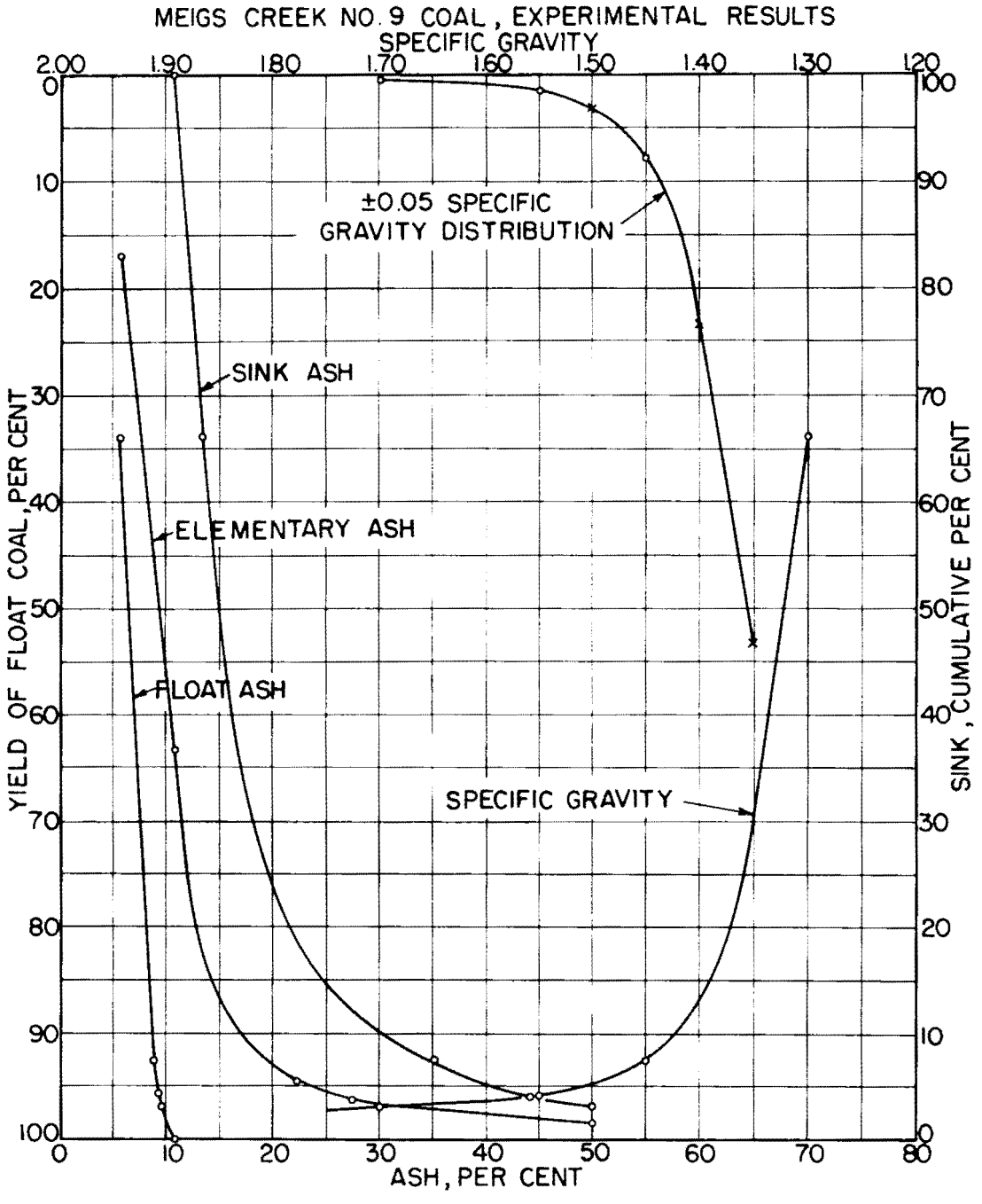
DATA SHEET 4. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (550 B pit) SE sec. 36, Athens Township, Harrison County, Ohio. Screen size: -3/4 to +1/2 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	2213	22.6	1.91	5.74	22.6	5.74	100.0	11.66	
1.30 - 1.45	6831	69.6	1.72	10.84	92.2	9.59	77.4	13.39	8.8
1.45 - 1.55	336	3.4	1.46	22.92	95.6	10.06	7.8	36.13	1.2
1.55 - 1.70	91	0.9	1.54	27.93	96.5	10.23	4.4	46.42	0.5
Sink 1.70	345	3.5	1.31	51.06	100.0	11.66	3.5	51.06	
Totals	9816	100.0							

* Moisture-free basis.

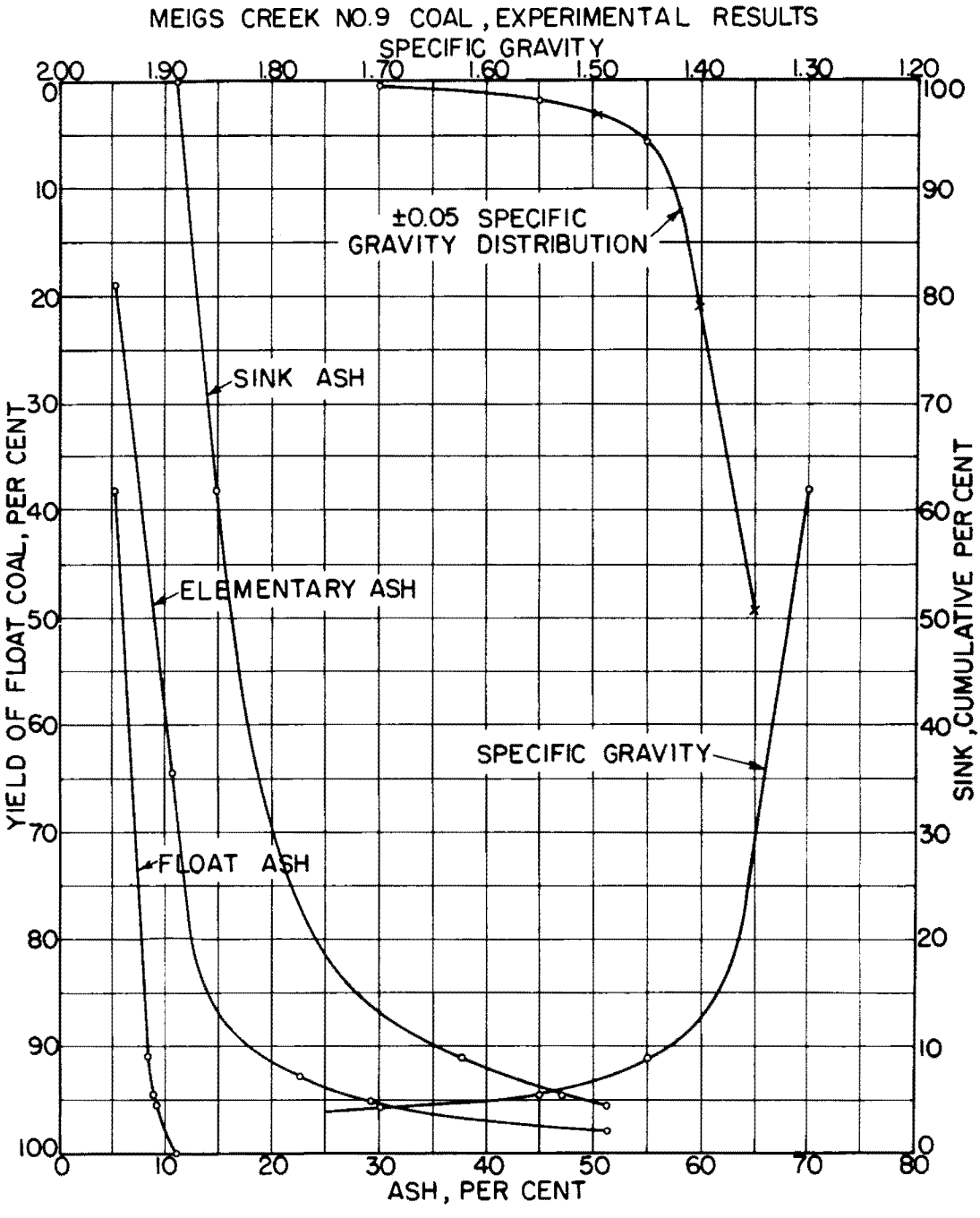
DATA SHEET 5. - Float-and-sink tests data sheet and washability curves: coal sample from Hanna Coal Company Georgetown No. 12 strip mine (550 B pit) SE sec. 36, Athens Township, Harrison County, Ohio. Screen size: -1/2 to +3/8 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	4595	33.9	1.78	5.70	33.9	5.70	100.0	10.77	
1.30 - 1.45	7965	58.8	1.46	10.66	92.7	8.85	66.1	13.37	7.8
1.45 - 1.55	408	3.0	1.46	22.27	95.7	9.27	7.3	35.15	1.9
1.55 - 1.70	145	1.1	1.36	27.44	96.8	9.47	4.3	44.15	0.4
Sink 1.70	427	3.2	1.25	49.98	100.0	10.77	3.2	49.98	
Totals	13,540	100.0							

* Moisture-free basis.

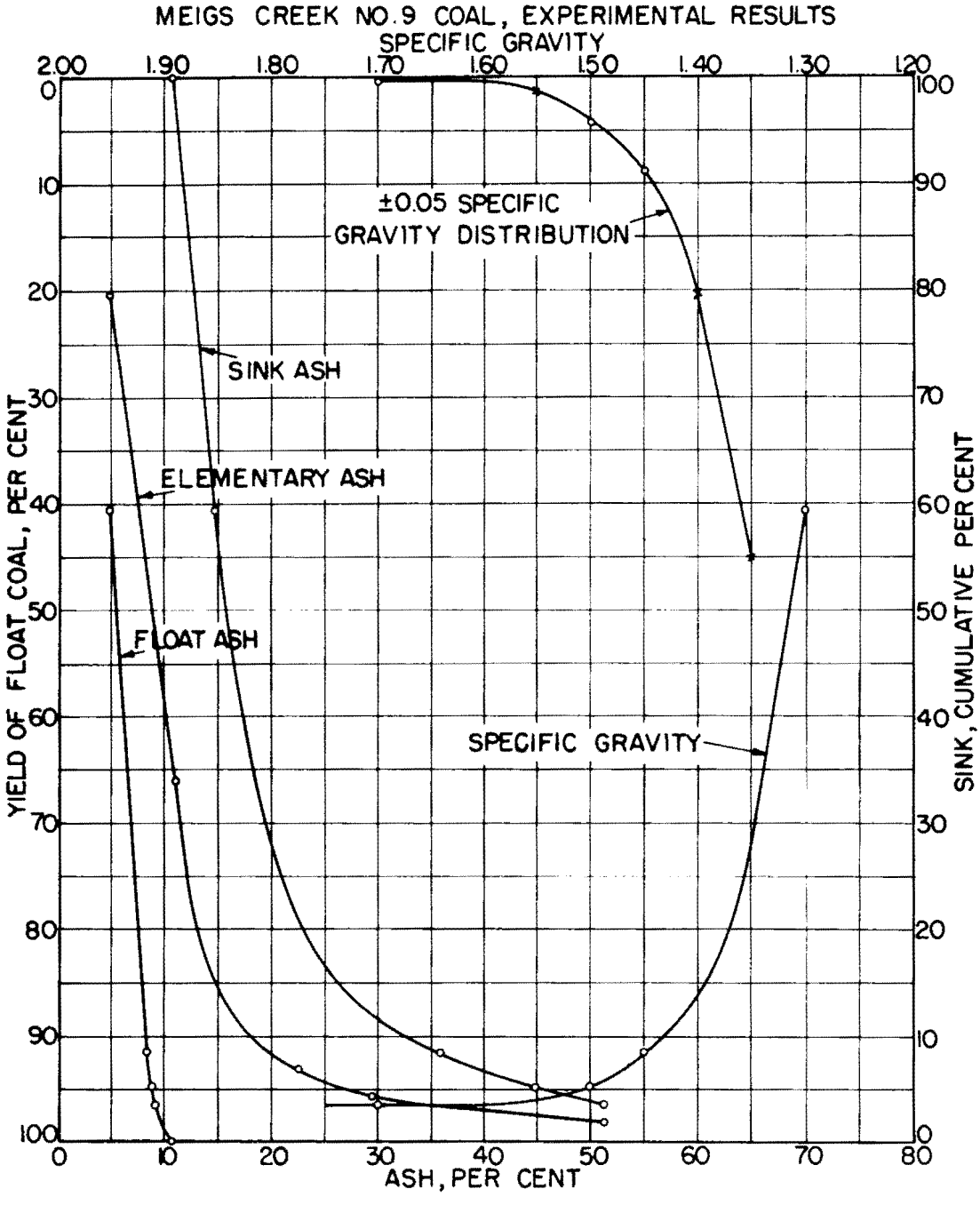
DATA SHEET 6. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (550 B pit) SE sec. 36, Athens Township, Harrison County, Ohio. Screen size: -3/8 to + 1/4 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	7062	38.2	2.22	5.14	38.2	5.14	100.0	10.96	
1.30 - 1.45	9752	52.8	1.57	10.60	91.0	8.31	61.8	14.56	5.7
1.45 - 1.55	621	3.4	1.57	22.59	94.4	8.82	9.0	37.75	1.7
1.55 - 1.70	200	1.1	2.08	29.19	95.5	9.06	5.6	47.03	0.5
Sink 1.70	825	4.5	1.92	51.29	100.0	10.96	4.5	51.29	
Totals	18460	100.0							

* Moisture-free basis.

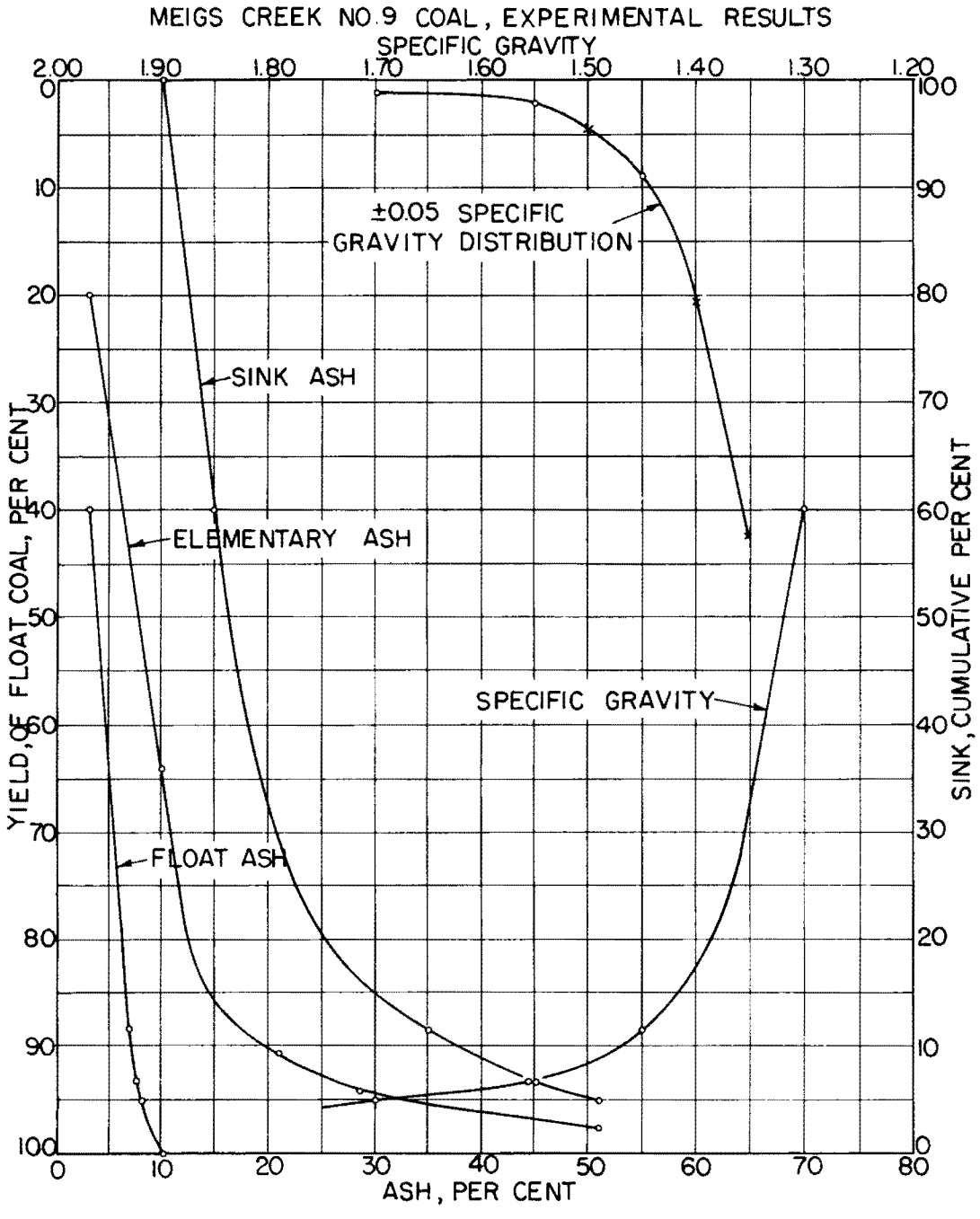
DATA SHEET 7. - Float-and-sink test data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (550 B pit) SE sec. 36, Athens Township, Harrison County, Ohio. Screen size: -1/4 to +1/8 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	2468	40.6	1.90	4.73	40.6	4.73	100.0	10.56	
1.30 - 1.45	3093	50.9	1.60	10.98	91.5	8.21	59.4	14.54	20.5
1.45 - 1.55	209	3.4	1.40	22.45	94.9	8.72	8.5	35.86	4.4
1.55 - 1.70	91	1.5	1.39	29.52	96.4	9.04	5.1	44.80	0.2
Sink 1.70	222	3.6	1.13	51.22	100.0	10.56	3.6	51.22	
Totals	6083	100.0							

* Moisture-free basis.

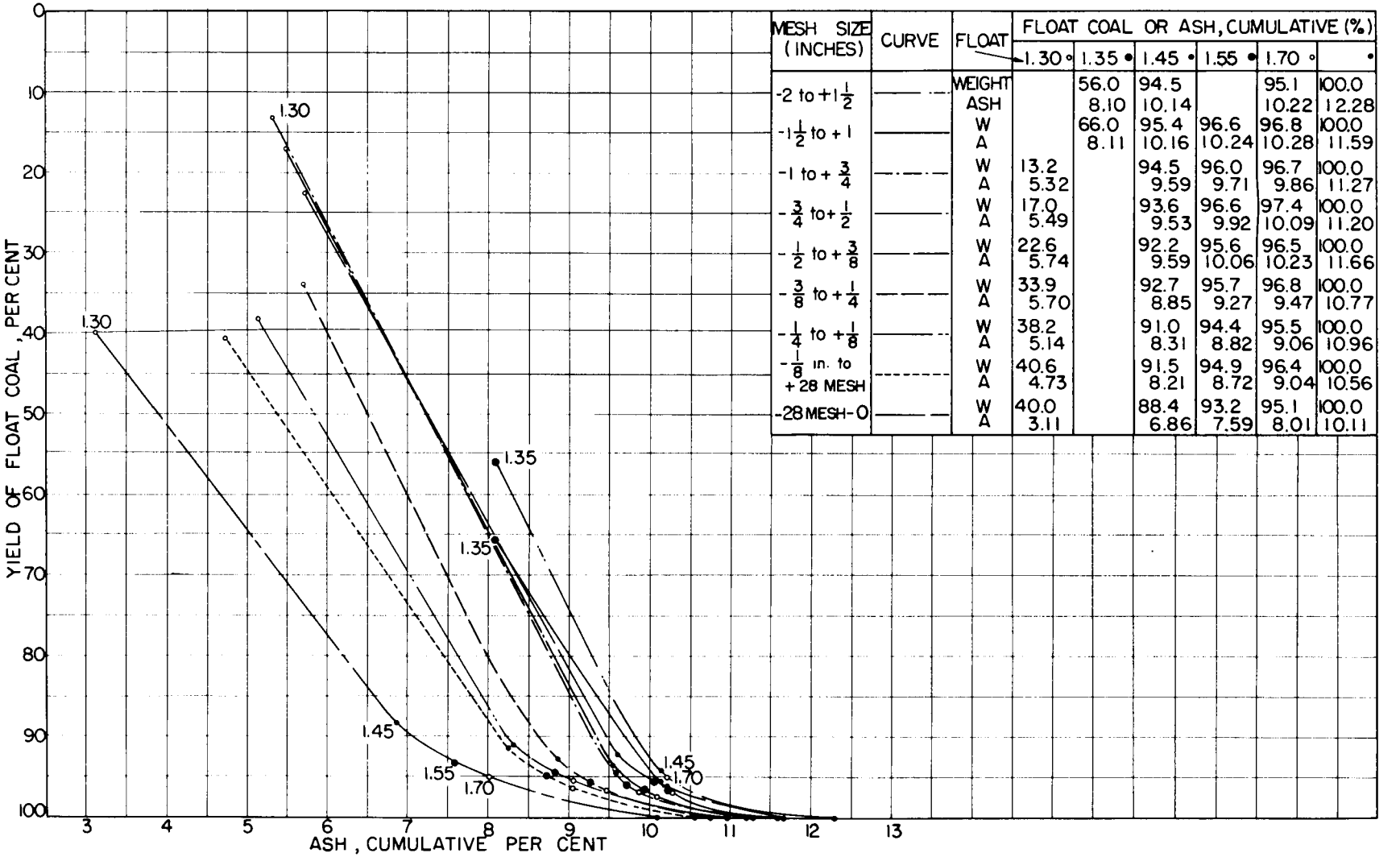
DATA SHEET 8. - Float-and-sind tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (550 B pit) SE sec. 36, Athens Township, Harrison County, Ohio. Screen size: -1/8 inches to +28 mesh.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	79.4	40.0	2.30	3.11	40.0	3.11	100.0	10.11	
1.30 - 1.45	96.0	48.4	1.76	9.96	88.4	6.86	60.0	14.78	9.0
1.45 - 1.55	9.4	4.8	1.68	21.02	93.2	7.59	11.6	34.88	2.3
1.55 - 1.70	3.8	1.9	1.72	28.55	95.1	8.01	6.8	44.65	1.3
Sink 1.70	9.6	4.9	1.58	50.82	100.0	10.11	4.9	50.82	
Totals	198.2	100.0							

* Moisture-free basis.

DATA SHEET 9. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (550 B pit) SE sec. 36, Athens Township, Harrison County, Ohio. Screen size: -28 mesh to 0.

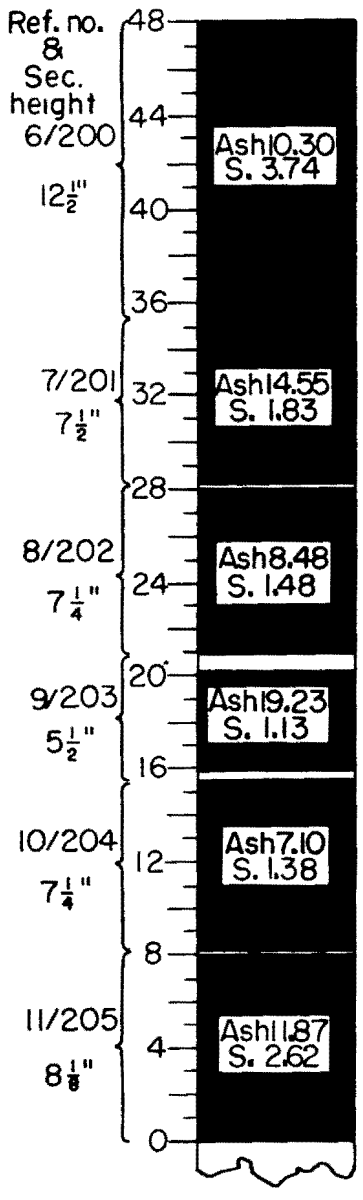


MESH SIZE (INCHES)	CURVE	FLOAT	FLOAT COAL OR ASH, CUMULATIVE (%) 1.30 ◦	1.35 •	1.45 •	1.55 •	1.70 ◦	•
-2 to +1 1/2	—·—	WEIGHT		56.0	94.5		95.1	100.0
		ASH		8.10	10.14		10.22	12.28
-1 1/2 to +1	——	W		66.0	95.4	96.6	96.8	100.0
		A		8.11	10.16	10.24	10.28	11.59
-1 to +3/4	—·—·—	W	13.2		94.5	96.0	96.7	100.0
		A	5.32		9.59	9.71	9.86	11.27
-3/4 to +1/2	—·—	W	17.0		93.6	96.6	97.4	100.0
		A	5.49		9.53	9.92	10.09	11.20
-1/2 to +3/8	——	W	22.6		92.2	95.6	96.5	100.0
		A	5.74		9.59	10.06	10.23	11.66
-3/8 to +1/4	——	W	33.9		92.7	95.7	96.8	100.0
		A	5.70		8.85	9.27	9.47	10.77
-1/4 to +1/8	—·—	W	38.2		91.0	94.4	95.5	100.0
		A	5.14		8.31	8.82	9.06	10.96
-1/8 in. to +28 MESH	- - -	W	40.6		91.5	94.9	96.4	100.0
		A	4.73		8.21	8.72	9.04	10.56
-28 MESH-0	——	W	40.0		88.4	93.2	95.1	100.0
		A	3.11		6.86	7.59	8.01	10.11

DATA SHEET 10.—FLOAT AND SINK TESTS DATA SHEET, AND FLOAT ASH CURVES SHOWING YIELD OF FLOAT COAL VS. CUMULATIVE ASH CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COMPOSITE COAL SAMPLE (SECTIONS NO.1 TO 5) FROM HANNA COAL COMPANY GEORGETOWN NO.12 STRIP MINE (550B PIT) SE SEC. 36, ATHENS TWP., HARRISON CO., OHIO.

Blank Page

INVESTIGATION RESULTS OF COAL SAMPLES FROM HANNA COAL COMPANY GEORGETOWN NO. 12 STRIP MINE (300-E PIT).



Top of coal, roadway in pit on coal surface.

12½" Coal, bright, blocky, hard.

7½" Coal, bright, blocky, with numerous thin partings ½" to 1" apart. Notable shaly parting at top and bottom and variable parting ⅛" to ½" thick 1¼" below top of sample.

⅛" Shaly, bony.

7⅛" Coal, bright, blocky, laterally contains several 1/32" to 1/16" shaly pyritic partings.

¾" Coal, bony, hard.

4⅜" Coal, bright, with abundant fusain partings.

⅜" Shale, bony to clayey, varies ¼" to ⅝".

7¼" Coal, bright, blocky.

⅛" Shale, bony, coaly.

8" Coal, bright, blocky

Underclay.

Fig. 8.- Cross section of coal bed at sampling face (Ref. No. 6/200 to 11/205) in central Sec. 31, Athens Township, Harrison County, Ohio, of the Hanna Coal Company Georgetown No. 12 strip mine (300-E pit).

TABLE V. Analysis and carbonization assay data of coal samples (Ref. No. 6/200 to 11/205) from Hanna Coal Company, Georgetown No. 12 strip mine (300-E pit), Central Sec. 31, Athens Township, Harrison County, Ohio.

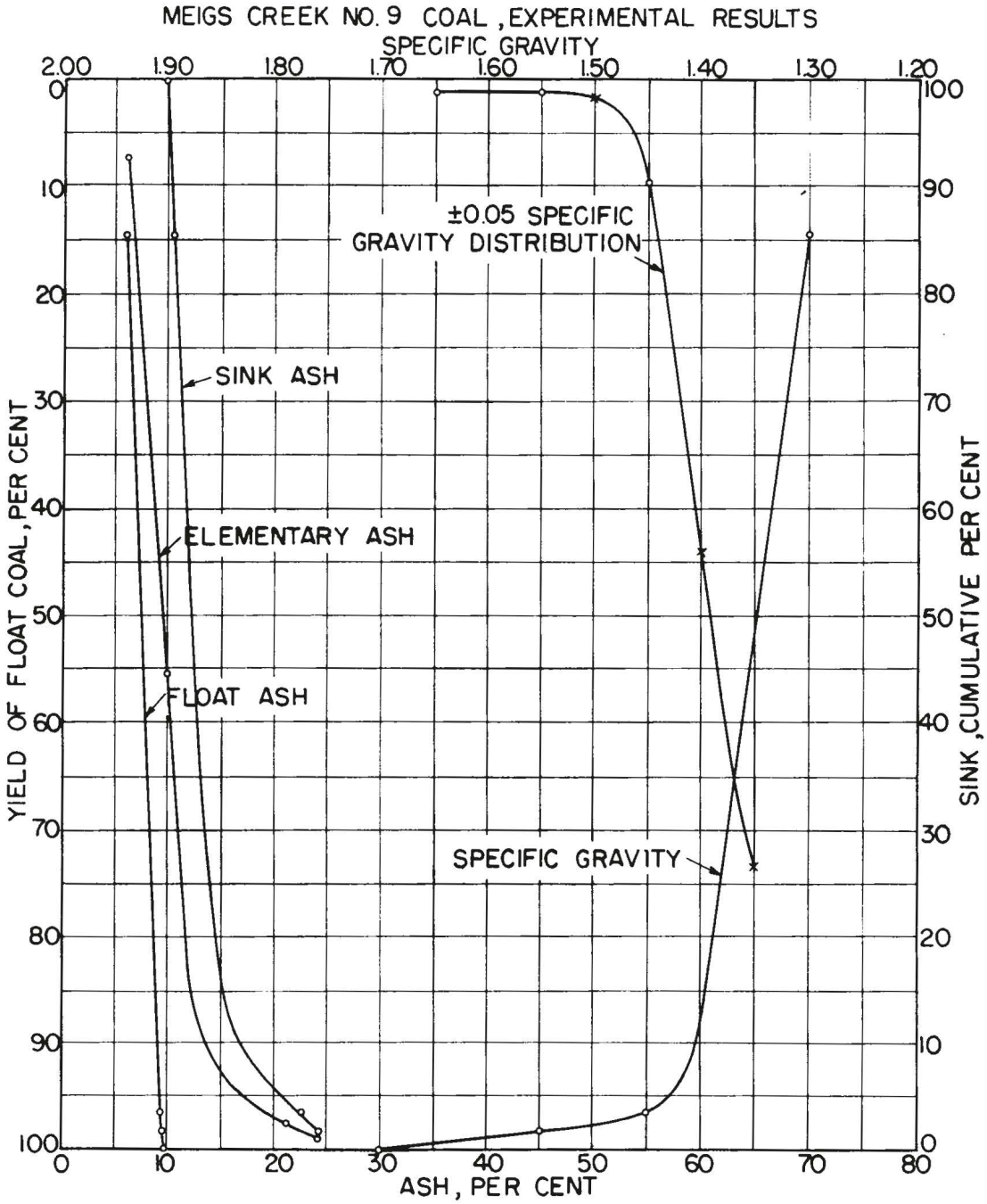
Sample				Proximate analysis (% by wt.)					Gross heating value		Carbonization assay						
												Yields					
Reference number												cc./100 gm. charge		% by wt.		gal./ton	
E.E.S. Laboratory	G.S.O. Locality	Thickness (in.)	Condition *	Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Btu./lb.	kg.-cal./kg.	Charge (gm.)	Tar	Liquor	Coke	Gas & loss	Tar	Liquor
6/200	523-1	12½	a	1.90	38.13	49.86	10.11	3.67	12,656	7031	150.0	12.7	4.3	70.2	12.8	30.4	10.3
			b	0.00	38.87	50.83	10.30	3.74	12,901	7167	147.2	13.0	2.5	71.5	13.0	31.1	6.0
7/201	523-2	7⅓	a	2.02	33.58	50.14	14.26	1.79	12,014	6674	150.0	12.3	4.7	71.6	11.4	29.5	11.3
			b	0.00	34.27	51.18	14.55	1.83	12,261	6812	147.0	12.6	2.7	73.1	11.6	30.2	6.5
8/202	523-3	7¼	a	2.16	34.76	54.78	8.30	1.45	12,894	7163	150.0	12.0	5.5	71.4	11.1	28.8	13.2
			b	0.00	35.53	55.99	8.48	1.48	13,178	7321	146.8	12.3	3.3	73.0	11.4	29.5	7.9
9/203	523-4	5⅓	a	1.90	31.71	47.52	18.87	1.11	11,329	6294	150.0	9.5	5.8	73.5	11.2	22.8	13.9
			b	0.00	32.32	48.45	19.23	1.13	11,548	6416	147.2	9.7	4.0	74.9	11.4	23.2	9.6
10/204	523-5	7¼	a	2.06	35.82	55.17	6.95	1.35	13,099	7277	150.0	11.8	5.8	69.2	13.2	28.3	13.9
			b	0.00	36.57	56.33	7.10	1.38	13,374	7430	146.9	12.0	3.9	70.6	13.5	28.8	9.3
11/205	523-6	8⅛	a	2.20	34.88	51.31	11.61	2.56	12,246	6803	150.0	11.8	4.9	70.5	12.8	28.3	11.7
			b	0.00	35.66	52.47	11.87	2.62	12,522	6957	146.7	12.1	2.8	72.1	13.0	29.0	6.7
Total or average (Calculated upon thickness)		48⅜	a	2.03	35.28	51.43	11.26	2.21	12,438	6910	150.0	11.9	5.0	70.9	12.2	28.5	12.0
			b	0.00	36.01	52.50	11.49	2.26	12,696	7053	147.0	12.1	3.1	72.4	12.4	29.0	7.4

* Condition a refers to the air-dry sample; condition b refers to moisture-free sample.

TABLE VI. Weight, elementary and cumulative weight per cent of various screen sizes of the composite sample (Ref. No. 6/200 to 11/205) from Hanna Coal Co., Georgetown No. 12 strip mine (300 E pit), Central Sec. 31, Athens Township, Harrison County, Ohio.

Reference number		Screen size (in.)	Condition*	Elementary data		Computed cumulative wt. %
E.E.S. Laboratory	G.S.O. Locality			wt. gm.	wt. %	
6/200 to 11/205	523 - 1 to 6	−2 to +1½	a	3629	38.6	38.6
(Composite Sample)		−1½ to +1	a	1814	19.3	57.9
		−1 to +¾	a	1134	12.0	69.9
		−¾ to +½	a	1388	14.8	84.7
		−½ to +⅜	a	172	1.8	86.5
		−⅜ to +¼	a	481	5.1	91.6
		−¼ to +⅛	a	368	3.9	95.5
		−⅛ inches to + 28 mesh	a	313	3.3	98.8
		−28 mesh to 0	a	113	1.2	100.0
Total		−2 to 0	a	9412	100.0	–

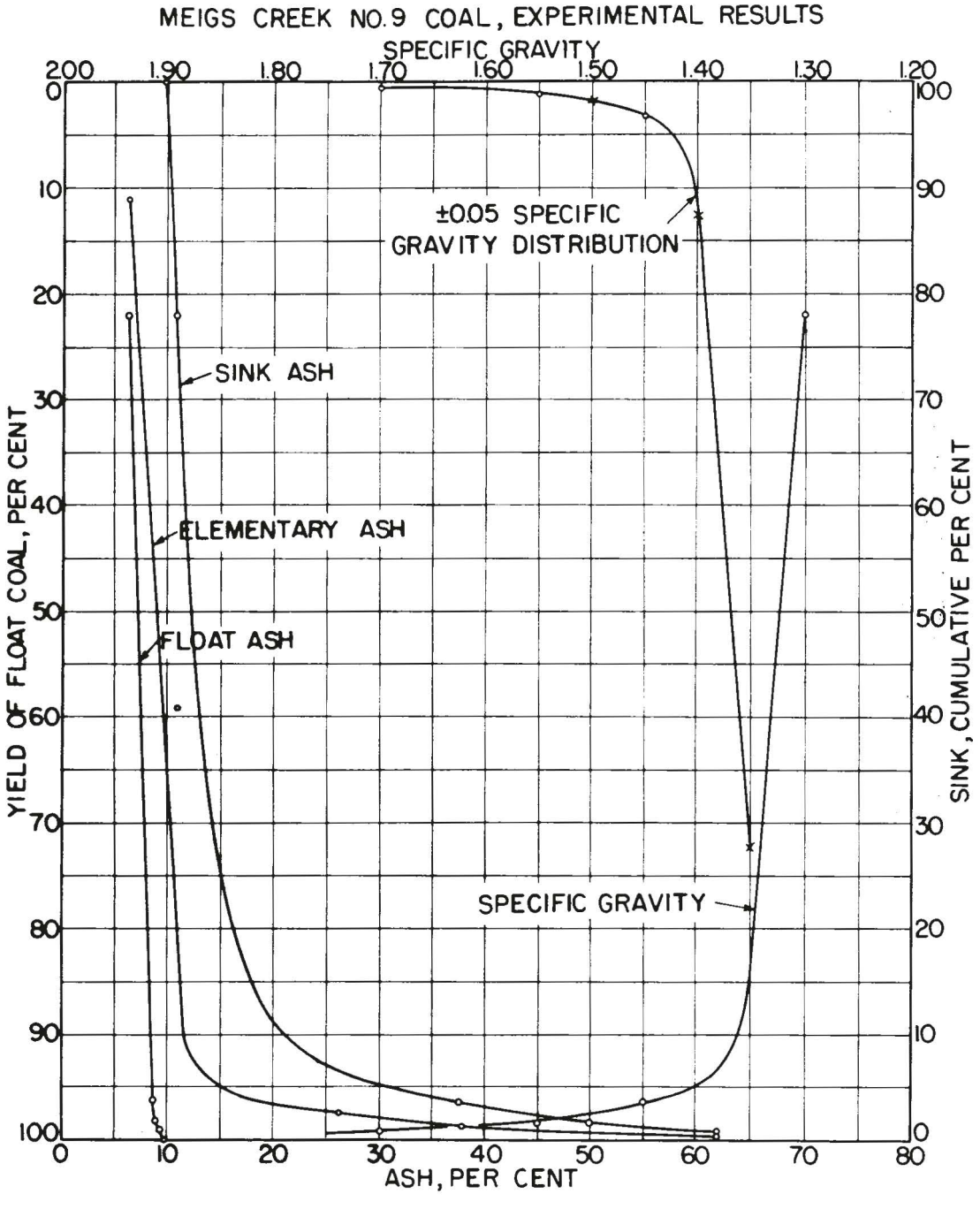
* Condition a refers to the air-dry sample.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	513	14.4	1.54	6.11	14.4	6.11	100.0	9.79	
1.30 - 1.45	2921	82.2	1.12	9.88	96.6	9.32	85.6	10.41	9.6
1.45 - 1.55	59	1.7	1.16	21.91	98.3	9.54	3.4	23.14	1.2
1.55 - 1.70	59	1.7	0.88	24.21	100.0	9.79	1.7	24.21	
Sink 1.70	0	0.0							
Totals	3552	100.0							

* Moisture-free basis.

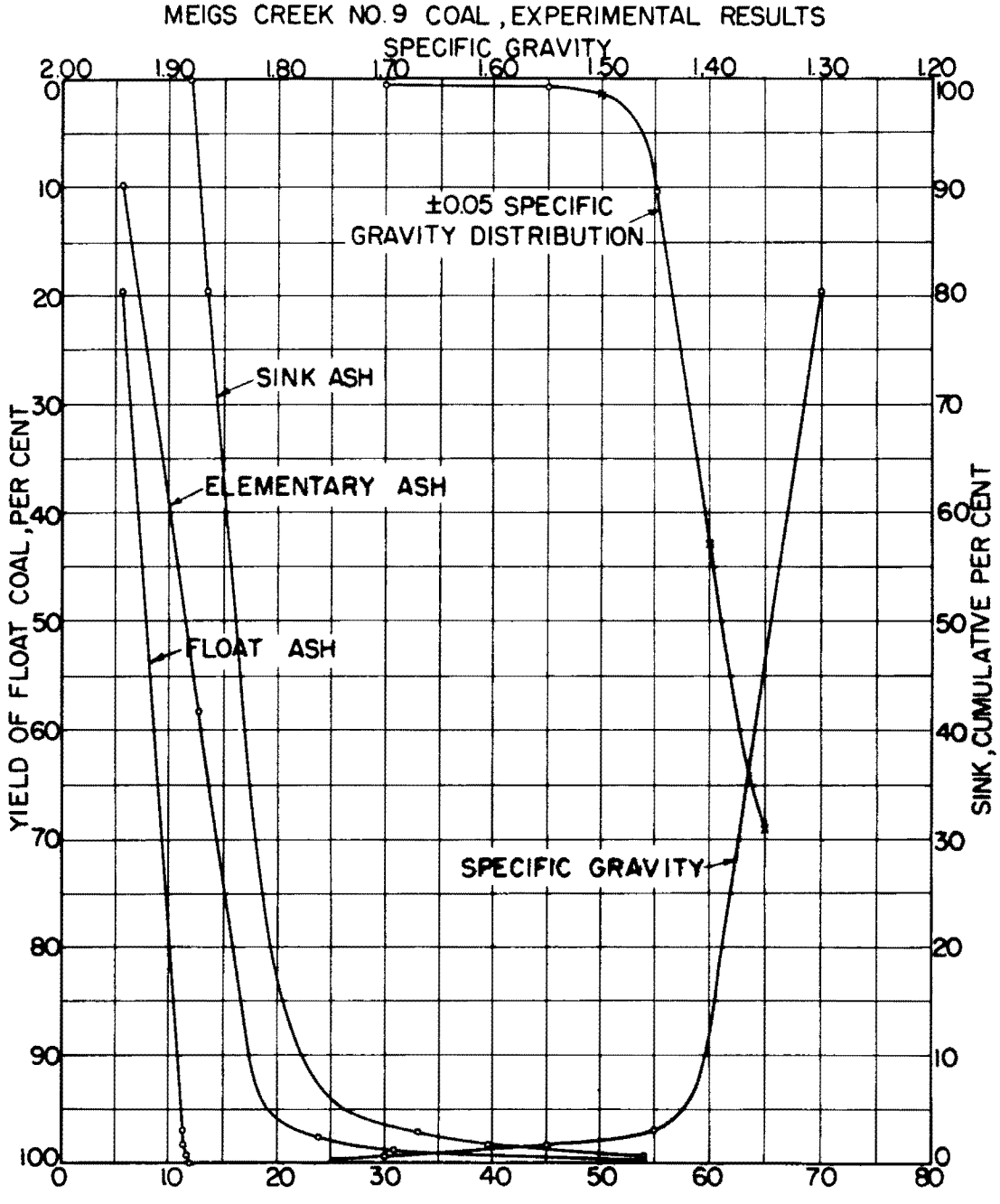
DATA SHEET 11. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (300 E pit) central sec. 31, Athens Township, Harrison County, Ohio. Screen size: -2 to +1½ inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	681	22.0	1.41	6.32	22.0	6.32	100.0	11.00	
1.30 - 1.45	2295	74.3	1.52	11.06	96.3	9.98	78.0	12.32	3.3
1.45 - 1.55	59	1.9	1.27	26.29	98.2	10.29	3.7	37.55	1.2
1.55 - 1.70	27	0.9	1.42	37.90	99.1	10.54	1.8	49.73	0.5
Sink 1.70	27	0.9	1.40	61.78	100.0	11.00	0.9	61.78	
Totals	3089	100.0							

* Moisture-free basis.

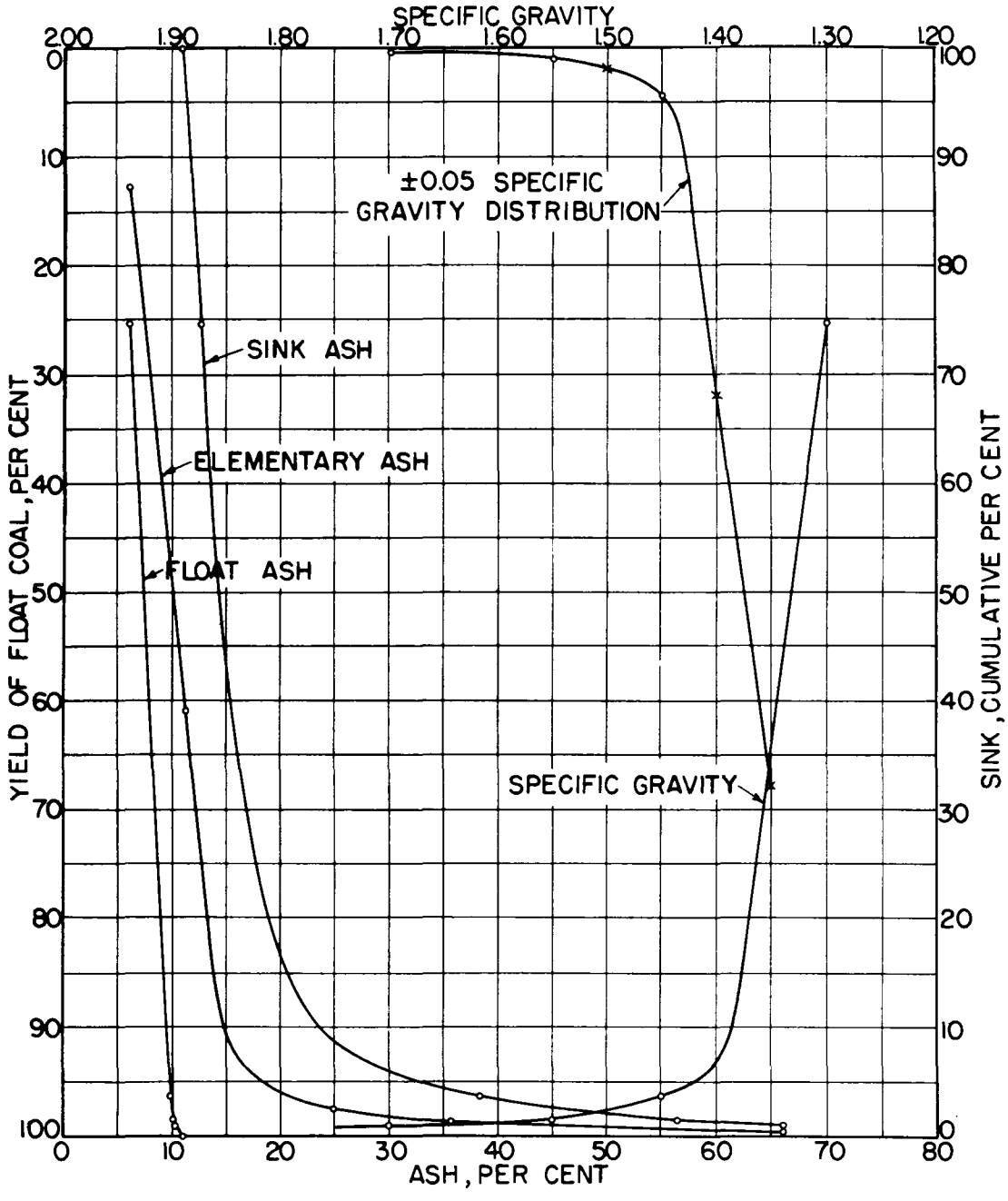
DATA SHEET 12. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (300 E pit) central sec. 31, Athens Township, Harrison County, Ohio. Screen size: -1½ to +1 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	540	19.6	1.58	5.56	19.6	5.56	100.0	11.90	
1.30 - 1.45	2127	77.3	1.24	12.66	96.9	11.22	80.4	13.45	10.3
1.45 - 1.55	36	1.3	1.28	23.86	98.2	11.39	3.1	33.15	0.9
1.55 - 1.70	32	1.1	1.26	30.84	99.3	11.61	1.8	39.72	0.5
Sink 1.70	18	0.7	1.28	54.00	100.0	11.90	0.7	54.00	
Totals	2753	100.0							

* Moisture-free basis.

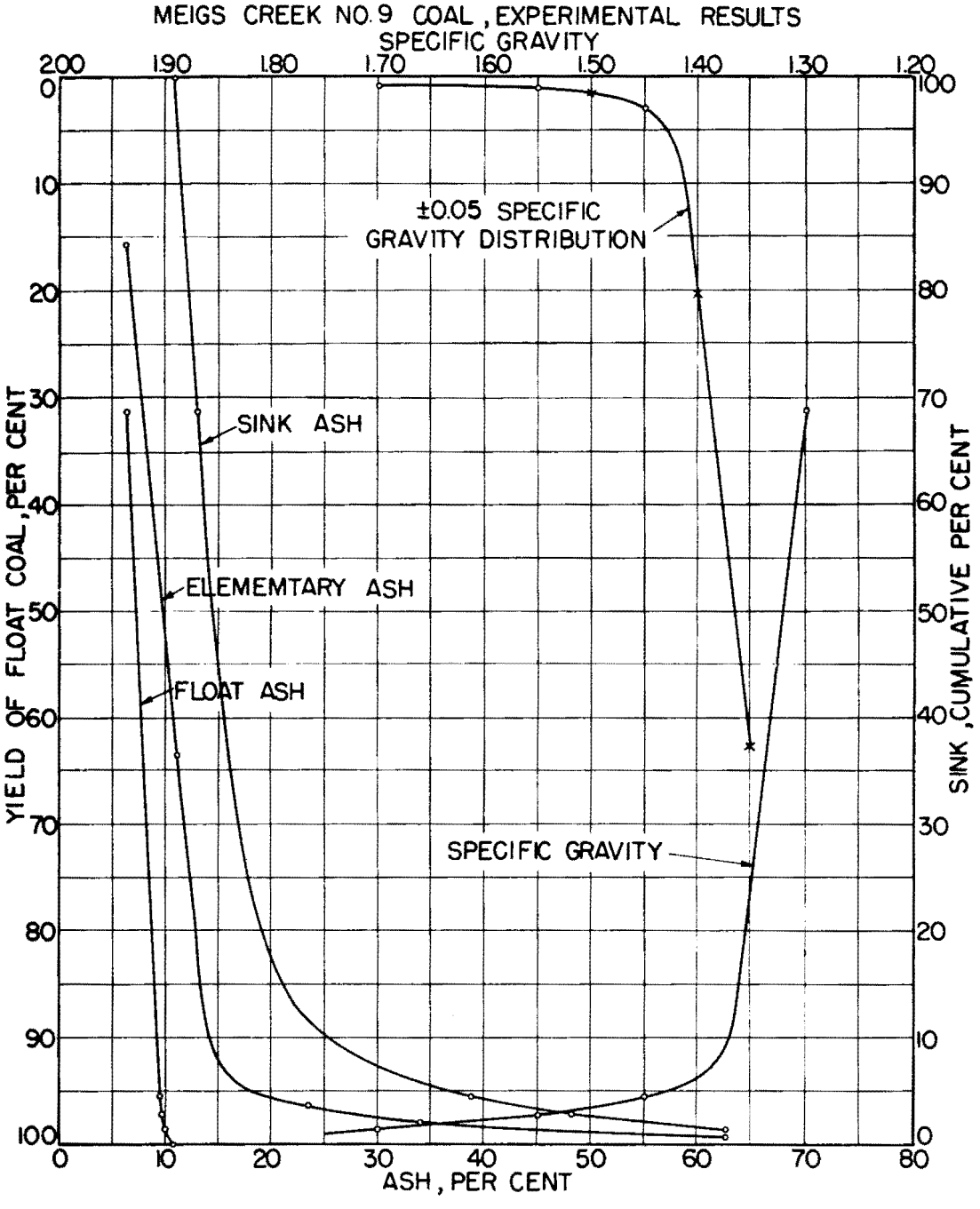
DATA SHEET 13. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (300 E pit), central sec, 31, Athens Township, Harrison County, Ohio. Screen size: -1 to +3/4 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	1334	25.4	1.34	6.04	25.4	6.04	100.0	10.94	
1.30 - 1.45	3715	70.8	1.02	11.23	96.2	9.86	74.6	12.61	4.3
1.45 - 1.55	113	2.2	1.40	24.88	98.4	10.20	3.8	38.28	1.1
1.55 - 1.70	27	0.5	1.68	35.66	98.9	10.32	1.6	56.45	0.3
Sink 1.70	59	1.1	1.69	66.20	100.0	10.94	1.1	66.20	
Totals	5248	100.0							

* Moisture-free basis.

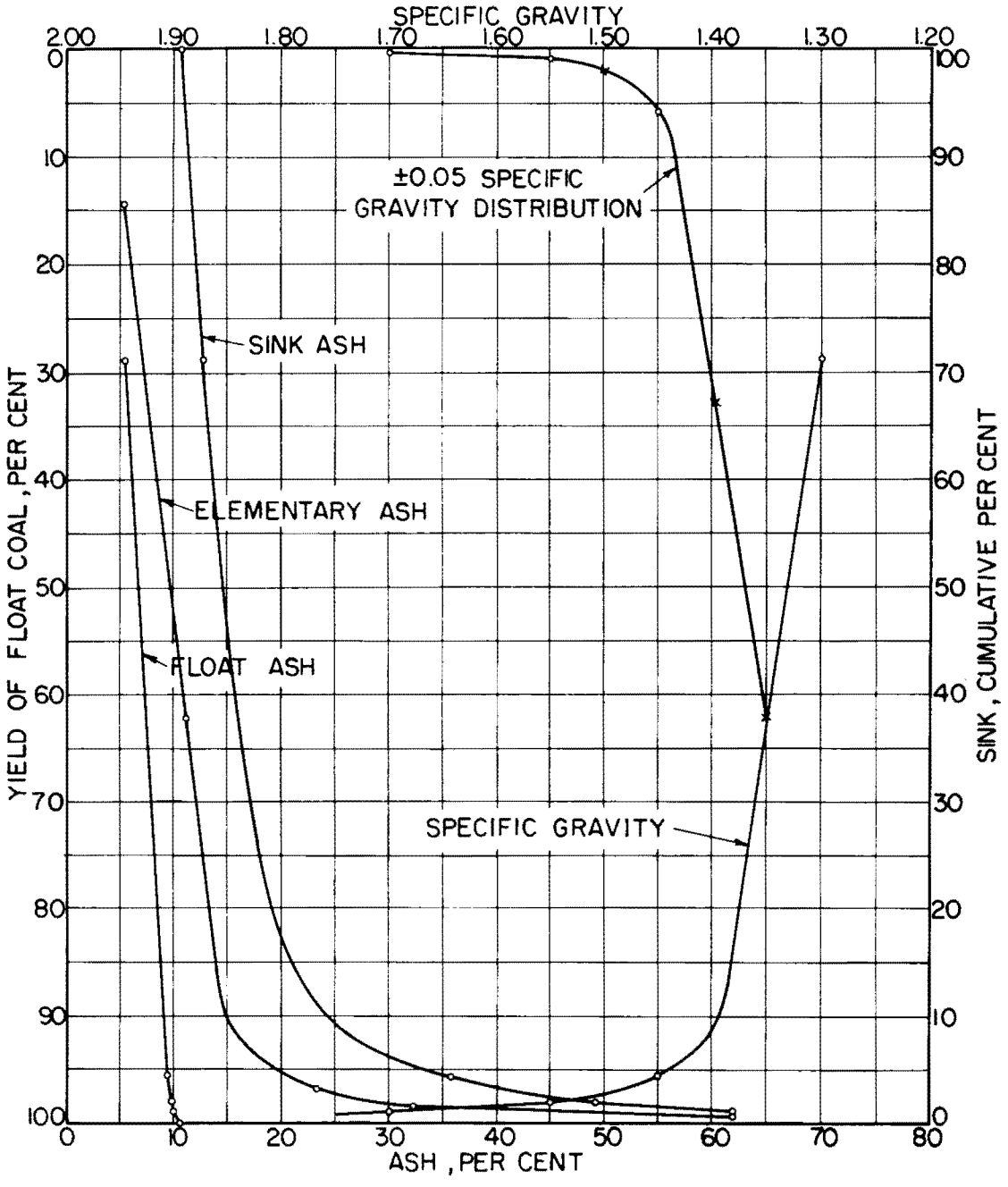
DATA SHEET 14. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (300 E pit), central sec. 31, Athens Township, Harrison County, Ohio. Screen size: -3/4 to+1/2 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	594	31.3	1.57	6.19	31.3	6.19	100.0	10.81	
1.30 - 1.45	1220	64.2	1.68	11.10	95.5	9.49	68.7	12.91	2.9
1.45 - 1.55	32	1.7	1.37	23.45	97.2	9.73	4.5	38.82	1.0
1.55 - 1.70	27	1.4	1.27	34.02	98.6	10.08	2.8	48.30	0.8
Sink 1.70	27	1.4	1.25	62.58	100.0	10.81	1.4	62.58	
Totals	1900	100.0							

* Moisture-free basis.

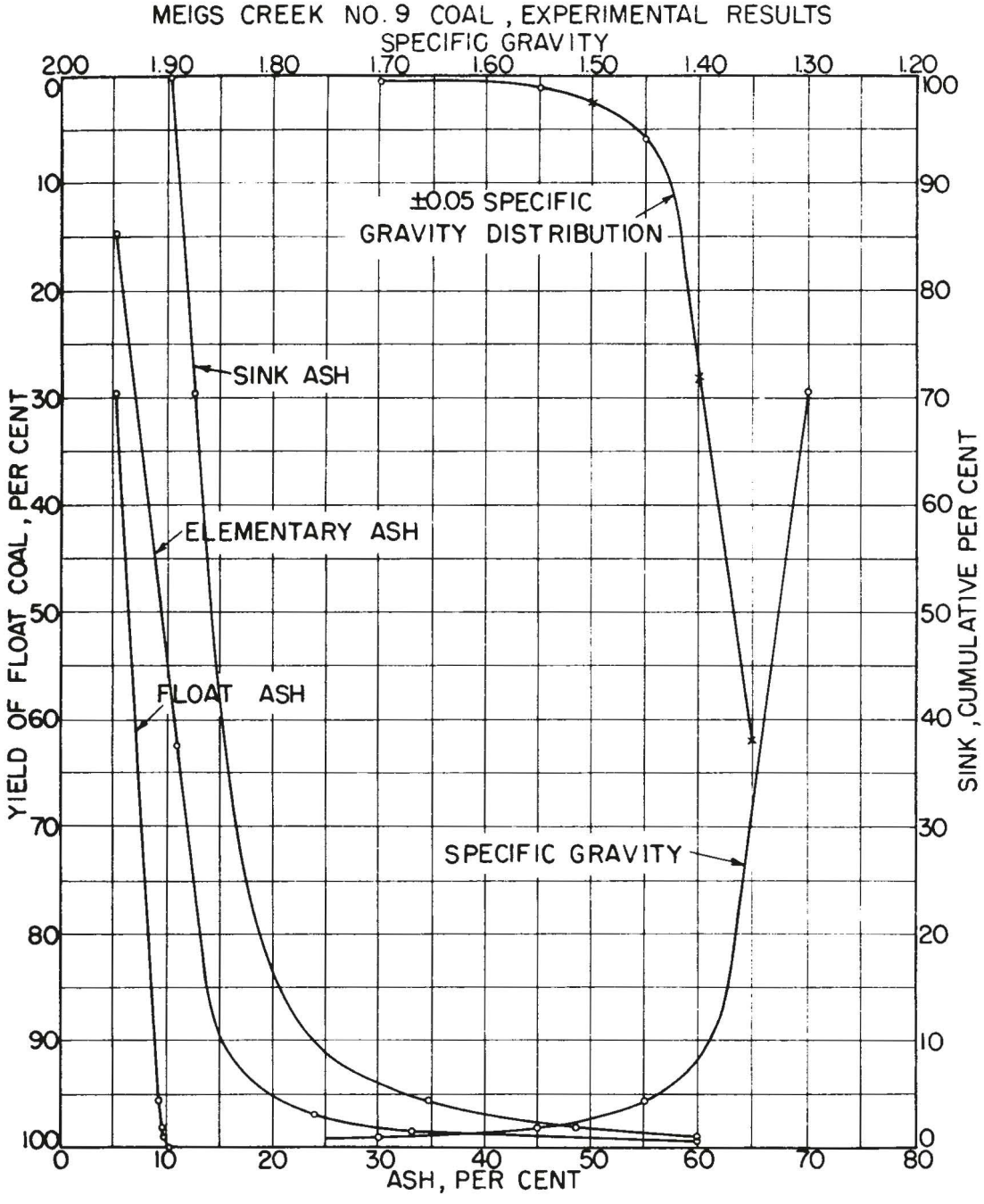
DATA SHEET 15. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (300 E pit), central sec. 31, Athens Township, Harrison County, Ohio. Screen size: -1/2 to +3/8 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	1021	28.9	1.95	5.47	28.9	5.47	100.0	10.57	
1.30 - 1.45	2354	66.7	1.56	11.12	95.6	9.41	71.1	12.64	6.0
1.45 - 1.55	81	2.3	1.22	23.34	97.9	9.74	4.4	35.77	1.0
1.55 - 1.70	32	0.9	1.53	32.45	98.8	9.95	2.1	49.26	0.5
Sink 1.70	41	1.2	1.43	61.96	100.0	10.57	1.2	61.96	
Totals	3529	100.0							

* Moisture-free basis.

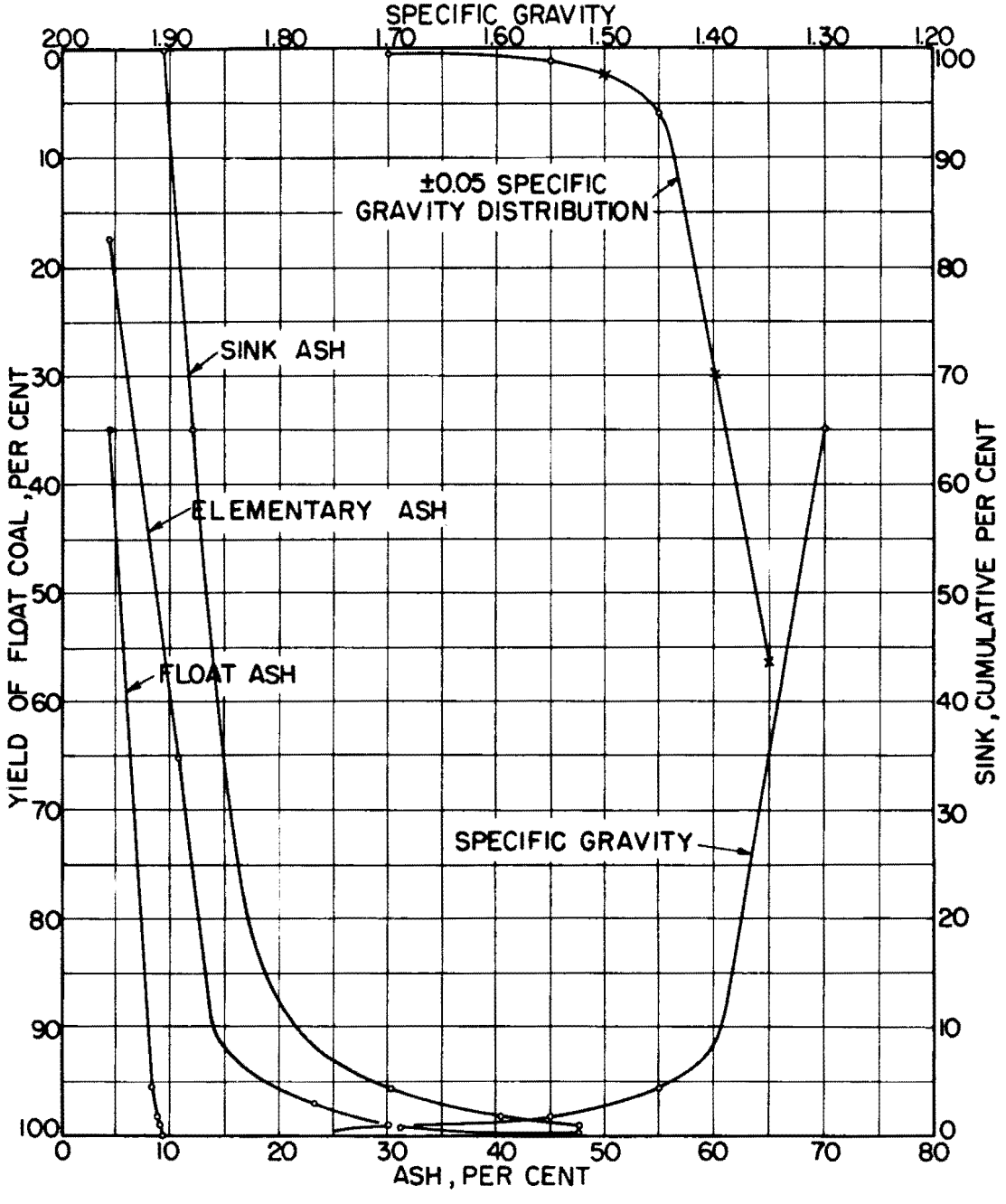
DATA SHEET 16. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (300 F pit), central sec. 31, Athens Township, Harrison County, Ohio. Screen size: -3/8 to +1/4 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	993	29.4	1.93	5.19	29.4	5.19	100.0	10.36	
1.30 - 1.45	2241	66.2	1.64	11.04	95.6	9.24	70.6	12.51	5.8
1.45 - 1.55	86	2.5	1.19	23.99	98.1	9.62	4.4	34.70	1.1
1.55 - 1.70	27	0.8	1.47	33.20	98.9	9.81	1.9	48.57	0.5
Sink 1.70	36	1.1	1.27	59.95	100.0	10.36	1.1	59.95	
Totals	3383	100.0							

* Moisture-free basis.

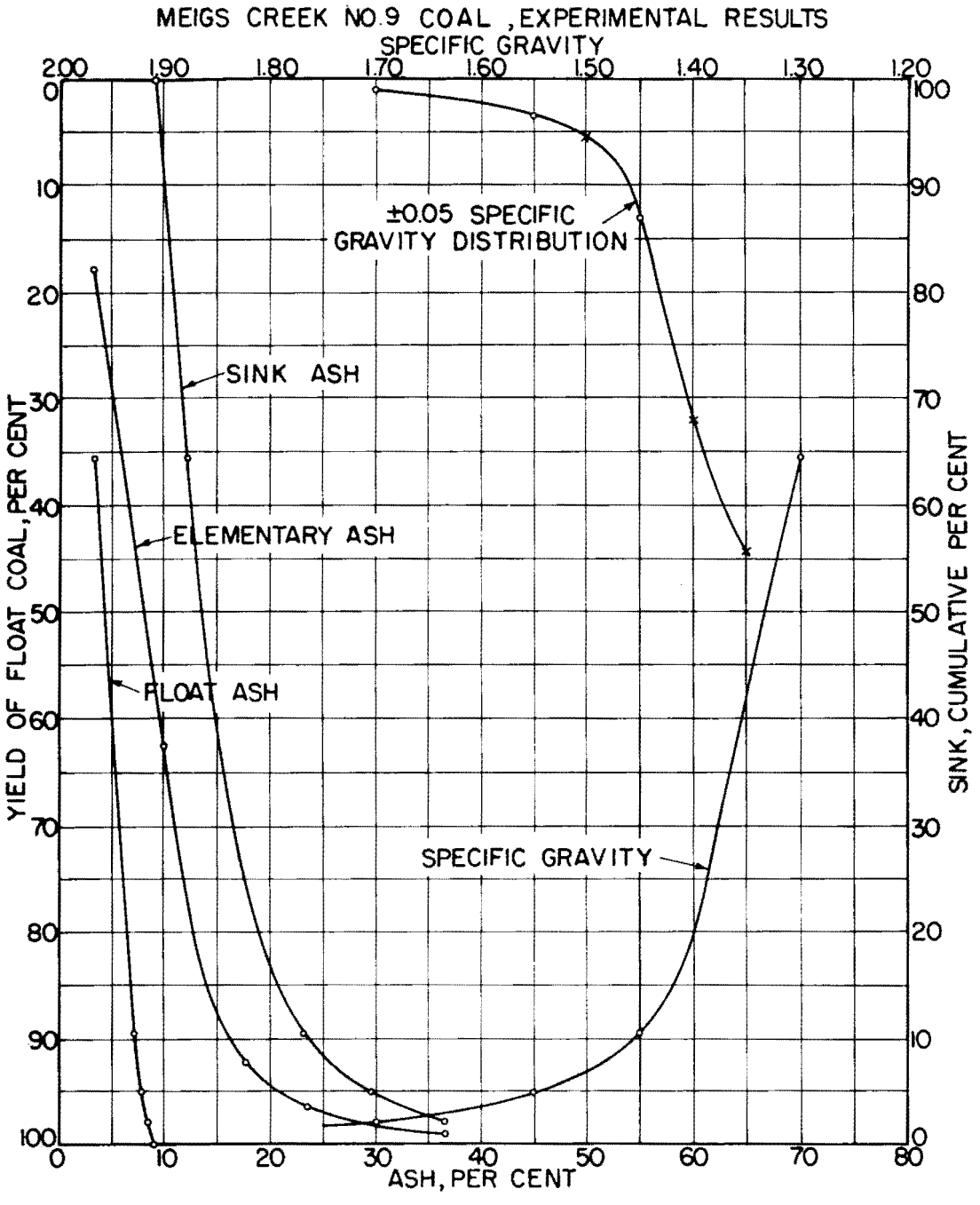
DATA SHEET 17. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (300 F pit), central sec. 31, Athens Township, Harrison County, Ohio. Screen size: -1/4 to +1/8 inches.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	966	35.0	1.44	4.30	35.0	4.30	100.0	9.33	
1.30 - 1.45	1674	60.6	1.27	10.72	95.6	8.37	65.0	12.04	6.0
1.45 - 1.55	72	2.6	1.12	23.24	98.2	8.76	4.4	30.19	1.2
1.55 - 1.70	23	0.8	0.95	31.23	99.0	8.95	1.8	40.43	0.5
Sink 1.70	27	1.0	0.98	47.64	100.0	9.33	1.0	47.64	
Totals	2762	100.0							

* Moisture-free basis.

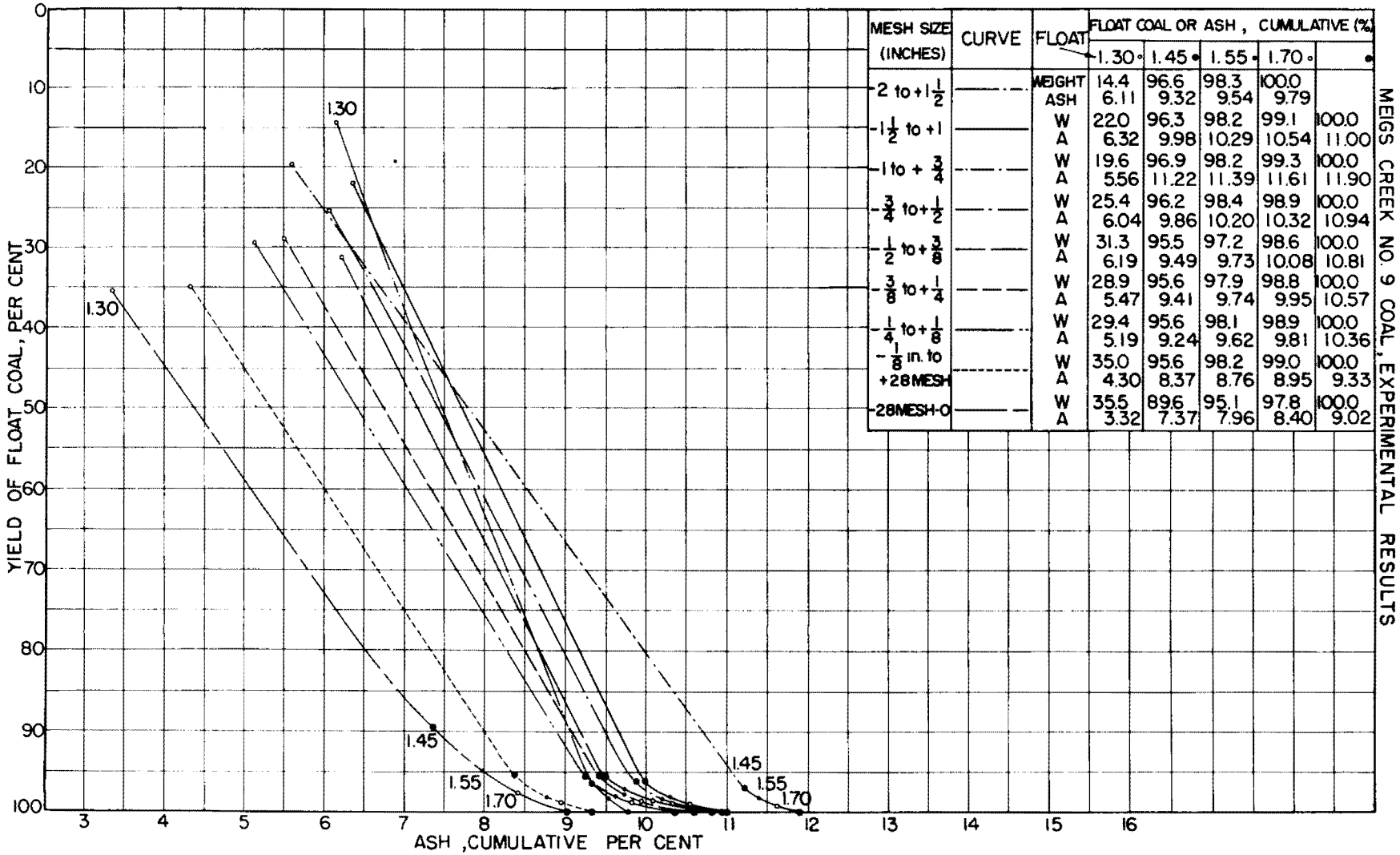
DATA SHEET 18. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (300 E pit), central sec. 31, Athens Township, Harrison County, Ohio. Screen size: -1/8 inches to + 28 mesh.



Specific Gravity Fractions	Elementary Data				Computed Cumulative Data Per Cent				Near Gravity ±0.05%
	Weight Grams	Per Cent			Float Cumulative		Sink Cumulative		
		Weight	Moisture	Ash*	Weight	Ash*	Weight	Ash*	
Float 1.30	540	35.5	1.96	3.32	35.5	3.32	100.0	9.02	
1.30 - 1.45	822	54.1	1.79	10.02	89.6	7.37	64.5	12.16	13.0
1.45 - 1.55	83	5.5	1.88	17.70	95.1	7.96	10.4	23.24	3.3
1.55 - 1.70	41	2.7	1.89	23.64	97.8	8.40	4.9	29.59	0.9
Sink 1.70	33	2.2	1.55	36.58	100.0	9.02	2.2	36.58	
Totals	1519	100.0							

* Moisture-free basis.

DATA SHEET 19. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Georgetown No. 12 strip mine (300 E pit), central sec. 31, Athens Township, Harrison County, Ohio. Screen size: -28 mesh to 0.



MESH SIZE (INCHES)	CURVE	FLOAT	FLOAT COAL OR ASH, CUMULATIVE (%) 1.30	1.45	1.55	1.70	
2 to +1 1/2		WEIGHT	14.4	96.6	98.3	100.0	
		ASH	6.11	9.32	9.54	9.79	
-1 1/2 to +1		W	22.0	96.3	98.2	99.1	100.0
		A	6.32	9.98	10.29	10.54	11.00
-1 to + 3/4		W	19.6	96.9	98.2	99.3	100.0
		A	5.56	11.22	11.39	11.61	11.90
-3/4 to+1/2		W	25.4	96.2	98.4	98.9	100.0
		A	6.04	9.86	10.20	10.32	10.94
-1/2 to+3/8		W	31.3	95.5	97.2	98.6	100.0
		A	6.19	9.49	9.73	10.08	10.81
-3/8 to+1/4		W	28.9	95.6	97.9	98.8	100.0
		A	5.47	9.41	9.74	9.95	10.57
-1/4 to+1/8		W	29.4	95.6	98.1	98.9	100.0
		A	5.19	9.24	9.62	9.81	10.36
-1/8 in. to +28 MESH		W	35.0	95.6	98.2	99.0	100.0
		A	4.30	8.37	8.76	8.95	9.33
-28 MESH-0		W	35.5	89.6	95.1	97.8	100.0
		A	3.32	7.37	7.96	8.40	9.02

MEIGS CREEK NO. 9 COAL, EXPERIMENTAL RESULTS

DATA SHEET 20.— FLOAT AND SINK TESTS DATA SHEET, AND FLOAT ASH CURVES SHOWING YIELD OF FLOAT COAL VS. CUMULATIVE ASH CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COMPOSITE COAL SAMPLE (SECTIONS NO. 6 TO 11) FROM HANNA COAL COMPANY, GEORGETOWN NO. 12 STRIP MINE (300 E PIT) CENTRAL SEC. 31, ATHENS TWP., HARRISON CO., OHIO.

Blank Page

INVESTIGATION RESULTS OF COAL SAMPLES FROM JANES COAL SALES, INC. STRIP MINE IN BRISTOL TOWNSHIP, MORGAN COUNTY, OHIO.

TABLE VII. Analysis of coal samples (Ref. No. 12/243A to 14/243C; G.S.O. Locality 542) from Janes Coal Sales Inc., strip mine in Bristol Township, Morgan County, Ohio

Sample			Proximate analysis (% by wt.)					Fusion of ash** °F (°C)			Gross heating value		Carbonization assay							
Reference number														Yields						
														(% by wt.)				(per short ton)		
E.E.S. Laboratory	G.S.O. Locality	Condition*	Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Initial	Complete	Fluid temp.	Btu./lb.	kg.-cal/kg.	Charge (gm.)	Tar	Liquor	Coke	Gas†	Tar (gal.)	Liquor (gal.)	Gas ‡ (cu.ft.)	Sulfur (lb.)
12/243A	542-1	a	3.69	39.76	41.54	15.01	6.21	2170	2270	2360	11,694	6497	72.1	14.7	8.5	68.9	7.8	35.2	20.4	1848	33.5
		b	2.41	40.29	42.09	15.21	6.29	(1188)	(1243)	(1293)	11,849	6583	71.2	14.9	7.3	69.8	7.9	35.7	17.5	1873	33.9
		c	0.00	41.28	43.13	15.59	6.45				12,142	6746	69.5	15.3	5.0	71.5	8.1	36.7	12.0	1919	34.7
13/243B	542-2	a	4.60	40.75	42.30	12.35	4.91	2180	2280	2380	12,008	6671									
		b	2.53	41.64	43.22	12.61	5.02	(1193)	(1249)	(1304)	12,271	6817									
		c	0.00	42.72	44.34	12.94	5.15				12,589	6994									
14/243C	542-3	a	16.01	27.62	30.79	25.58	8.16				8,133	4518									
		b	1.53	32.38	36.10	29.99	9.57				9,535	5297									
		c	0.00	32.88	36.66	30.46	9.72				9,683	5379									
13A/243B	542-2	b	1.66	43.30	44.68	10.36	4.66				12,712	7063									
		c	0.00	44.03	45.44	10.53	4.74				12,926	7181									
13B/243B	542-2	b	1.25	32.05	34.35	32.35	8.89				9,158	5088									
		c	0.00	32.46	34.78	32.76	9.00				9,274	5152									

*Condition a refers to the sample as received; condition b refers to the air-dry sample; condition c refers to moisture-free sample.

**Fusion of ash data submitted by F.H. Westlake.

†Includes H_2S, 1.75 per cent by weight of charge.

‡30in., 60°F, wet.

TABLE VIII. Gas analysis of assay carbonization of the coal sample (Ref. No. 12/243A) from Janes Coal Sales, Inc. strip mine in Bristol Township, Morgan County, Ohio

Condition*	Composition, dry (% by vol.)								Carbon number	Total H_2S (gr/100 cu.ft.)
	H_2S	CO_2	Illuminants	O_2	CO	H_2	Saturated hydrocarbons	N_2		
a	22.3	10.8	4.1	0.0	4.5	6.4	50.5	1.4	1.27	13,978
b	0.0	13.9	5.3	0.0	5.8	8.2	65.0	1.8		

* a - air-free; b - air- and H_2S-free.

TABLE IX - Screen tests and analysis data of various screen sizes of the coal sample (Ref. No. 12/243A) from Janes Coal Sales Inc., strip mine in Bristol Township, Morgan County, Ohio.

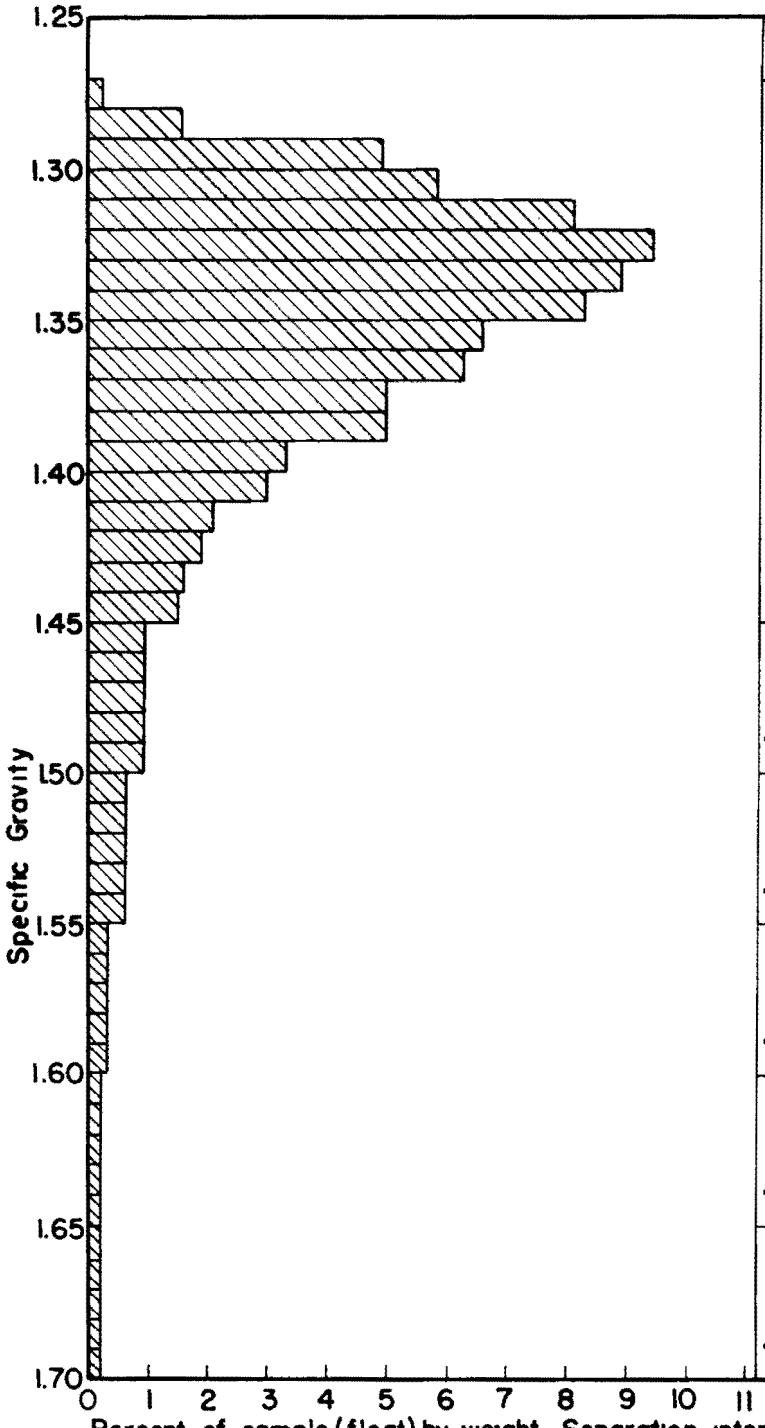
Sample					Elementary data (%)				Gross heating value		Computed cumulative data (%)		
Reference number		Screen size (in.)	Condition*	Weight (gm.)	Weight	Moisture	Ash	Sulfur	Btu/lb.	kg-cal/kg	Weight	Ash	Sulfur
E.E.S Laboratory	G.S.O. Locality												
12/243A	542-1	-2 to +1½	a	9,070	6.5	2.64	15.34	5.43	11,661	6478	6.5	15.34	5.43
			b			0.00	15.76	5.58	11,977	6654		15.76	5.58
			c			0.00	00.00	0.00	14,639	8133			
		-1½ to +1¼	a	18,877	13.5	2.64	13.39	6.38	11,884	6602	20.0	14.02	6.07
			b			0.00	13.75	6.55	12,206	6781		14.40	6.24
			c			0.00	00.00	0.00	14,567	8093			
		-1¼ to +1	a	30,385	21.8	2.51	12.89	5.61	12,121	6734	41.8	13.43	5.83
			b			0.00	13.22	5.75	12,433	6907		13.78	5.98
			c			0.00	00.00	0.00	14,712	8173			
		-1 to +¾	a	22,421	16.1	2.41	14.19	5.65	11,876	6597	57.9	13.64	5.78
			b			0.00	14.54	5.79	12,169	6760		13.98	5.93
			c			0.00	00.00	0.00	14,665	8147			
		-¾ to +½	a	26,136	18.7	2.66	14.46	5.79	11,773	6540	76.6	13.84	5.78
			b			0.00	14.86	5.95	12,095	6719		14.23	5.94
			c			0.00	00.00	0.00	14,623	8124			
		-½ to +⅜	a	4,507	3.2	2.70	13.56	4.99	11,923	6624	79.8	13.83	5.75
			b			0.00	13.94	5.13	12,254	6808		14.21	5.91
			c			0.00	00.00	0.00	14,610	8117			
		-⅜ to +¼	a	10,600	7.6	2.65	14.73	5.44	11,770	6539	87.4	13.91	5.72
			b			0.00	15.13	5.59	12,090	6716		14.29	5.87
			c			0.00	00.00	0.00	14,656	8142			
		-¼ to +⅛	a	7,313	5.3	2.71	14.83	5.01	11,677	6487	92.7	13.96	5.68
			b			0.00	15.24	5.15	12,002	6667		14.35	5.84
			c			0.00	00.00	0.00	14,552	8084			
		-⅛ inches to +28 mesh	a	6,604	4.7	2.65	16.27	5.04	11,411	6339	97.4	14.07	5.65
			b			0.00	16.71	5.18	11,722	6512		14.46	5.80
			c			0.00	00.00	0.00	14,491	8050			
		-28 mesh to 0	a	3,656	2.6	2.94	21.06	5.28	10,518	5843	100.0	14.26	5.64
			b			0.00	21.70	5.44	10,836	6020		14.65	5.79
			c			0.00	00.00	0.00	14,359	7977			
Total or average			a	139,569	100.0	2.59	14.26	5.64	11,823	6568			
			b			0.00	14.65	5.79	12,137	6743			
			c			0.00	00.00	0.00	14,628	8127			
Head sample** (10 per cent by wt. from each screen size)			a	13,957	10.0	2.65	14.18	5.72	11,854	6585			
			b			0.00	14.57	5.88	12,177	6764			
			c			0.00	00.00	0.00	14,664	8147			

* Condition a refers to the air-dry sample; condition b refers to the moisture-free sample; condition c refers to the mineral matter-free sample.

** Mineral CO_2 content in the head sample: 0.13 per cent

Table X – Elementary and computed cumulative float-and-sink tests data of a coal sample (Ref-No. 12/243A) from Janes Coal Sales, Inc. strip mine in Bristol Township, Morgan County, Ohio. Screen size: -¾ to +½ inch.

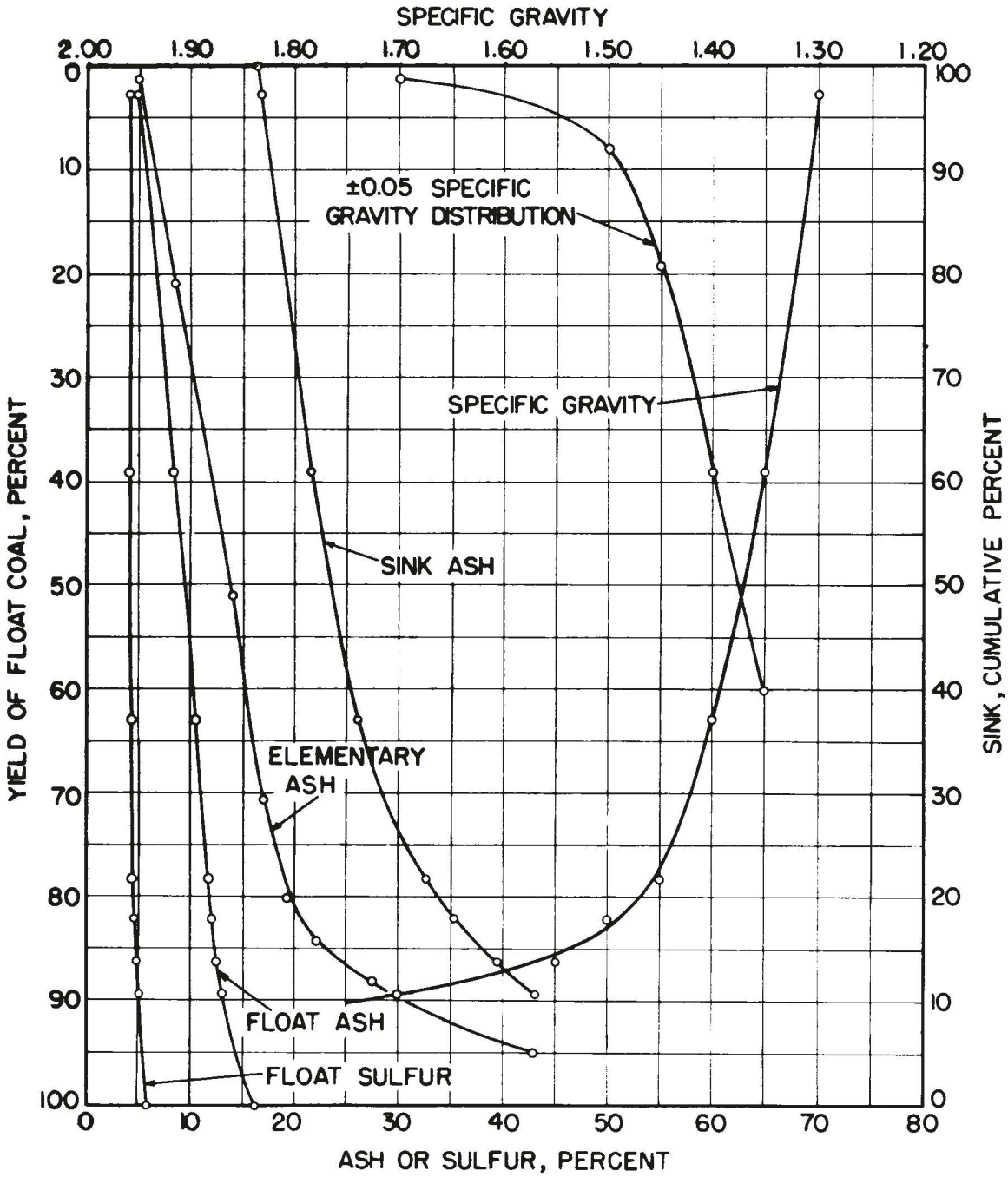
Specific gravity fractions	Elementary data		Computed cumulative data	
	Weight (gm.)	Weight (%)	Float cumulative (%)	Sink cumulative (%)
Float – 1.28	36	0.2	0.2	100.0
1.28 – 1.29	346	1.5	1.7	99.8
1.29 – 1.30	1159	4.9	6.6	98.3
1.30 – 1.31	1369	5.8	12.4	93.4
1.31 – 1.32	1899	8.1	20.5	87.6
1.32 – 1.33	2207	9.4	29.9	79.5
1.33 – 1.34	2101	8.9	38.8	70.1
1.34 – 1.35	1961	8.3	47.1	61.2
1.35 – 1.36	1544	6.6	53.7	52.9
1.36 – 1.37	1479	6.3	60.0	46.3
1.37 – 1.38	1169	5.0	65.0	40.0
1.38 – 1.39	1185	5.0	70.0	35.0
1.39 – 1.40	769	3.3	73.3	30.0
1.40 – 1.41	696	3.0	76.3	26.7
1.41 – 1.42	496	2.1	78.4	23.7
1.42 – 1.43	455	1.9	80.3	21.6
1.43 – 1.44	382	1.6	81.9	19.7
1.44 – 1.45	365	1.5	83.4	18.1
1.45 – 1.50	1114	4.7	88.1	16.6
1.50 – 1.55	723	3.1	91.2	11.9
1.55 – 1.60	391	1.7	92.9	8.8
1.60 – 1.65	234	1.0	93.9	7.1
1.65 – 1.70	226	1.0	94.9	6.1
Sink – 1.70	1194	5.1	100.0	5.1
Total	23,500	100.0		



Weight, Percent	
Elementary	Cumulative
0.2	0.2
1.5	1.7
4.9	6.6
5.8	12.4
8.1	20.5
9.4	29.9
8.9	38.8
8.3	47.1
6.6	53.7
6.3	60.0
5.0	65.0
5.0	70.0
3.3	73.3
3.0	76.3
2.1	78.4
1.9	80.3
1.6	81.9
1.5	83.4
Average 0.94	88.1
Average 0.62	91.2
Average 0.34	92.9
Average 0.20	93.9
Average 0.20	94.9

DATA SHEET 21.—FLOAT AND SINK TESTS DATA SHEET SHOWING YIELD OF FLOAT COAL USING SPECIFIC GRAVITY SEPARATION INTERVAL 0.01. COAL SAMPLE FROM JANES COAL SALES, INC. STRIP MINE IN BRISTOL TWP., MORGAN CO., OHIO. SCREEN SIZE: $-\frac{3}{4}$" to $+\frac{1}{2}$".

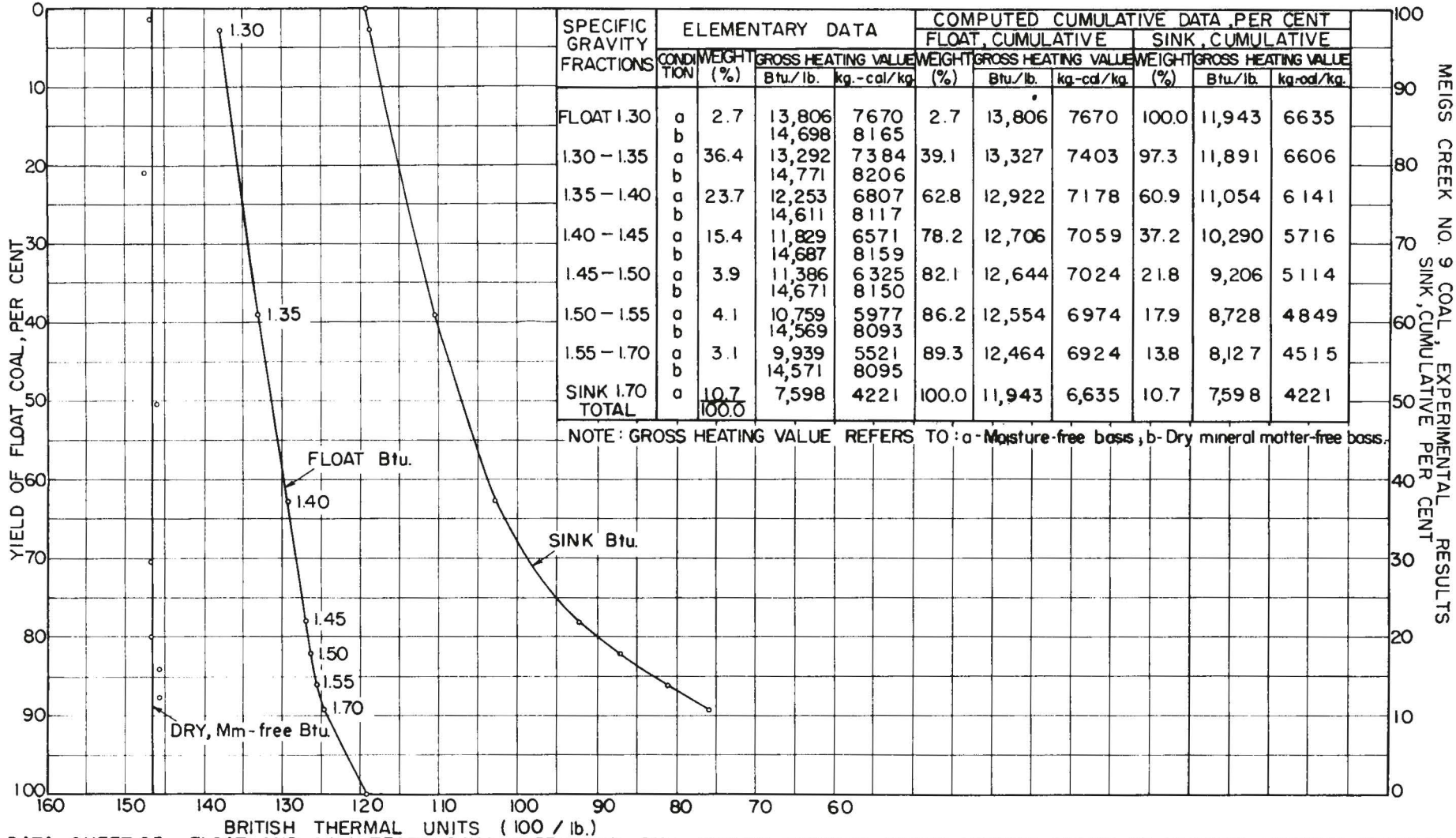
MEIGS CREEK NO.9 COAL, EXPERIMENTAL RESULTS



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	206	2.7	2.79	4.83	4.05	2.7	4.83	4.05	100.0	16.26	5.83	
1.30 - 1.35	2835	36.4	2.56	8.50	4.19	39.1	8.25	4.18	97.3	16.58	5.88	60.1
1.35 - 1.40	1843	23.7	2.09	14.04	4.63	62.8	10.43	4.35	60.9	21.40	6.89	39.1
1.40 - 1.45	1195	15.4	2.11	17.01	5.47	78.2	11.73	4.57	37.2	26.10	8.33	19.3
1.45 - 1.50	306	3.9	2.11	19.20	7.52	82.1	12.08	4.71	21.8	32.51	10.35	8.0
1.50 - 1.55	318	4.1	1.97	22.07	8.91	86.2	12.56	4.91	17.9	35.43	10.97	5.4
1.55 - 1.70	243	3.1	2.21	27.50	10.11	89.3	13.08	5.09	13.8	39.37	11.58	1.2
Sink 1.70	834	10.7	2.03	42.81	12.02	100.0	16.26	5.83	10.7	42.81	12.02	
Totals	7780	100.0										

* Moisture-free basis.

DATA SHEET 22. - Float-and-sink tests data sheet and washability curves; coal sample from Janes Coal Sales, Inc., strip mine in Bristol Township, Morgan County, Ohio. Screen size: -2 to +1½ inches.



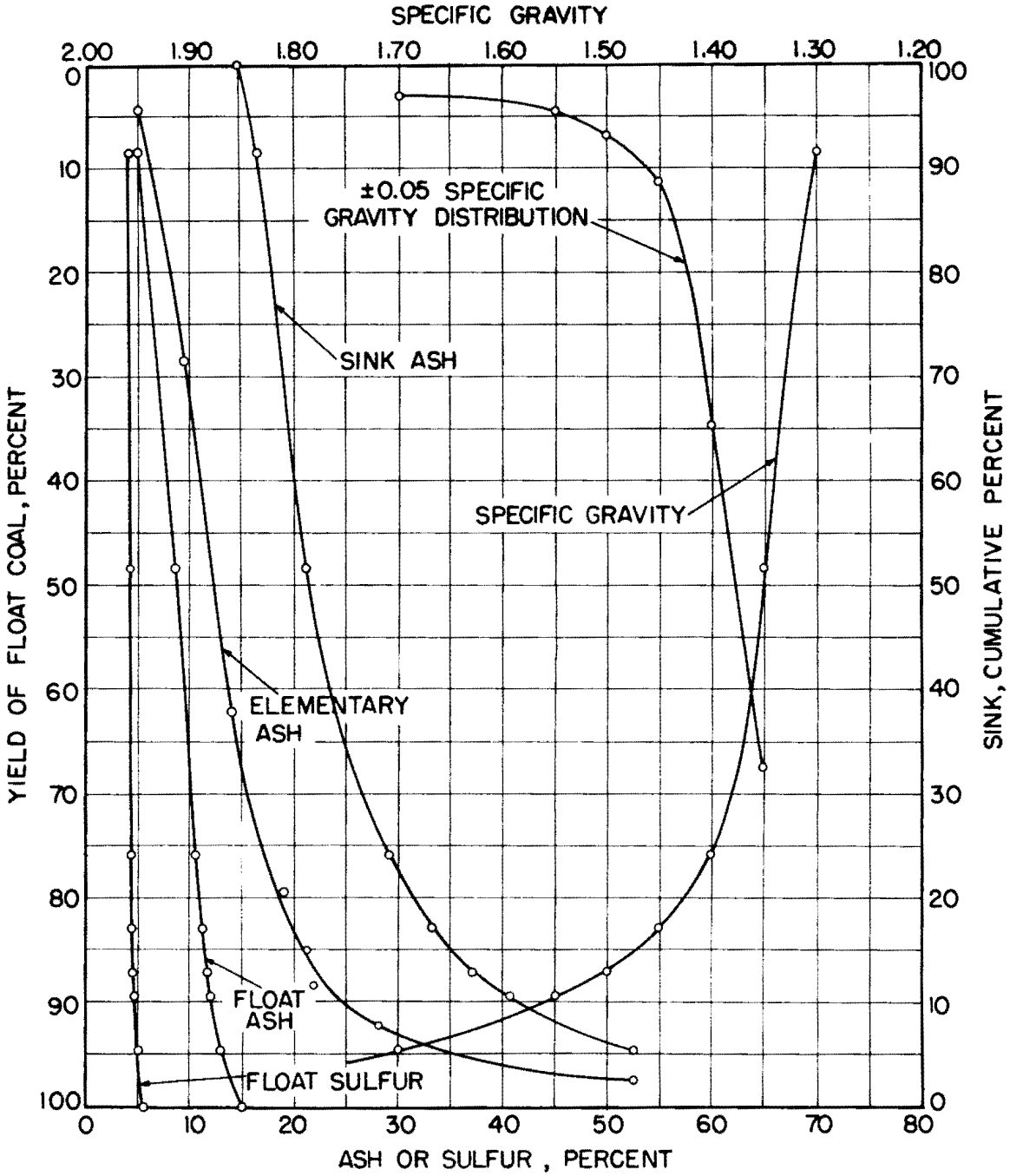
SPECIFIC GRAVITY FRACTIONS	ELEMENTARY DATA				COMPUTED CUMULATIVE DATA, PER CENT					
					FLOAT, CUMULATIVE			SINK, CUMULATIVE		
	CONDITION	WEIGHT (%)	GROSS HEATING VALUE		WEIGHT (%)	GROSS HEATING VALUE		WEIGHT (%)	GROSS HEATING VALUE	
			Btu./lb.	kg.-cal/kg.		Btu./lb.	kg.-cal/kg.		Btu./lb.	kg.-cal/kg.
FLOAT 1.30	a	2.7	13,806	7670	2.7	13,806	7670	100.0	11,943	6635
	b		14,698	8165						
1.30 – 1.35	a	36.4	13,292	7384	39.1	13,327	7403	97.3	11,891	6606
	b		14,771	8206						
1.35 – 1.40	a	23.7	12,253	6807	62.8	12,922	7178	60.9	11,054	6141
	b		14,611	8117						
1.40 – 1.45	a	15.4	11,829	6571	78.2	12,706	7059	37.2	10,290	5716
	b		14,687	8159						
1.45 – 1.50	a	3.9	11,386	6325	82.1	12,644	7024	21.8	9,206	5114
	b		14,671	8150						
1.50 – 1.55	a	4.1	10,759	5977	86.2	12,554	6974	17.9	8,728	4849
	b		14,569	8093						
1.55 – 1.70	a	3.1	9,939	5521	89.3	12,464	6924	13.8	8,127	4515
	b		14,571	8095						
SINK 1.70	a	10.7	7,598	4221	100.0	11,943	6,635	10.7	7,598	4221
TOTAL		100.0								

NOTE: GROSS HEATING VALUE REFERS TO: a - Moisture-free basis, b - Dry mineral matter-free basis.

MEIGS CREEK NO. 9 COAL, EXPERIMENTAL RESULTS

DATA SHEET 23. – FLOAT AND SINK TESTS DATA SHEET AND B.T.U. CURVES SHOWING GROSS HEATING VALUE OF VARIOUS SPECIFIC GRAVITY FRACTIONS; COAL SAMPLE FROM JANES COAL SALES INC. STRIP MINE IN BRISTOL TWP., MORGAN CO., OHIO. SCREEN SIZE: -2" to +1 1/2"

MEIGS CREEK NO.9 COAL , EXPERIMENTAL RESULTS

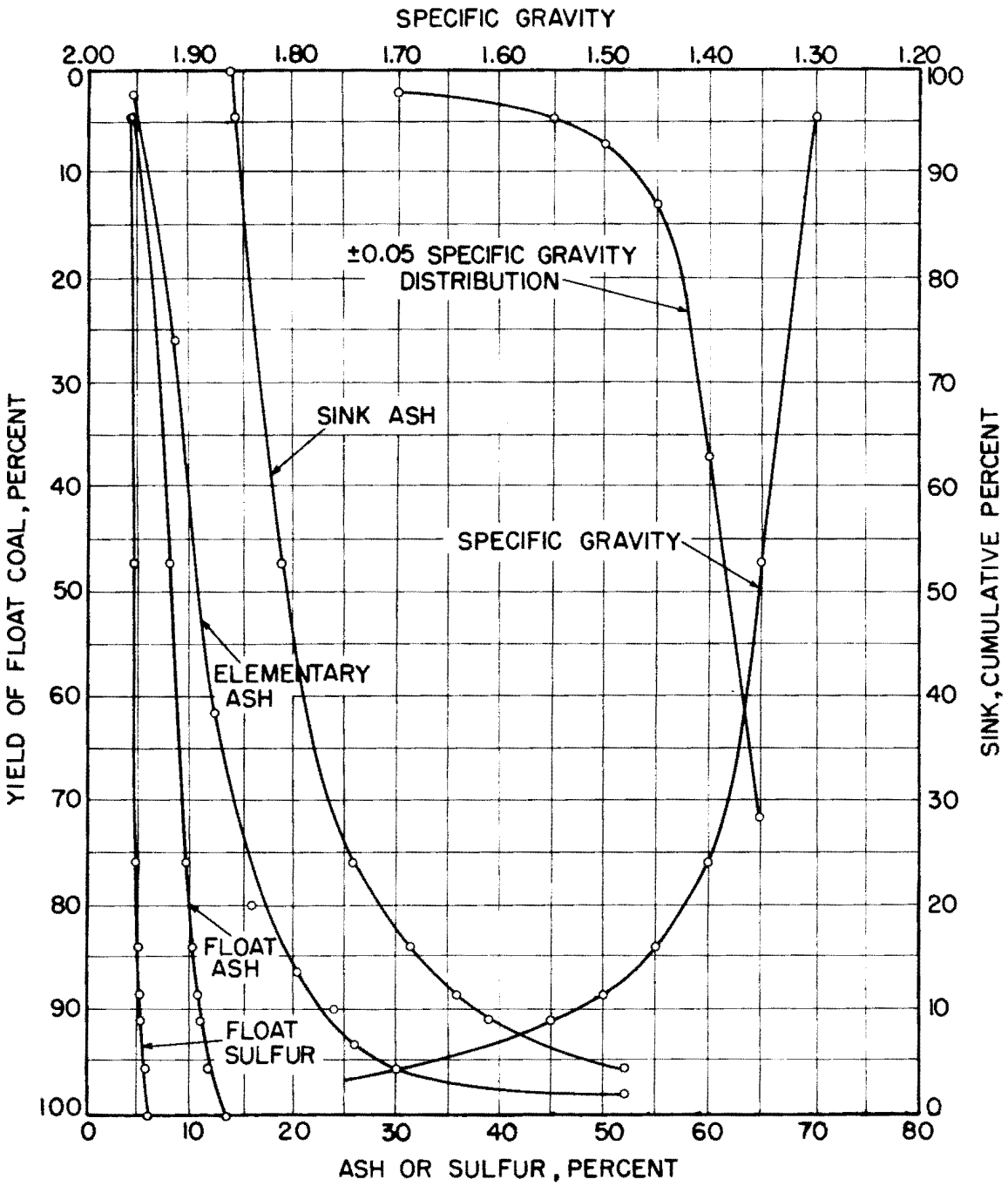


Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	1324	8.4	2.45	4.97	4.02	8.4	4.97	4.02	100.0	15.01	5.51	
1.30 - 1.35	6279	39.8	2.41	9.24	4.07	48.2	8.50	4.06	91.6	16.29	5.65	67.4
1.35 - 1.40	4363	27.6	1.93	13.99	4.57	75.8	10.50	4.25	51.8	21.07	6.86	34.5
1.40 - 1.45	1089	6.9	1.82	19.09	6.25	82.7	11.21	4.41	24.2	29.14	9.46	11.2
1.45 - 1.50	681	4.3	2.03	21.19	6.13	87.0	11.71	4.50	17.3	33.18	10.77	6.7
1.50 - 1.55	381	2.4	1.77	21.91	10.53	89.4	11.98	4.66	13.0	37.09	12.27	4.3
1.55 - 1.70	815	5.2	1.67	28.11	10.29	94.6	12.87	4.97	10.6	40.56	12.68	2.8
Sink 1.70	856	5.4	1.57	52.59	14.96	100.0	15.01	5.51	5.4	52.59	14.96	
Totals	15,788	100.0										

* Moisture-free basis.

DATA SHEET 24. - Float-and-sink tests data sheet and washability curves; coal sample from Janes Coal Sales, Inc. strip mine in Bristol Township, Morgan County, Ohio. Screen size: -$1\frac{1}{2}$ to +$1\frac{1}{4}$ inches.

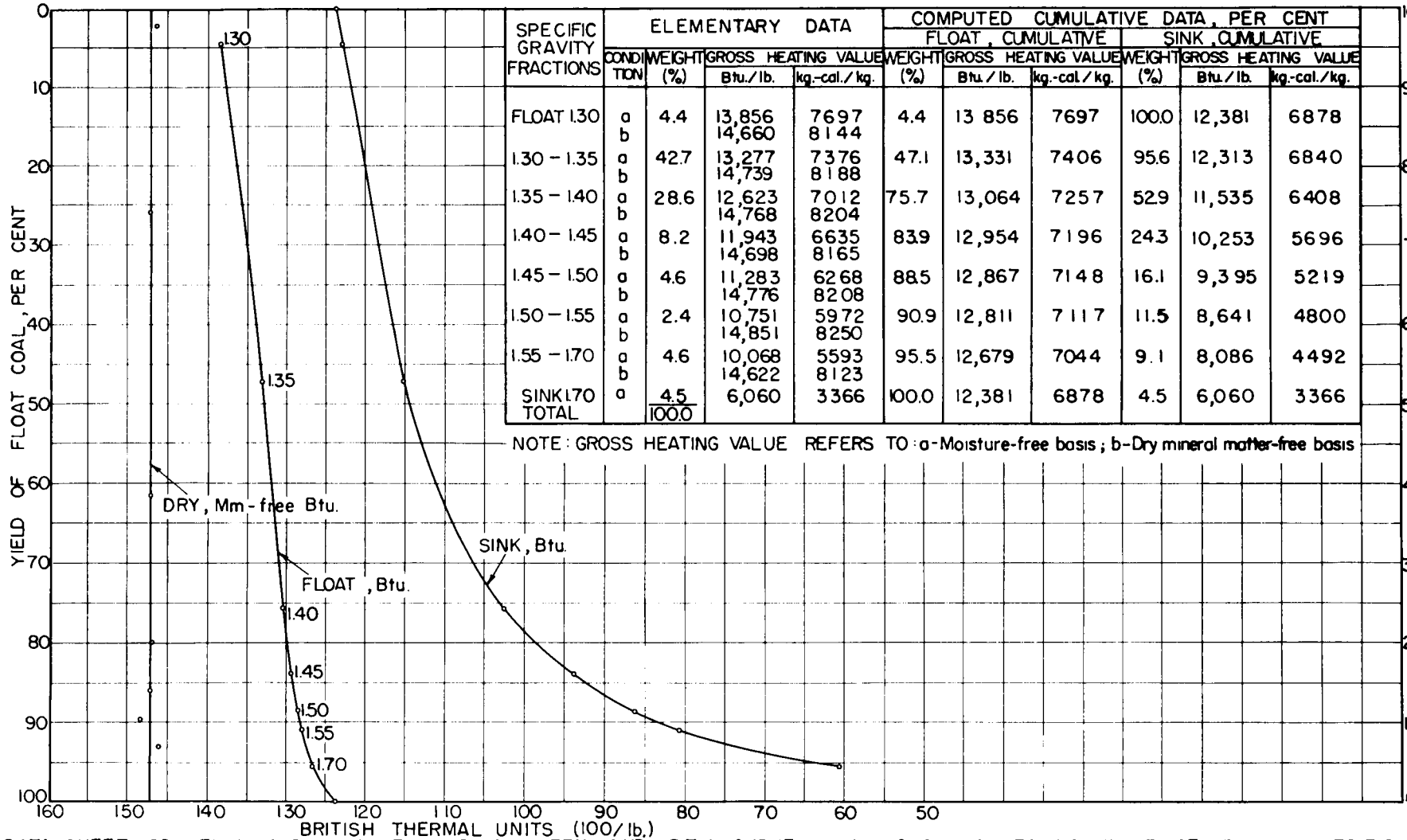
MEIGS CREEK NO.9 COAL, EXPERIMENTAL RESULTS



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	1,340	4.4	2.32	4.30	4.21	4.4	4.30	4.21	100.0	13.63	5.98	
1.30 - 1.35	12,927	42.7	2.27	8.29	4.53	47.1	7.92	4.50	95.6	14.06	6.06	71.3
1.35 - 1.40	8,675	28.6	2.06	12.41	5.29	75.7	9.61	4.80	52.9	18.71	7.30	36.8
1.40 - 1.45	2,469	8.2	1.96	15.99	6.99	83.9	10.24	5.01	24.3	26.15	9.66	12.8
1.45 - 1.50	1,395	4.6	1.90	20.30	8.10	88.5	10.76	5.17	16.1	31.30	11.03	7.0
1.50 - 1.55	731	2.4	1.85	23.96	8.13	90.9	11.11	5.25	11.5	35.72	12.21	4.5
1.55 - 1.70	1,384	4.6	1.77	25.85	11.14	95.5	11.82	5.53	9.1	38.80	13.27	2.0
Sink 1.70	1,368	4.5	1.90	51.94	15.50	100.0	13.63	5.98	4.5	51.94	15.50	
Totals	30,289	100.0										

* Moisture-free basis.

DATA SHEET 25. - Float-and-sink tests data sheet and washability curves; coal sample from Janes Coal Sales, Inc. strip mine in Bristol Township, Morgan County, Ohio. Screen size: -1¼ to + 1 inches.

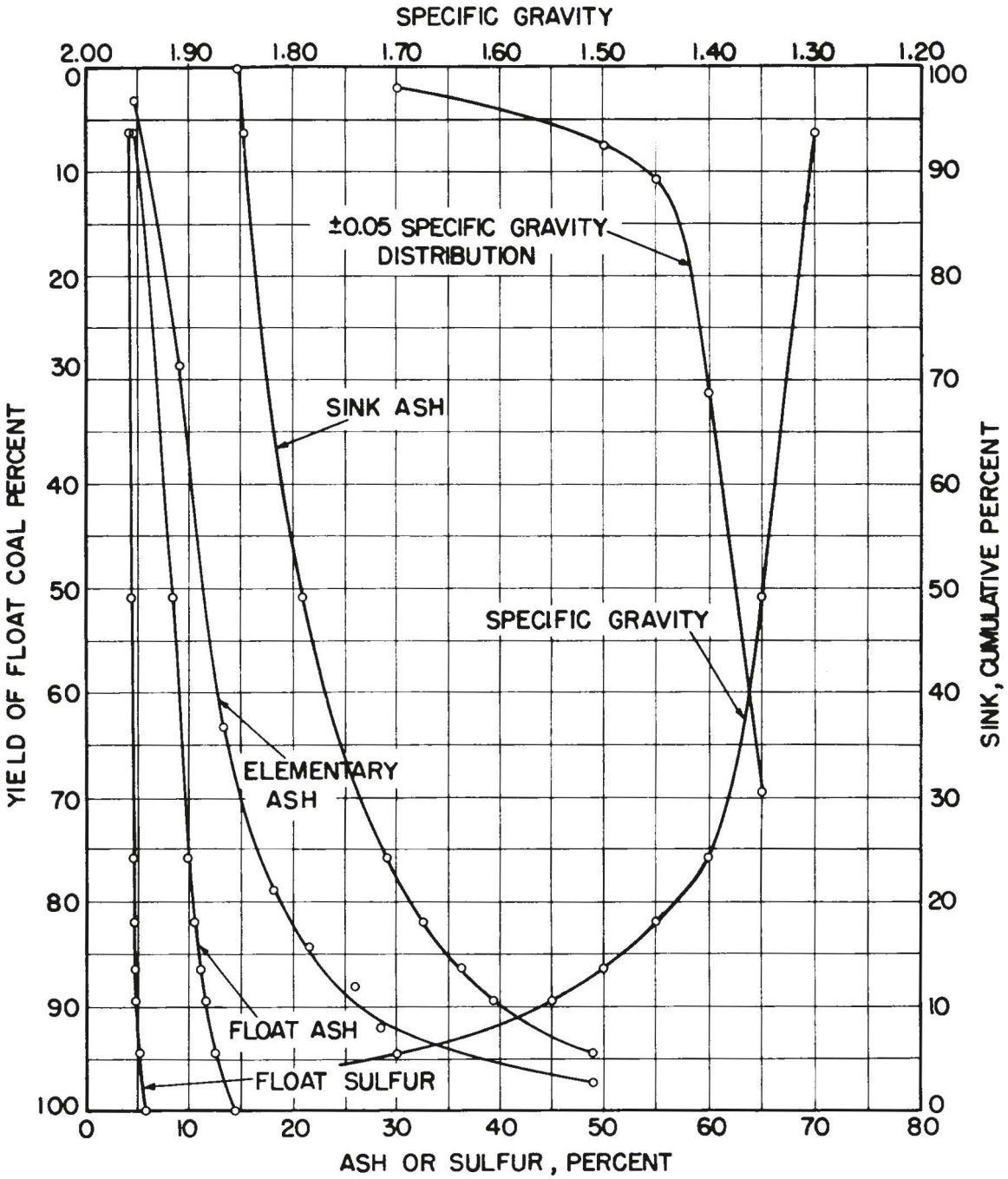


SPECIFIC GRAVITY FRACTIONS	ELEMENTARY DATA				COMPUTED CUMULATIVE DATA, PER CENT					
					FLOAT, CUMULATIVE			SINK, CUMULATIVE		
	CONDITION	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.
FLOAT 1.30	a	4.4	13,856	7697	4.4	13 856	7697	100.0	12,381	6878
	b		14,660	8144						
1.30 – 1.35	a	42.7	13,277	7376	47.1	13,331	7406	95.6	12,313	6840
	b		14,739	8188						
1.35 – 1.40	a	28.6	12,623	7012	75.7	13,064	7257	52.9	11,535	6408
	b		14,768	8204						
1.40 – 1.45	a	8.2	11,943	6635	83.9	12,954	7196	24.3	10,253	5696
	b		14,698	8165						
1.45 – 1.50	a	4.6	11,283	6268	88.5	12,867	7148	16.1	9,395	5219
	b		14,776	8208						
1.50 – 1.55	a	2.4	10,751	5972	90.9	12,811	7117	11.5	8,641	4800
	b		14,851	8250						
1.55 – 1.70	a	4.6	10,068	5593	95.5	12,679	7044	9.1	8,086	4492
	b		14,622	8123						
SINK 1.70	a	4.5	6,060	3366	100.0	12,381	6878	4.5	6,060	3366
TOTAL		100.0								

NOTE: GROSS HEATING VALUE REFERS TO: a-Moisture-free basis; b-Dry mineral matter-free basis

DATA SHEET 26. – FLOAT AND SINK TESTS DATA SHEET AND B.T.U. CURVES SHOWING GROSS HEATING VALUE OF VARIOUS SPECIFIC GRAVITY FRACTIONS; COAL SAMPLE FROM JANES COAL SALES INC. STRIP MINE IN BRISTOL TWP., MORGAN CO., OHIO. SCREEN SIZE: $-1\frac{1}{4}$" to +1".

MEIGS CREEK NO.9 COAL, EXPERIMENTAL RESULTS

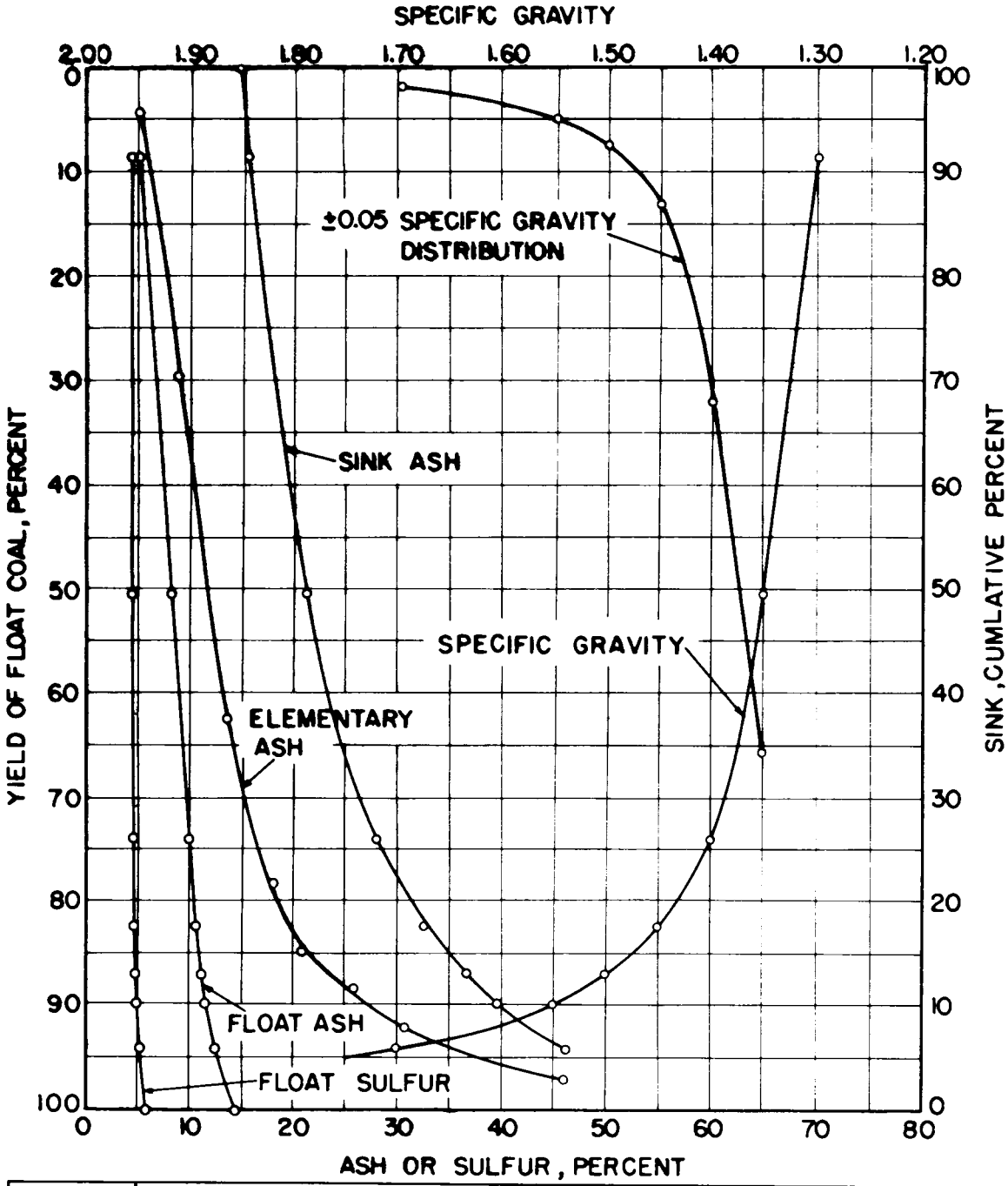


Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	2,068	6.3	2.53	4.49	4.08	6.3	4.49	4.08	100.0	14.48	5.72	
1.30 - 1.35	14,572	44.4	2.54	8.87	4.34	50.7	8.33	4.31	93.7	15.15	5.83	69.4
1.35 - 1.40	8,209	25.0	2.45	13.12	4.96	75.7	9.91	4.52	49.3	20.80	7.17	31.3
1.40 - 1.45	2,070	6.3	2.42	18.04	5.66	82.0	10.53	4.61	24.3	28.72	9.46	10.8
1.45 - 1.50	1,487	4.5	2.17	21.49	6.74	86.5	11.10	4.72	18.0	32.47	10.78	7.6
1.50 - 1.55	1,016	3.1	2.10	25.79	7.36	89.6	11.61	4.81	13.5	36.14	12.13	5.3
1.55 - 1.70	1,612	4.9	2.18	28.37	11.15	94.5	12.48	5.14	10.4	39.21	13.56	2.0
Sink 1.70	1,786	5.5	1.91	48.86	15.56	100.0	14.48	5.72	5.5	48.86	15.56	
Totals	32,820	100.0										

* Moisture-free basis.

DATA SHEET 27. - Float-and-sink tests data sheet and washability curves; coal sample from Janes Coal Sales, Inc. strip mine in Bristol Township, Morgan County, Ohio. Screen size: -1 to +3/4 inches.

MEIGS CREEK NO.9 COAL, EXPERIMENTAL RESULTS

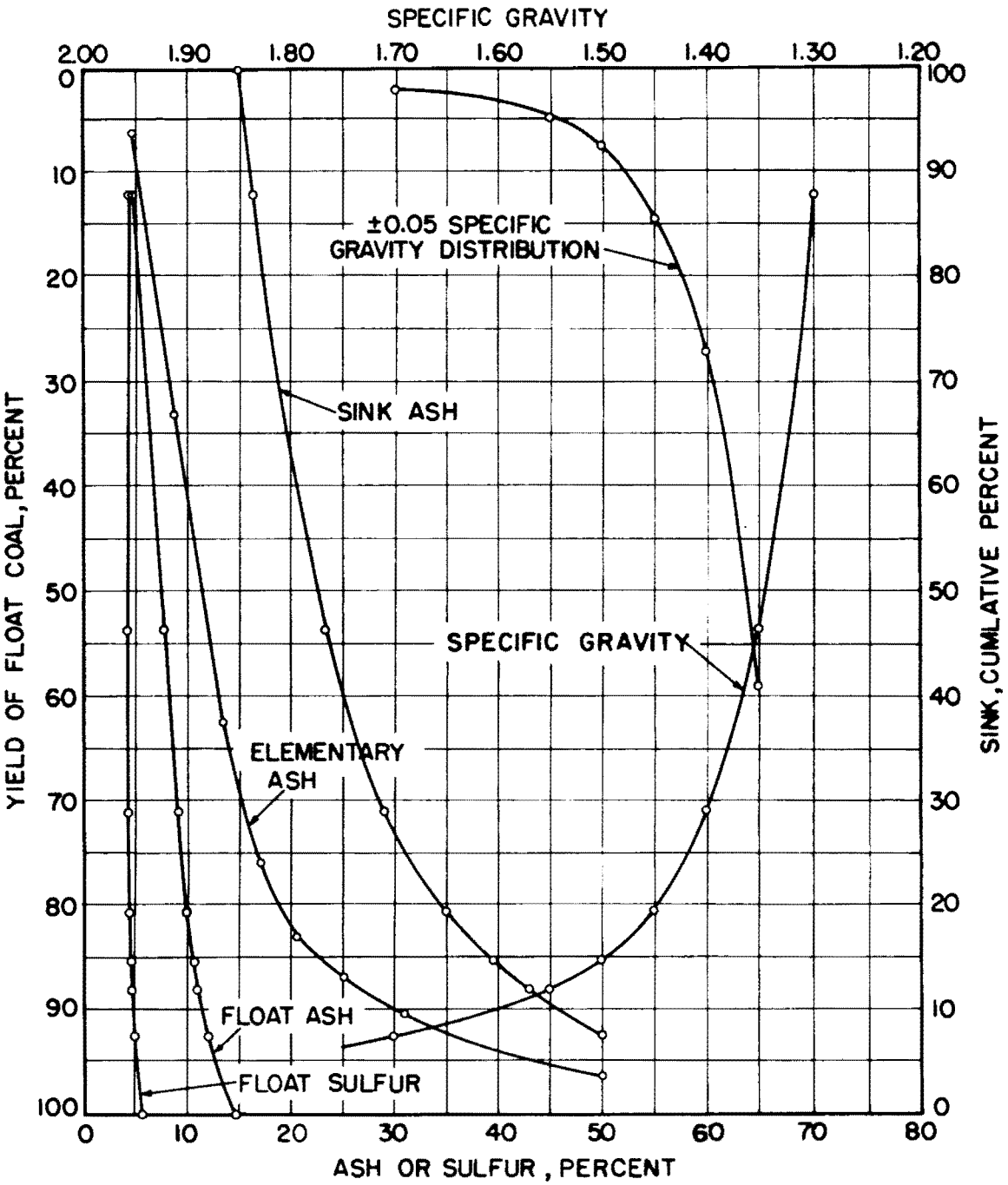


Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	4,111	8.6	2.74	4.89	4.10	8.6	4.89	4.10	100.0	14.49	5.86	
1.30 - 1.35	20,015	41.9	2.70	8.72	4.38	50.5	8.07	4.33	91.4	15.38	6.03	65.4
1.35 - 1.40	11,198	23.5	2.14	13.52	4.86	74.0	9.80	4.50	49.5	21.04	7.42	31.9
1.40 - 1.45	3,998	8.4	2.13	18.08	5.62	82.4	10.64	4.61	26.0	27.84	9.73	13.0
1.45 - 1.50	2,218	4.6	1.86	20.80	7.40	87.0	11.18	4.76	17.6	32.52	11.71	7.4
1.50 - 1.55	1,357	2.8	1.87	25.83	9.16	89.8	11.64	4.90	13.0	36.64	13.22	4.8
1.55 - 1.70	2,051	4.3	1.96	30.68	11.95	94.1	12.51	5.22	10.2	39.58	14.31	1.7
Sink 1.70	2,816	5.9	1.83	46.15	16.01	100.0	14.49	5.86	5.9	46.15	16.01	
Totals	47,764	100.0										

* Moisture-free basis.

DATA SHEET 28. - Float-and-sink tests data sheet and washability curves; coal sample from Janes Coal Sales, Inc. strip mine in Bristol Township, Morgan County, Ohio. Screen Size: -3/4 to +1/2 inches.

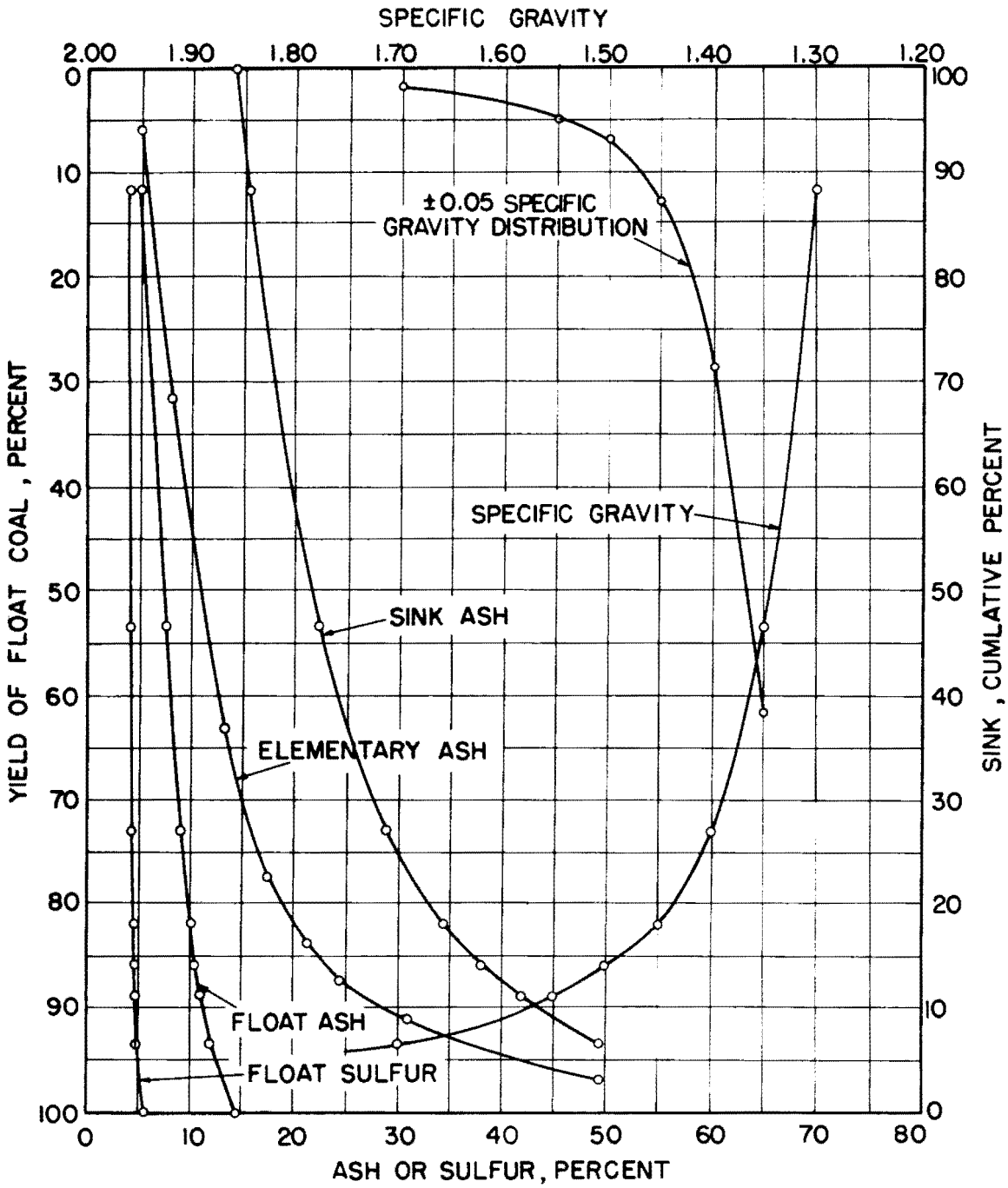
MEIGS CREEK NO.9 COAL, EXPERIMENTAL RESULTS



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	2182	12.1	2.26	4.79	4.18	12.1	4.79	4.18	100.0	14.91	5.80	
1.30 - 1.35	7541	41.6	2.52	8.63	4.40	53.7	7.76	4.35	87.9	16.30	6.02	59.0
1.35 - 1.40	3147	17.4	2.79	13.50	4.75	71.1	9.17	4.45	46.3	23.20	7.48	27.0
1.40 - 1.45	1738	9.6	2.77	17.11	5.55	80.7	10.11	4.58	28.9	29.03	9.12	14.3
1.45 - 1.50	853	4.7	2.58	20.57	7.09	85.4	10.69	4.72	19.3	34.98	10.90	7.4
1.50 - 1.55	497	2.7	2.62	25.04	7.32	88.1	11.13	4.80	14.6	39.59	12.12	4.9
1.55 - 1.70	815	4.5	2.83	30.96	8.82	92.6	12.09	4.99	11.9	42.89	13.20	2.0
Sink 1.70	1344	7.4	2.50	50.11	15.89	100.0	14.91	5.80	7.4	50.11	15.89	
Totals	18,117	100.0										

* Moisture-free basis.

DATA SHEET 29. - Float-and-sink tests data sheet and washability curves; coal sample from Janes Coal Sales, Inc. strip mine in Bristol Township, Morgan County, Ohio. Screen size: -1/2 to +3/8 inches.

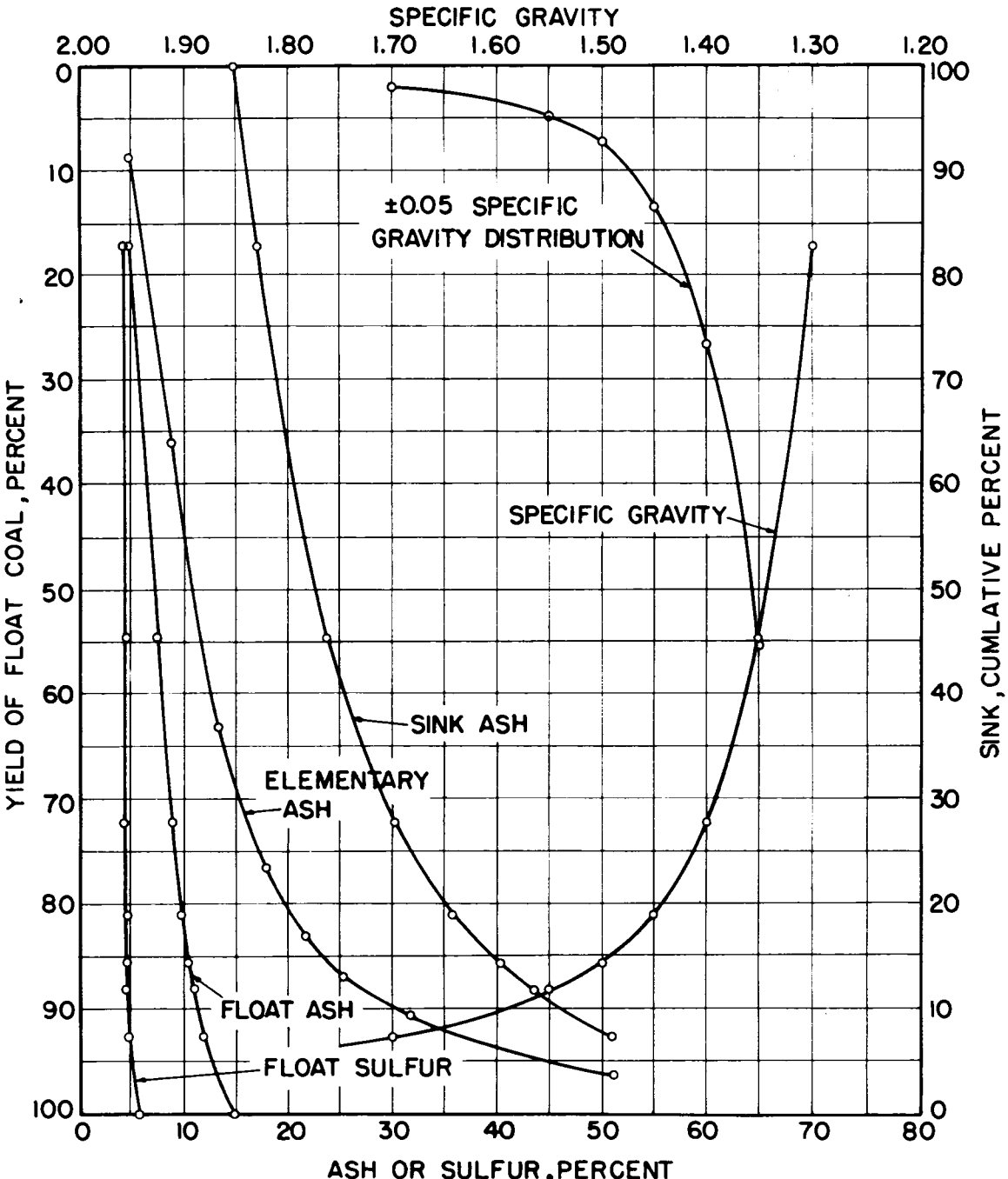


Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	2281	11.6	2.93	5.19	4.16	11.6	5.19	4.16	100.0	14.48	5.76	
1.30 - 1.35	8194	41.8	2.82	8.34	4.35	53.4	7.66	4.31	88.4	15.70	5.97	61.4
1.35 - 1.40	3845	19.6	2.74	13.23	4.82	73.0	9.15	4.45	46.6	22.30	7.42	28.5
1.40 - 1.45	1746	8.9	2.64	17.50	5.61	81.9	10.06	4.57	27.0	28.89	9.30	12.8
1.45 - 1.50	770	3.9	2.82	21.25	6.35	85.8	10.57	4.65	18.1	34.48	11.14	7.8
1.50 - 1.55	599	3.1	2.78	24.39	7.75	88.9	11.05	4.76	14.2	38.11	12.47	4.9
1.55 - 1.70	888	4.5	2.63	30.95	9.01	93.4	12.01	4.97	11.1	41.95	13.77	2.1
Sink 1.70	1297	6.6	2.36	49.44	17.03	100.0	14.48	5.76	6.6	49.44	17.03	
Totals	19,620	100.0										

* Moisture-free basis.

DATA SHEET 30. - Float-and-sink tests data sheet and washability curves; coal sample from Janes Coal Sales, Inc. strip mine in Bristol Township, Morgan County, Ohio. Screen size: -3/8 to +1/4 inches.

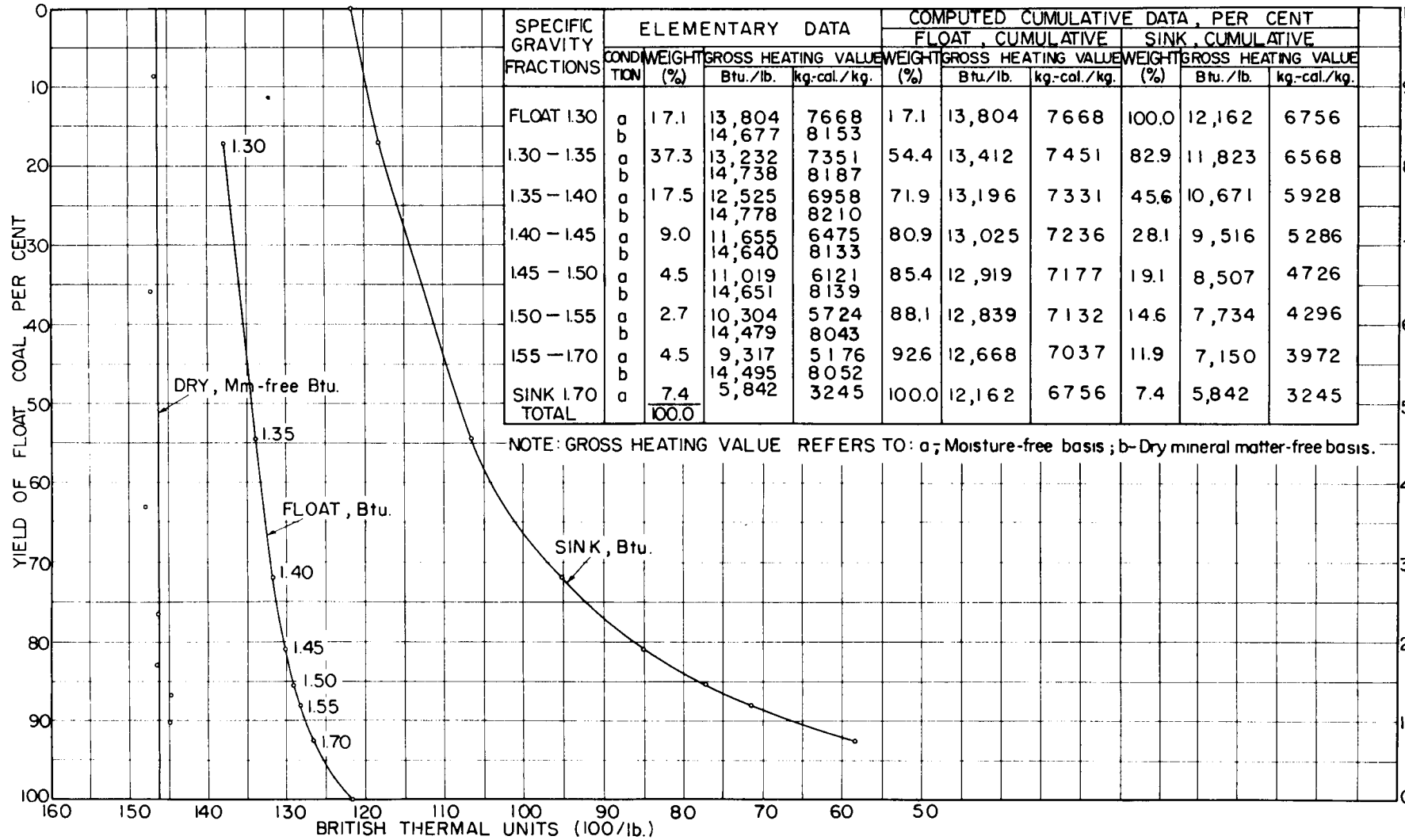
MEIGS CREEK NO. 9 COAL, EXPERIMENTAL RESULTS



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	3386	17.1	2.62	4.76	4.13	17.1	4.76	4.13	100.0	14.79	5.68	
1.30 - 1.35	7410	37.3	2.60	8.59	4.48	54.4	7.39	4.37	82.9	16.86	6.00	54.8
1.35 - 1.40	3464	17.5	2.29	13.17	4.82	71.9	8.79	4.48	45.6	23.62	7.24	26.5
1.40 - 1.45	1781	9.0	2.41	17.82	5.48	80.9	9.80	4.59	28.1	30.14	8.75	13.5
1.45 - 1.50	900	4.5	2.74	21.70	6.44	85.4	10.43	4.69	19.1	35.93	10.30	7.2
1.50 - 1.55	537	2.7	2.77	25.34	7.24	88.1	10.88	4.77	14.6	40.29	11.47	4.9
1.55 - 1.70	892	4.5	3.04	31.53	8.15	92.6	11.89	4.93	11.9	43.74	12.42	2.0
Sink 1.70	1475	7.4	2.57	51.19	15.03	100.0	14.79	5.68	7.4	51.19	15.03	
Totals	19,845	100.0										

* Moisture-free basis.

DATA SHEET 31. - Float-and-sink tests data sheet and washability curves; coal sample from Janes Coal Sales, Inc. strip mine in Bristol Township, Morgan County, Ohio. Screen size: -1/4 to +1/8 inches.



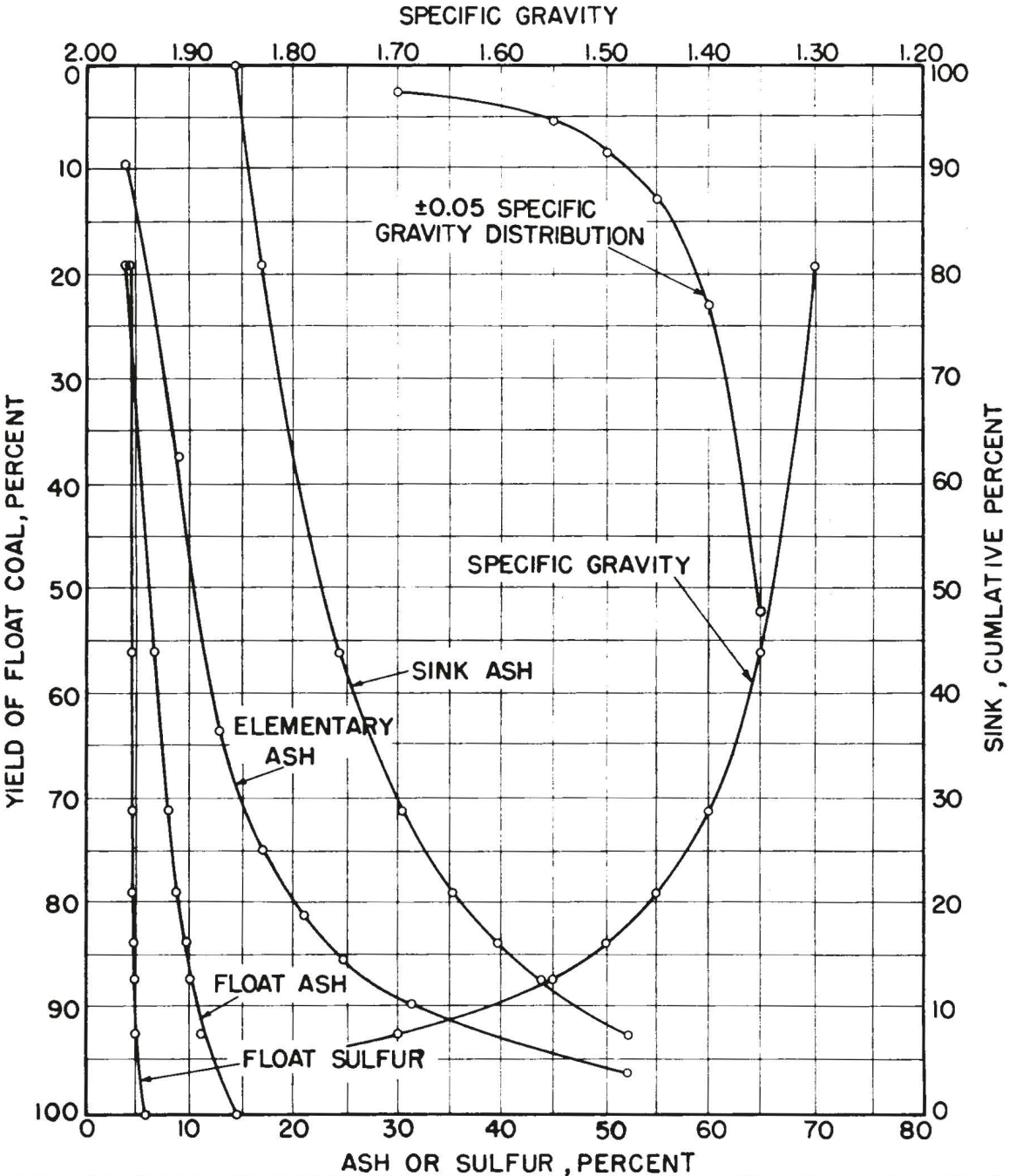
SPECIFIC GRAVITY FRACTIONS	ELEMENTARY DATA				COMPUTED CUMULATIVE DATA, PER CENT					
					FLOAT, CUMULATIVE			SINK, CUMULATIVE		
	CONDITION	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.
FLOAT 1.30	a	17.1	13,804	7668	17.1	13,804	7668	100.0	12,162	6756
	b		14,677	8153						
1.30 – 1.35	a	37.3	13,232	7351	54.4	13,412	7451	82.9	11,823	6568
	b		14,738	8187						
1.35 – 1.40	a	17.5	12,525	6958	71.9	13,196	7331	45.6	10,671	5928
	b		14,778	8210						
1.40 – 1.45	a	9.0	11,655	6475	80.9	13,025	7236	28.1	9,516	5286
	b		14,640	8133						
1.45 – 1.50	a	4.5	11,019	6121	85.4	12,919	7177	19.1	8,507	4726
	b		14,651	8139						
1.50 – 1.55	a	2.7	10,304	5724	88.1	12,839	7132	14.6	7,734	4296
	b		14,479	8043						
1.55 – 1.70	a	4.5	9,317	5176	92.6	12,668	7037	11.9	7,150	3972
	b		14,495	8052						
SINK 1.70	a	7.4	5,842	3245	100.0	12,162	6756	7.4	5,842	3245
TOTAL		100.0								

NOTE: GROSS HEATING VALUE REFERS TO: a-Moisture-free basis; b-Dry mineral matter-free basis.

MEIGS CREEK NO. 9 COAL, EXPERIMENTAL RESULTS

DATA SHEET 32.– FLOAT AND SINK TESTS DATA SHEET AND B.T.U. CURVES SHOWING GROSS HEATING VALUE OF VARIOUS SPECIFIC GRAVITY FRACTIONS; COAL SAMPLE FROM JANES COAL SALES INC. STRIP MINE IN BRISTOL TWP., MORGAN CO., OHIO. SCREEN SIZE: $-\frac{1}{4}$" to $+\frac{1}{8}$".

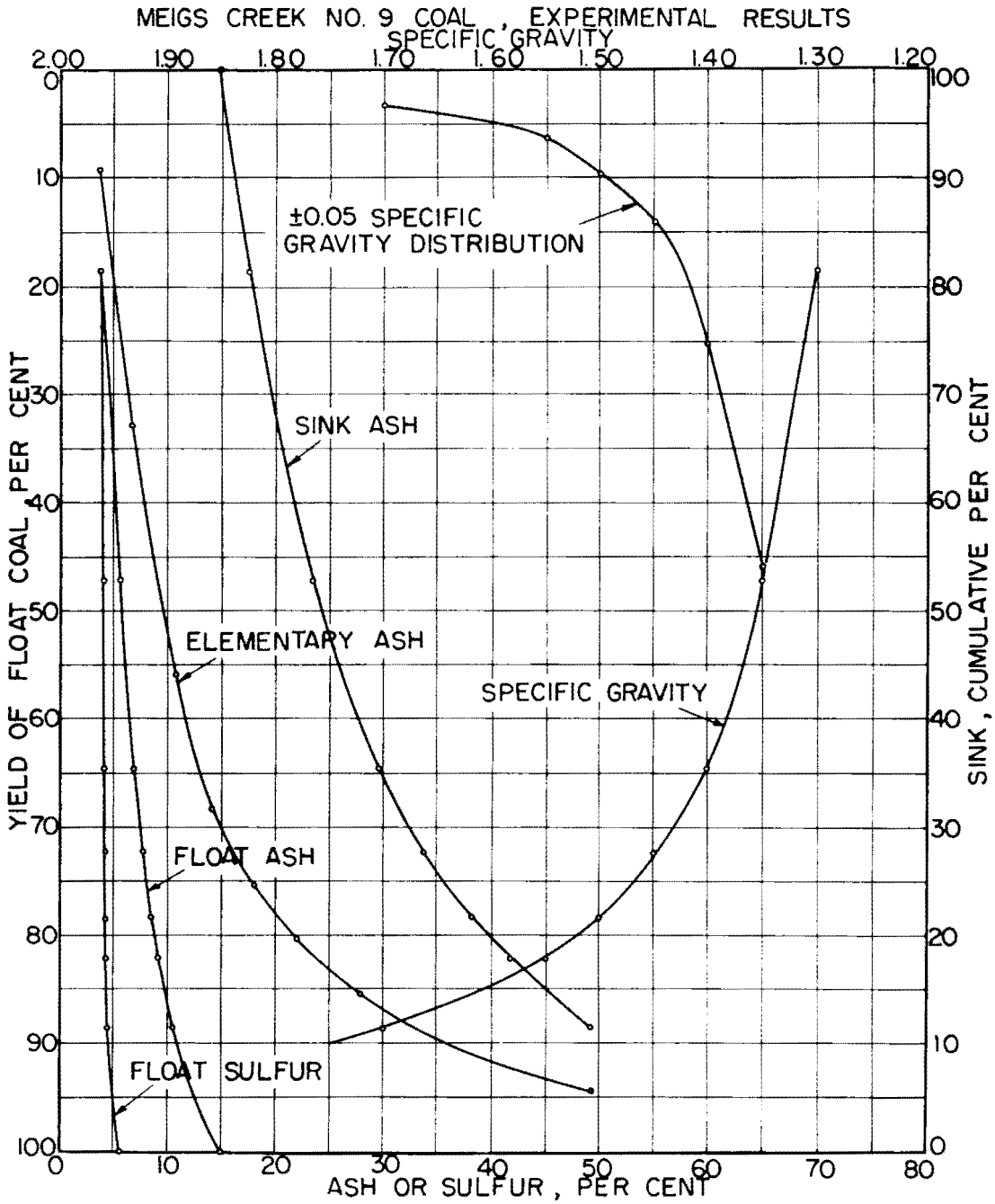
MEIGS CREEK NO.9 COAL, EXPERIMENTAL RESULTS



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	973	19.0	2.93	3.97	4.11	19.0	3.97	4.11	100.0	14.50	5.64	
1.30 - 1.35	1886	36.9	2.83	8.06	4.46	55.9	6.67	4.34	81.0	16.97	6.00	52.0
1.35 - 1.40	775	15.1	2.67	12.74	4.90	71.0	7.96	4.46	44.1	24.43	7.29	22.9
1.40 - 1.45	397	7.8	2.71	17.01	5.40	78.8	8.86	4.55	29.0	30.51	8.53	12.8
1.45 - 1.50	255	5.0	2.30	20.96	5.92	83.8	9.64	4.63	21.2	35.46	9.69	8.3
1.50 - 1.55	169	3.3	2.45	24.68	6.64	87.1	10.15	4.71	16.2	39.64	10.86	5.4
1.55 - 1.70	266	5.2	2.38	31.41	7.61	92.3	11.35	4.87	12.9	43.87	11.92	2.6
Sink 1.70	393	7.7	2.37	52.29	14.83	100.0	14.50	5.64	7.7	52.29	14.83	
Totals	5114	100.0										

* Moisture-free basis.

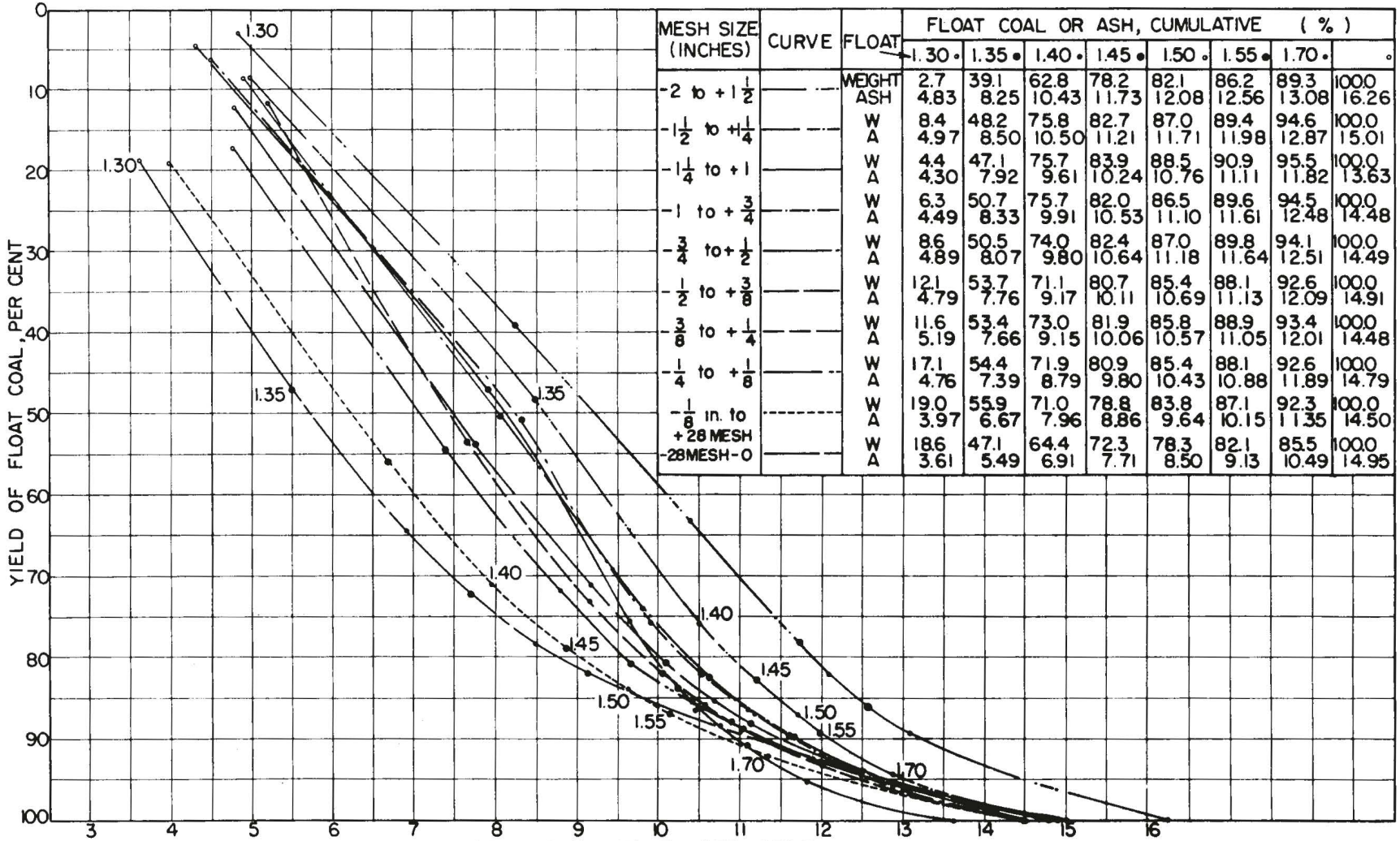
DATA SHEET 33. - Float-and-sink tests data sheet and washability curves; coal sample from Janes Coal Sales, Inc. strip mine in Bristol Township, Morgan County, Ohio. Screen size: -1/8 inches to +28 mesh.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	604	18.6	2.40	3.61	3.91	18.6	3.61	3.91	100.0	14.95	5.56	
1.30 - 1.35	923	28.5	2.36	6.71	4.19	47.1	5.49	4.08	81.4	17.54	5.94	45.8
1.35 - 1.40	559	17.3	2.40	10.80	4.47	64.4	6.91	4.18	52.9	23.37	6.88	25.2
1.40 - 1.45	255	7.9	2.60	14.22	4.78	72.3	7.71	4.25	35.6	29.49	8.06	13.9
1.45 - 1.50	195	6.0	2.84	18.03	4.96	78.3	8.50	4.30	27.7	33.85	8.98	9.8
1.50 - 1.55	124	3.8	3.06	22.10	5.40	82.1	9.13	4.35	21.7	38.22	10.11	6.4
1.55 - 1.70	208	6.4	3.79	27.88	6.04	88.5	10.49	4.48	17.9	41.64	11.11	3.3
Sink 1.70	372	11.5	3.81	49.29	13.91	100.0	14.95	5.56	11.5	49.29	13.91	
Totals	3240	100.0										

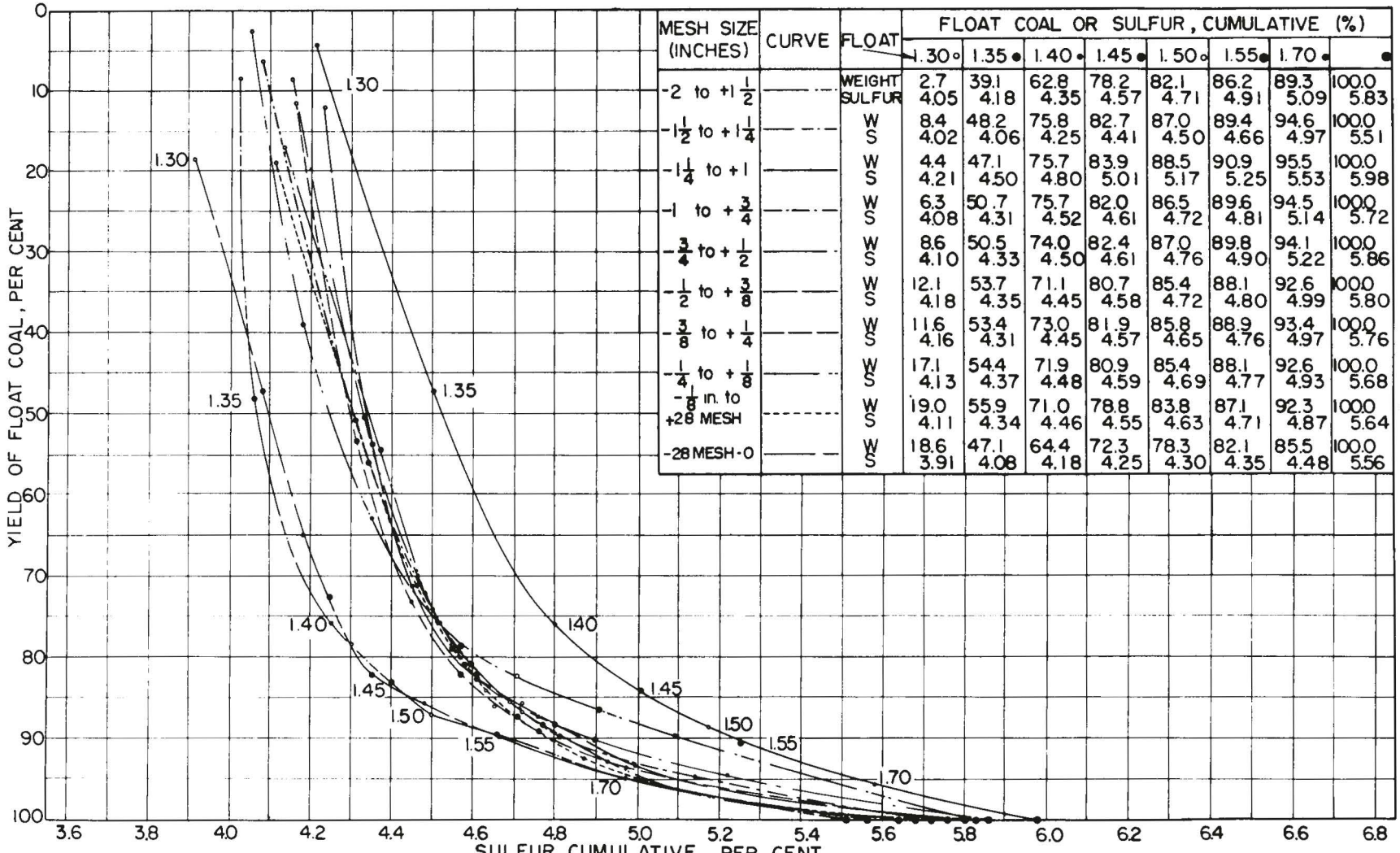
* Moisture-free basis.

DATA SHEET 34. - Float-and-sink tests data sheet and washability curves; coal sample from Janes Coal Sales, Inc., strip mine in Bristol Township, Morgan County, Ohio. Screen size: -28 mesh to 0.



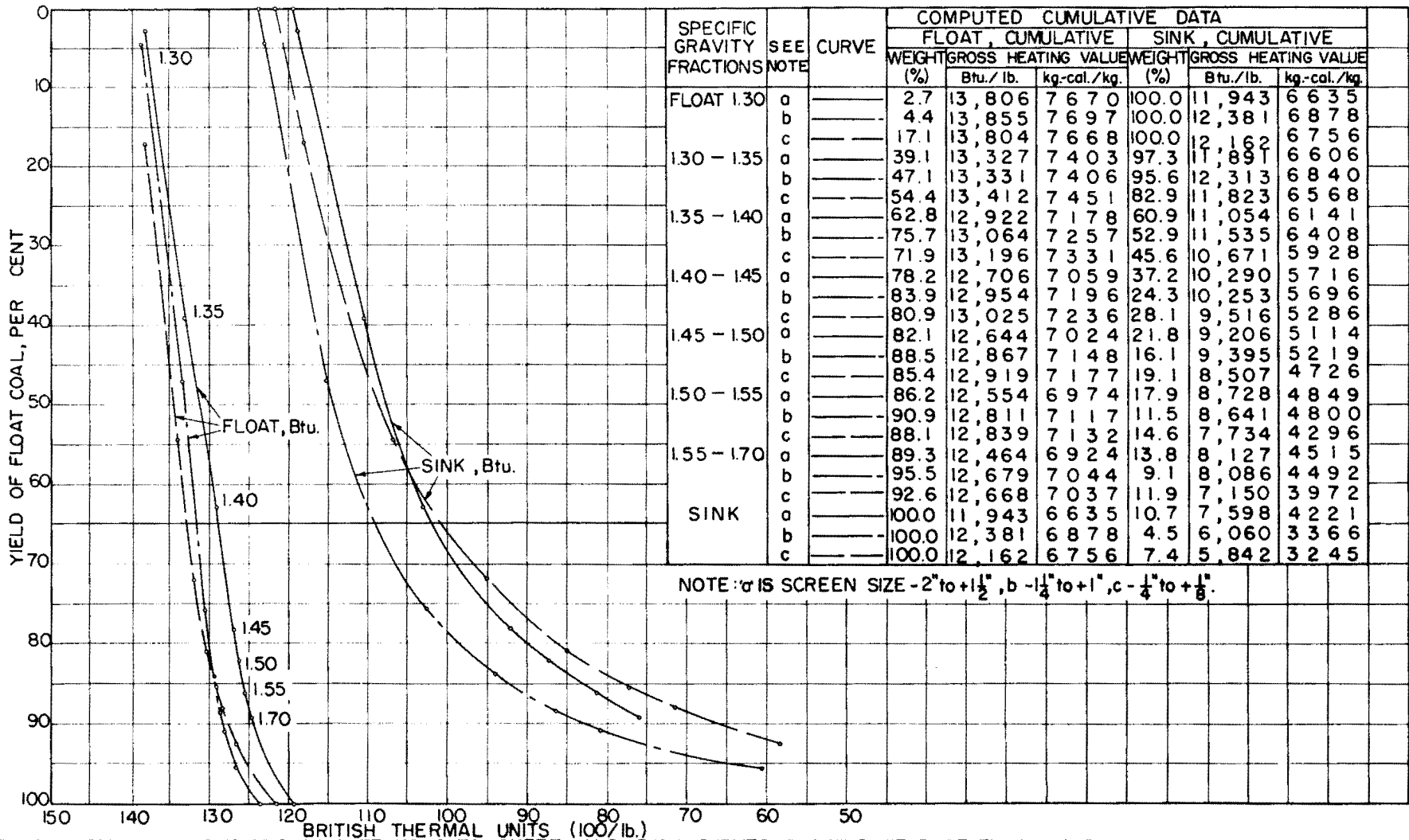
MESH SIZE (INCHES)	CURVE	FLOAT	FLOAT COAL OR ASH, CUMULATIVE (%) 1.30	1.35	1.40	1.45	1.50	1.55	1.70	∘
-2 to +1 1/2		WEIGHT	2.7	39.1	62.8	78.2	82.1	86.2	89.3	100.0
		ASH	4.83	8.25	10.43	11.73	12.08	12.56	13.08	16.26
-1 1/2 to +1 1/4		W	8.4	48.2	75.8	82.7	87.0	89.4	94.6	100.0
		A	4.97	8.50	10.50	11.21	11.71	11.98	12.87	15.01
-1 1/4 to +1		W	4.4	47.1	75.7	83.9	88.5	90.9	95.5	100.0
		A	4.30	7.92	9.61	10.24	10.76	11.11	11.82	13.63
-1 to +3/4		W	6.3	50.7	75.7	82.0	86.5	89.6	94.5	100.0
		A	4.49	8.33	9.91	10.53	11.10	11.61	12.48	14.48
-3/4 to +1/2		W	8.6	50.5	74.0	82.4	87.0	89.8	94.1	100.0
		A	4.89	8.07	9.80	10.64	11.18	11.64	12.51	14.49
-1/2 to +3/8		W	12.1	53.7	71.1	80.7	85.4	88.1	92.6	100.0
		A	4.79	7.76	9.17	10.11	10.69	11.13	12.09	14.91
-3/8 to +1/4		W	11.6	53.4	73.0	81.9	85.8	88.9	93.4	100.0
		A	5.19	7.66	9.15	10.06	10.57	11.05	12.01	14.48
-1/4 to +1/8		W	17.1	54.4	71.9	80.9	85.4	88.1	92.6	100.0
		A	4.76	7.39	8.79	9.80	10.43	10.88	11.89	14.79
-1/8 in. to +28 MESH		W	19.0	55.9	71.0	78.8	83.8	87.1	92.3	100.0
		A	3.97	6.67	7.96	8.86	9.64	10.15	11.35	14.50
-28 MESH-0		W	18.6	47.1	64.4	72.3	78.3	82.1	85.5	100.0
		A	3.61	5.49	6.91	7.71	8.50	9.13	10.49	14.95

DATA SHEET 35.— FLOAT AND SINK TESTS DATA SHEET, AND FLOAT ASH CURVES SHOWING YIELD OF FLOAT COAL VS. CUMULATIVE ASH CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COAL SAMPLE (NO. 12/243 A) FROM JANES COAL SALES INC. STRIP MINE IN BRISTOL TWP., MORGAN CO., OHIO.



MESH SIZE (INCHES)	CURVE	FLOAT	FLOAT COAL OR SULFUR, CUMULATIVE (%)							
			1.30 ○	1.35 ●	1.40 ●	1.45 ●	1.50 ○	1.55 ●	1.70 ●	●
-2 to +1 1/2	—·—	WEIGHT	2.7	39.1	62.8	78.2	82.1	86.2	89.3	100.0
		SULFUR	4.05	4.18	4.35	4.57	4.71	4.91	5.09	5.83
-1 1/2 to +1 1/4	—·—	W	8.4	48.2	75.8	82.7	87.0	89.4	94.6	100.0
		S	4.02	4.06	4.25	4.41	4.50	4.66	4.97	5.51
-1 1/4 to +1	——	W	4.4	47.1	75.7	83.9	88.5	90.9	95.5	100.0
		S	4.21	4.50	4.80	5.01	5.17	5.25	5.53	5.98
-1 to +3/4	—·—·	W	6.3	50.7	75.7	82.0	86.5	89.6	94.5	100.0
		S	4.08	4.31	4.52	4.61	4.72	4.81	5.14	5.72
-3/4 to +1/2	—··	W	8.6	50.5	74.0	82.4	87.0	89.8	94.1	100.0
		S	4.10	4.33	4.50	4.61	4.76	4.90	5.22	5.86
-1/2 to +3/8	— —	W	12.1	53.7	71.1	80.7	85.4	88.1	92.6	100.0
		S	4.18	4.35	4.45	4.58	4.72	4.80	4.99	5.80
-3/8 to +1/4	— — —	W	11.6	53.4	73.0	81.9	85.8	88.9	93.4	100.0
		S	4.16	4.31	4.45	4.57	4.65	4.76	4.97	5.76
-1/4 to +1/8	——	W	17.1	54.4	71.9	80.9	85.4	88.1	92.6	100.0
		S	4.13	4.37	4.48	4.59	4.69	4.77	4.93	5.68
-1/8 in. to +28 MESH	------	W	19.0	55.9	71.0	78.8	83.8	87.1	92.3	100.0
		S	4.11	4.34	4.46	4.55	4.63	4.71	4.87	5.64
-28 MESH-0	—— —	W	18.6	47.1	64.4	72.3	78.3	82.1	85.5	100.0
		S	3.91	4.08	4.18	4.25	4.30	4.35	4.48	5.56

DATA SHEET 36.- FLOAT AND SINK TESTS DATA SHEET, AND FLOAT SULFUR CURVES SHOWING YIELD OF FLOAT COAL VS. CUMULATIVE SULFUR CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COAL SAMPLE (NO. 12/243A) FROM JANES COAL SALES INC. STRIP MINE IN BRISTOL TWP., MORGAN CO., OHIO.



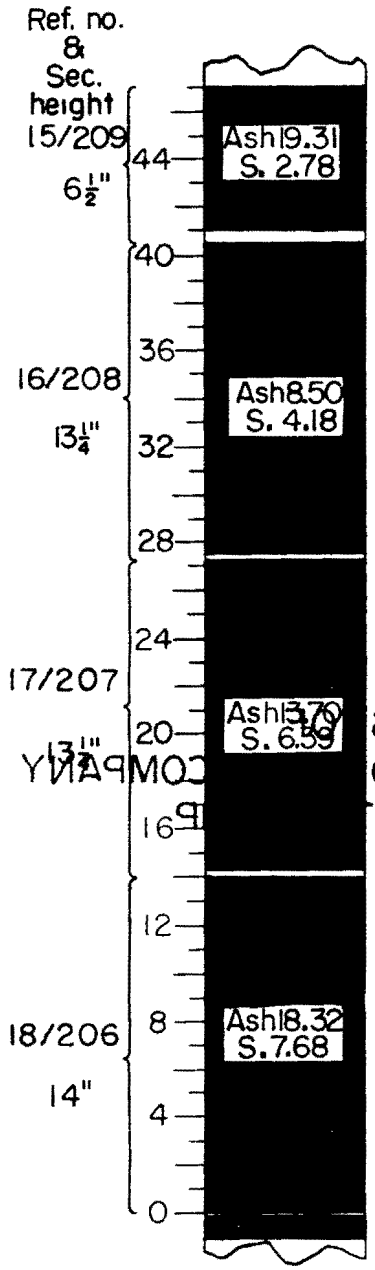
SPECIFIC GRAVITY FRACTIONS	SEE NOTE	CURVE	COMPUTED CUMULATIVE DATA: FLOAT, CUMULATIVE WEIGHT (%)	FLOAT, CUMULATIVE GROSS HEATING VALUE Btu./lb.	FLOAT, CUMULATIVE GROSS HEATING VALUE kg.-cal./kg.	SINK, CUMULATIVE WEIGHT (%)	SINK, CUMULATIVE GROSS HEATING VALUE Btu./lb.	SINK, CUMULATIVE GROSS HEATING VALUE kg.-cal./kg.
FLOAT 1.30	a	———	2.7	13,806	7670	100.0	11,943	6635
	b	———	4.4	13,855	7697	100.0	12,381	6878
	c	— —	17.1	13,804	7668	100.0	12,162	6756
1.30 – 1.35	a	———	39.1	13,327	7403	97.3	11,891	6606
	b	———	47.1	13,331	7406	95.6	12,313	6840
	c	— —	54.4	13,412	7451	82.9	11,823	6568
1.35 – 1.40	a	———	62.8	12,922	7178	60.9	11,054	6141
	b	———	75.7	13,064	7257	52.9	11,535	6408
	c	— —	71.9	13,196	7331	45.6	10,671	5928
1.40 – 1.45	a	———	78.2	12,706	7059	37.2	10,290	5716
	b	———	83.9	12,954	7196	24.3	10,253	5696
	c	— —	80.9	13,025	7236	28.1	9,516	5286
1.45 – 1.50	a	———	82.1	12,644	7024	21.8	9,206	5114
	b	———	88.5	12,867	7148	16.1	9,395	5219
	c	— —	85.4	12,919	7177	19.1	8,507	4726
1.50 – 1.55	a	———	86.2	12,554	6974	17.9	8,728	4849
	b	———	90.9	12,811	7117	11.5	8,641	4800
	c	— —	88.1	12,839	7132	14.6	7,734	4296
1.55 – 1.70	a	———	89.3	12,464	6924	13.8	8,127	4515
	b	———	95.5	12,679	7044	9.1	8,086	4492
	c	— —	92.6	12,668	7037	11.9	7,150	3972
SINK	a	———	100.0	11,943	6635	10.7	7,598	4221
	b	———	100.0	12,381	6878	4.5	6,060	3366
	c	— —	100.0	12,162	6756	7.4	5,842	3245

NOTE: a IS SCREEN SIZE - 2" to +1½", b - 1¼" to +1", c - ¼" to +⅛".

MEIGS CREEK NO.9 COAL, EXPERIMENTAL SINK, CUMULATIVE PER CENT RESULTS

DATA SHEET 37. – FLOAT AND SINK TESTS DATA SHEET AND B.T.U. CURVES SHOWING YIELD OF FLOAT AND SINK COAL VS. B.T.U. VALUE FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COAL SAMPLE, (REF. NO. 12/243A) FROM JANES COAL SALES INC. STRIP MINE IN BRISTOL TWP., MORGAN CO., OHIO.

INVESTIGATION RESULTS OF COAL SAMPLES FROM CENTRAL OHIO COAL COMPANY STRIP MINE IN BROOKFIELD TOWNSHIP



73' 6" Overburden, lower 25' is sandy shale overlain by imbedded limestone and calcareous shale.

6" Coal, blocky, bright, much fusain on bedding planes.

½" Clay shale parting, with considerable pyrite.

13" Coal, bright, blocky, with fine bony laminations.

¼" Clay parting.

13" Coal, bony, hard, bright, fine bony laminations.

¼" Clay parting.

14" Coal bony some small pyrite streaks.

1-" Coal, shaly, with much pyrite, not sampled.
Clay dark to medium gray.

Fig. 9.-Cross section of coal bed at sampling face (Ref. No. 15/209 to 18/206) in SE SW Sec. 4, Noble County, Ohio, of the Central Ohio Coal Company strip mine, Brookfield Township.

TABLE XI. Analysis of coal sample (Ref. No. 15/209 to 18/206) from Central Ohio Coal Company strip mine SE SW Sec. 4, Brookfield Township, Noble County, Ohio.

Sample				Proximate analysis (% by wt.)					Gross heating value		Carbonization assay						
Reference number												Yields					
												cc./100 gm. charge		% by wt.		gal./ton	
E.E.S. Lab.	G.S.O. Locality	Thickness (in.)	Condition *	Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Btu./lb.	kg.-cal./kg.	Charge (gm.)	Tar	Liquor	Coke	Gas & loss	Tar	Liquor
15/209	543-4	6½	a	3.23	33.75	44.33	18.69	2.69	10,943	6079	150.0	11.8	4.5	70.9	12.8	28.3	10.8
			b	0.00	34.88	45.81	19.31	2.78	11,308	6282	145.2	12.2	1.3	73.3	13.2	29.2	3.1
16/208	543-3	13¼	a	3.26	38.16	50.36	8.22	4.04	12,457	6920	150.0	13.8	5.0	65.3	15.9	33.1	12.0
			b	0.00	39.44	52.06	8.50	4.18	12,877	7153	145.1	14.3	1.8	67.5	16.4	34.3	4.3
17/207	543-2	13¼	a	2.75	37.47	46.46	13.32	6.21	11,401	6334	150.0	12.4	4.8	69.1	13.7	29.7	11.5
			b	0.00	38.53	47.77	13.70	6.39	11,723	6512	145.9	12.7	2.1	71.1	14.1	30.4	5.0
18/206	543-1	14	a	2.35	37.68	42.08	17.89	7.50	10,918	6065	150.0	13.5	4.5	65.8	16.2	32.4	10.8
			b	0.00	38.59	43.09	18.32	7.68	11,181	6211	146.5	13.8	2.2	67.4	16.6	33.1	5.3
Total or average (Calculated upon thickness)		47	a	2.84	37.21	45.96	13.99	5.50	11,476	6375	150.0	13.0	4.7	67.3	15.0	31.2	11.3
			b	0.00	38.30	47.30	14.40	5.66	11,811	6561	145.7	13.4	1.9	69.3	15.4	32.1	4.6
Head sample **			a	2.13	37.88	45.39	14.60	6.43									
			b	0.00	38.70	46.38	14.92	6.57									

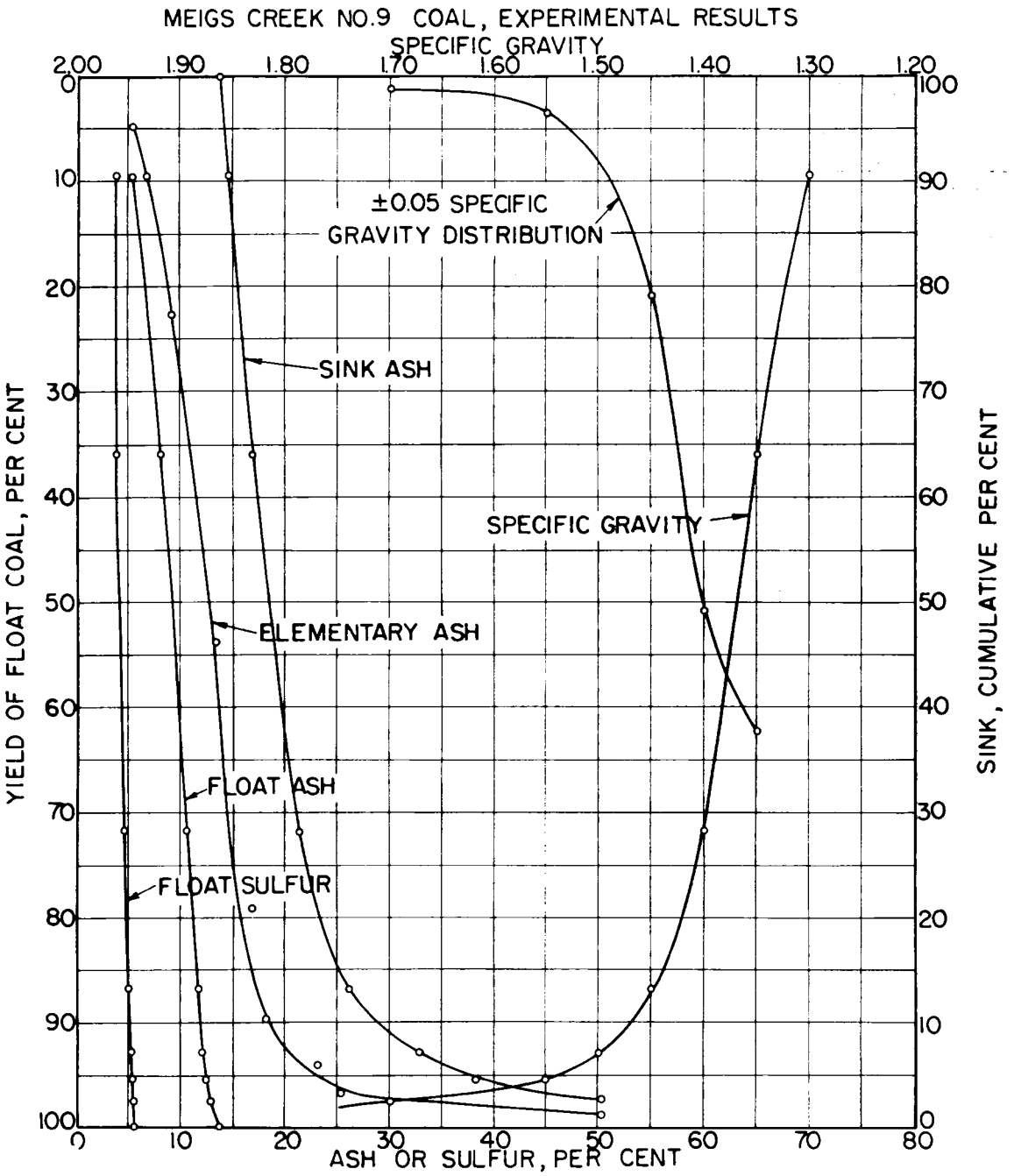
* Condition a refers to the air-dry sample; condition b refers to moisture-free sample.

** A composite sample containing the same weight per cent (10%) from the total weight of each bench sample collected separately (No. 15 to 18); mineral CO_2 content in the "head sample": 0.13 per cent.

TABLE XII. Screen tests and analysis data of various screen sizes of the composite coal sample (Ref. No. 15/209 to 18/206) from Central Ohio Coal Company strip mine, SE SW Sec. 4, Brookfield Township, Noble County, Ohio

Reference number		Screen size (in.)	Condition*	Weight (gm.)	Elementary data, (%)				Computed cumulative data, (%)		
E.E.S. Lab.	G.S.O. Locality				Weight	Moisture	Ash	Sulfur	Weight	Ash	Sulfur
15/209 to 18/206 (Composite sample)	543 1 to 4	−2 to + 1½	a	3670	11.2	2.37	16.41	5.61	11.2	16.41	5.61
			b			0.00	16.81	5.75		16.81	5.75
		−1½ to +1	a	5839	17.8	2.45	14.39	5.43	29.0	15.17	5.50
			b			0.00	14.75	5.57		15.55	5.64
		−1 to + ¾	a	4496	13.7	2.41	15.45	5.85	42.7	15.26	5.61
			b			0.00	15.83	5.99		15.64	5.75
		−¾ to +½	a	6854	20.9	1.88	14.17	6.08	63.6	14.90	5.77
			b			0.00	14.44	6.20		15.19	5.88
		−½ to +⅜	a	1624	5.0	2.22	15.61	5.67	68.6	14.96	5.76
			b			0.00	15.96	5.80		15.30	5.89
		−⅜ to +¼	a	3859	11.8	1.98	14.27	6.09	80.4	14.85	5.81
			b			0.00	14.56	6.21		15.15	5.93
		−¼ to +⅛	a	2662	8.1	2.50	14.92	6.17	88.5	14.86	5.84
			b			0.00	15.30	6.33		15.24	5.99
		−⅛ inches to +28 mesh	a	2336	7.1	2.13	16.56	6.06	95.6	14.99	5.86
			b			0.00	16.92	6.19		15.32	5.99
		−28 mesh to 0	a	1450	4.4	2.09	17.60	5.44	100.0	15.10	5.84
			b				17.98	5.56		15.43	5.97
Total or average (calculated upon weight)		−2 to 0	a	32,790	100.0	2.21	15.10	5.84			
			b			0.00	15.43	5.97			

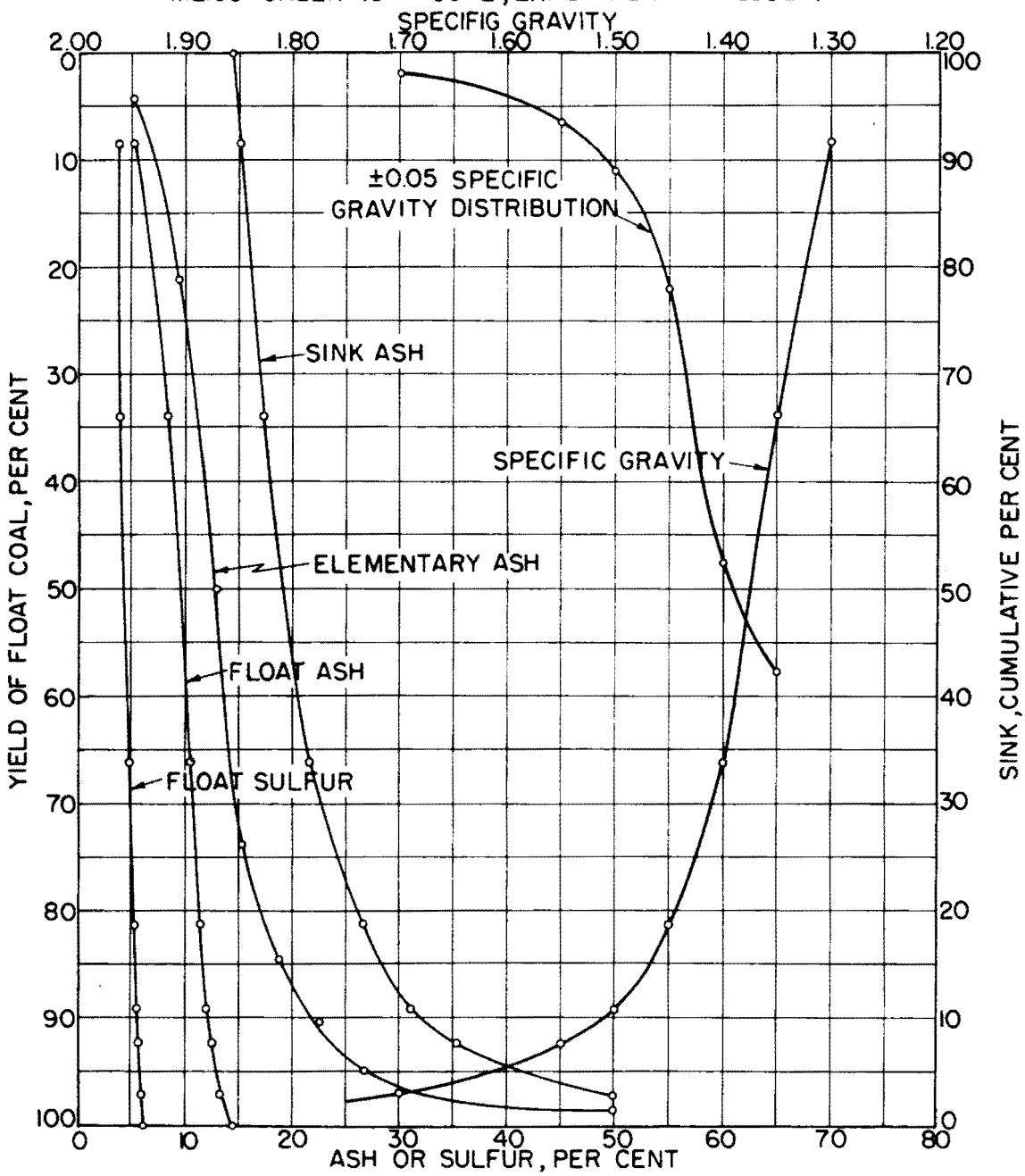
* Condition a refers to air-dry sample; condition b refers to moisture-free sample.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	327	9.4	2.61	5.27	3.65	9.4	5.27	3.65	100.0	13.59	5.78	
1.30 - 1.35	919	26.4	2.50	8.95	4.18	35.8	7.98	4.04	90.6	14.45	6.00	62.4
1.35 - 1.40	1255	36.0	2.21	13.20	5.57	71.8	10.60	4.81	64.2	16.72	6.75	50.9
1.40 - 1.45	518	14.9	1.97	16.82	6.67	86.7	11.67	5.13	28.2	21.20	8.25	20.9
1.45 - 1.50	208	6.0	2.03	18.09	8.70	92.7	12.08	5.36	13.3	26.11	10.02	8.7
1.50 - 1.55	95	2.7	2.17	23.23	8.80	95.4	12.40	5.46	7.3	32.76	11.11	3.5
1.55 - 1.70	76	2.2	2.21	25.32	9.84	97.6	12.69	5.55	4.6	38.27	12.42	1.2
Sink 1.70	85	2.4	2.47	50.31	15.01	100.0	13.59	5.78	2.4	50.31	15.01	
Totals	3483	100.0										

* Moisture-free basis.

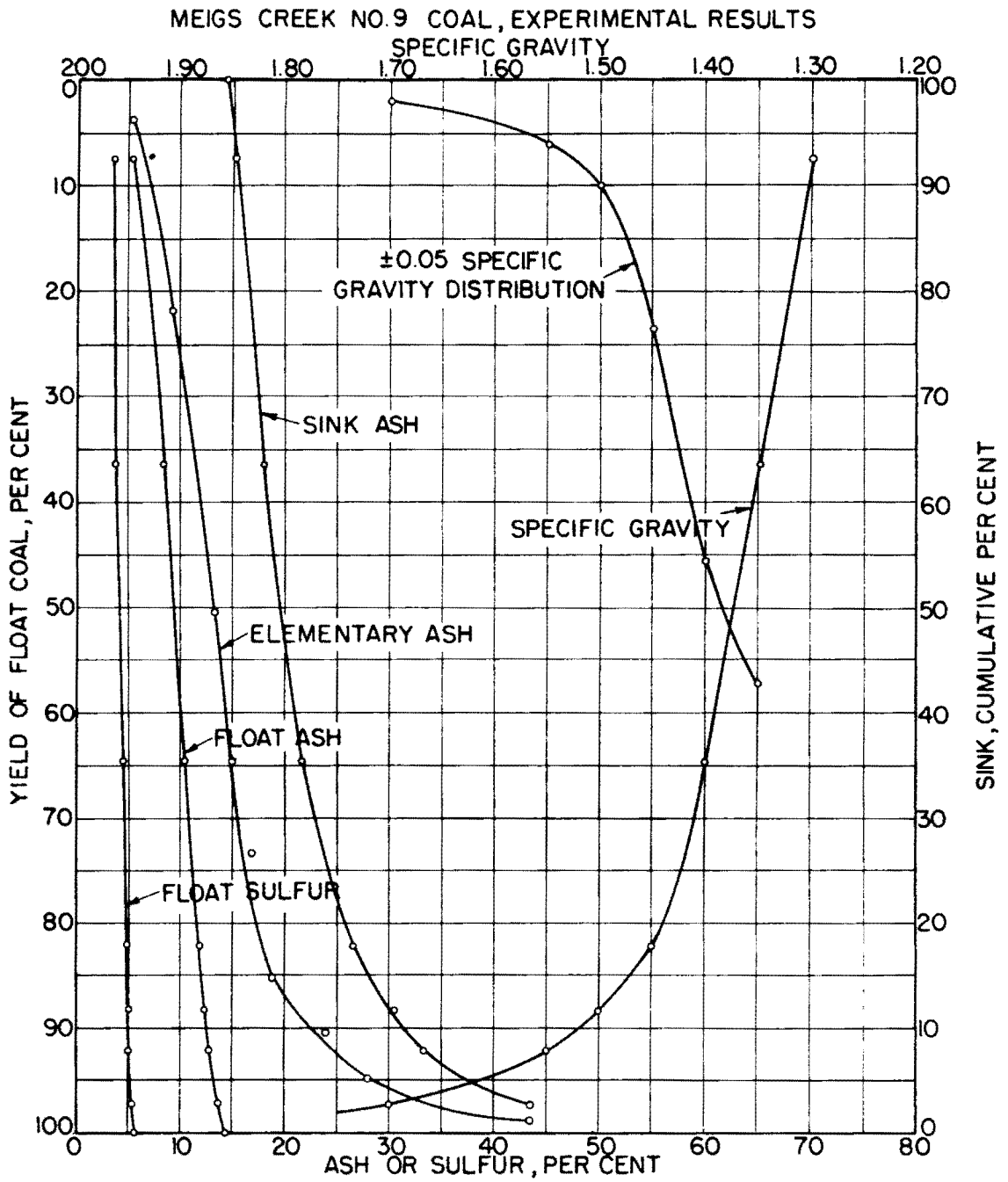
DATA SHEET 38. - Float-and-sink tests data sheet and washability curves; coal sample from Central Ohio Coal Company strip mine, SE SW Sec. 4, Brookfield Township, Noble County, Ohio. Screen size: -2 to +1½ inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	609	8.4	2.47	5.23	3.71	8.4	5.23	3.71	100.0	14.29	6.19	
1.30 - 1.35	1842	25.3	2.49	9.32	4.38	33.7	8.30	4.21	91.6	15.12	6.42	57.6
1.35 - 1.40	2347	32.3	2.18	12.97	5.66	66.0	10.59	4.92	66.3	17.33	7.20	47.5
1.40 - 1.45	1106	15.2	2.04	15.19	7.32	81.2	11.45	5.37	34.0	21.47	8.66	22.0
1.45 - 1.50	498	6.8	2.22	18.84	8.09	88.0	12.02	5.58	18.8	26.56	9.73	11.0
1.50 - 1.55	306	4.2	2.11	22.90	8.51	92.2	12.51	5.75	12.0	30.94	10.66	6.5
1.55 - 1.70	358	4.9	2.03	26.67	10.28	97.1	13.23	5.98	7.8	35.33	11.39	1.8
Sink 1.70	213	2.9	2.05	49.93	13.12	100.0	14.29	6.19	2.9	49.93	13.12	
Totals	7279	100.0										

* Moisture-free basis.

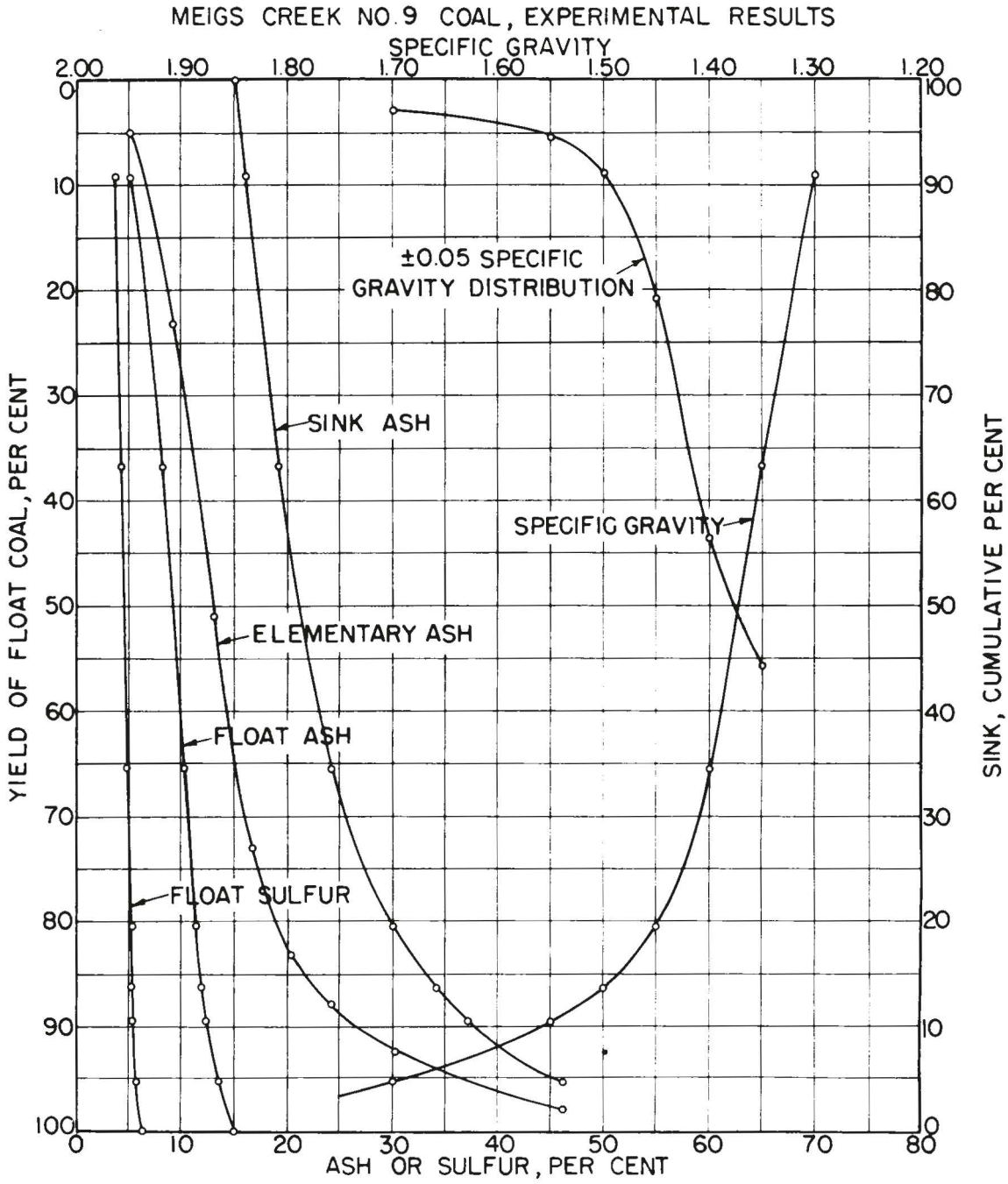
DATA SHEET 39. - Float-and-sink tests data sheet and washability curves; coal sample from Central Ohio Coal Company strip mine SE SW Sec. 4, Brookfield Township, Noble County, Ohio. Screen size: -1½ to +1 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	536	7.5	2.20	5.31	3.55	7.5	5.31	3.55	100.0	14.37	5.68	
1.30 - 1.35	2079	29.0	2.20	9.10	4.15	36.5	8.32	4.03	92.5	15.10	5.85	57.2
1.35 - 1.40	2021	28.2	2.20	13.10	5.33	64.7	10.40	4.59	63.5	17.85	6.63	45.7
1.40 - 1.45	1252	17.5	2.09	16.73	6.16	82.2	11.75	4.93	35.3	21.65	7.68	23.7
1.45 - 1.50	441	6.2	2.28	18.95	7.70	88.4	12.26	5.12	17.8	26.47	9.14	10.0
1.50 - 1.55	273	3.8	2.12	24.62	7.35	92.2	12.77	5.21	11.6	30.45	9.95	6.2
1.55 - 1.70	366	5.1	2.04	27.97	10.15	97.3	13.56	5.47	7.8	33.28	11.24	2.0
Sink 1.70	191	2.7	2.12	43.49	13.11	100.0	14.37	5.68	2.7	43.49	13.11	
Totals	7159	100.0										

* Moisture-free basis.

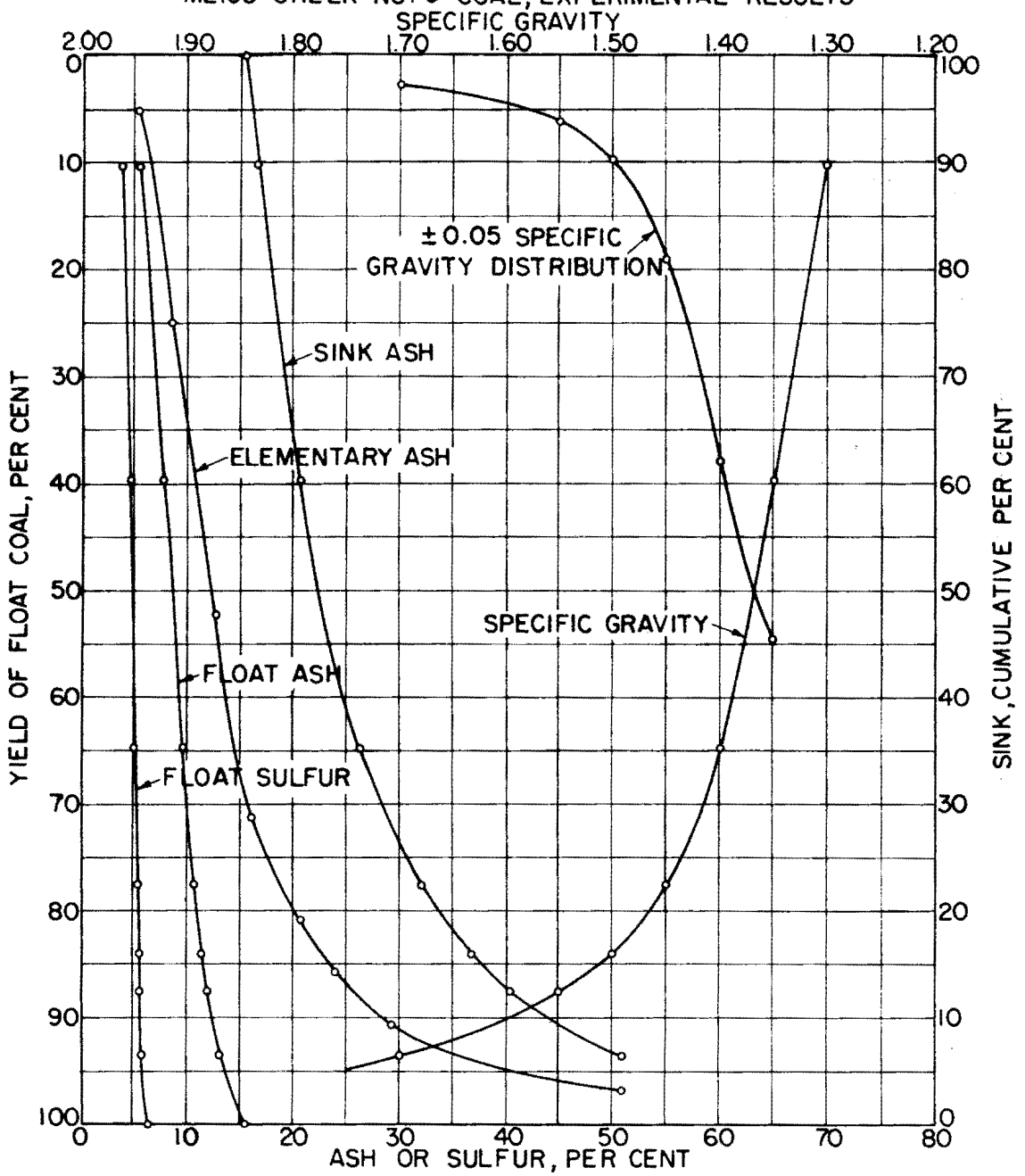
DATA SHEET 40. - Float-and-sink tests data sheet and washability curves; coal sample from Central Ohio Coal Company strip mine, SE SW Sec. 4, Brookfield Township, Noble County, Ohio. Screen size: -1 to +3/4 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	1144	9.7	2.32	5.09	3.68	9.7	5.09	3.68	100.0	15.05	6.24	
1.30 - 1.35	3174	27.0	2.30	9.09	4.44	36.7	8.03	4.24	90.3	16.12	6.51	55.7
1.35 - 1.40	3375	28.7	2.18	12.96	5.61	65.4	10.20	4.84	63.3	19.12	7.40	43.7
1.40 - 1.45	1763	15.0	2.26	16.54	6.82	80.4	11.38	5.21	34.6	24.22	8.89	20.8
1.45 - 1.50	685	5.8	2.29	20.30	6.90	86.2	11.98	5.32	19.6	30.10	10.47	9.1
1.50 - 1.55	394	3.3	2.19	24.22	8.83	89.5	12.43	5.45	13.8	34.23	11.99	5.5
1.55 - 1.70	677	5.8	2.26	30.26	10.05	95.3	13.52	5.73	10.5	37.38	12.97	2.8
Sink 1.70	559	4.7	2.02	46.15	16.56	100.0	15.05	6.24	4.7	46.15	16.56	
Totals	11,771	100.0										

* Moisture-free basis.

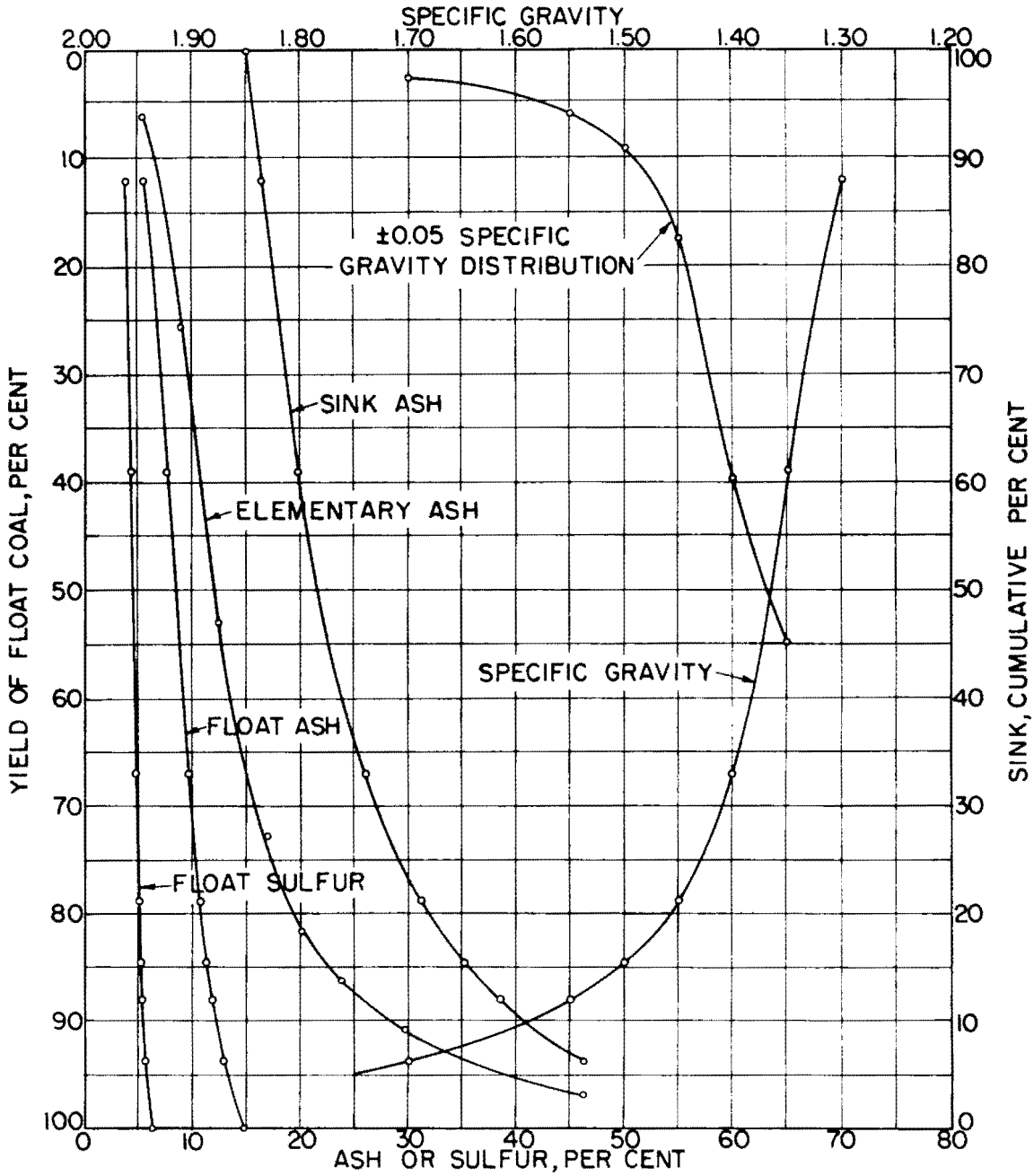
DATA SHEET 41. - Float-and-sink tests data sheet and washability curves; coal sample from Central Ohio Coal Company strip mine, SE SW Sec. 4, Brookfield Township, Noble County, Ohio. Screen size: -3/4 to +1/2 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	300	10.3	2.08	5.44	4.15	10.3	5.44	4.15	100.0	15.47	6.35	
1.30 - 1.35	854	29.4	2.17	8.48	4.73	39.7	7.69	4.58	89.7	16.62	6.60	54.5
1.35 - 1.40	728	25.1	2.22	12.65	5.64	64.8	9.61	4.99	60.3	20.59	7.52	37.9
1.40 - 1.45	370	12.8	2.17	15.94	7.23	77.6	10.66	5.36	35.2	26.26	8.85	19.2
1.45 - 1.50	186	6.4	2.28	20.57	7.18	84.0	11.41	5.50	22.4	32.13	9.78	9.9
1.50 - 1.55	102	3.5	2.21	23.97	8.06	87.5	11.91	5.60	16.0	36.79	10.81	6.1
1.55 - 1.70	176	6.1	2.21	29.37	9.13	93.6	13.05	5.83	12.5	40.39	11.60	2.8
Sink 1.70	185	6.4	2.10	50.81	14.02	100.0	15.47	6.35	6.4	50.81	14.02	
Totals	2901	100.0										

* Moisture-free basis.

DATA SHEET 42. - Float-and-sink tests datasheet and washability curves; coal sample from Central Ohio Coal Company strip mine, SE SW Sec. 4, Brookfield Township, Noble County, Ohio. Screen size: -1/2 to +3/8 inches.

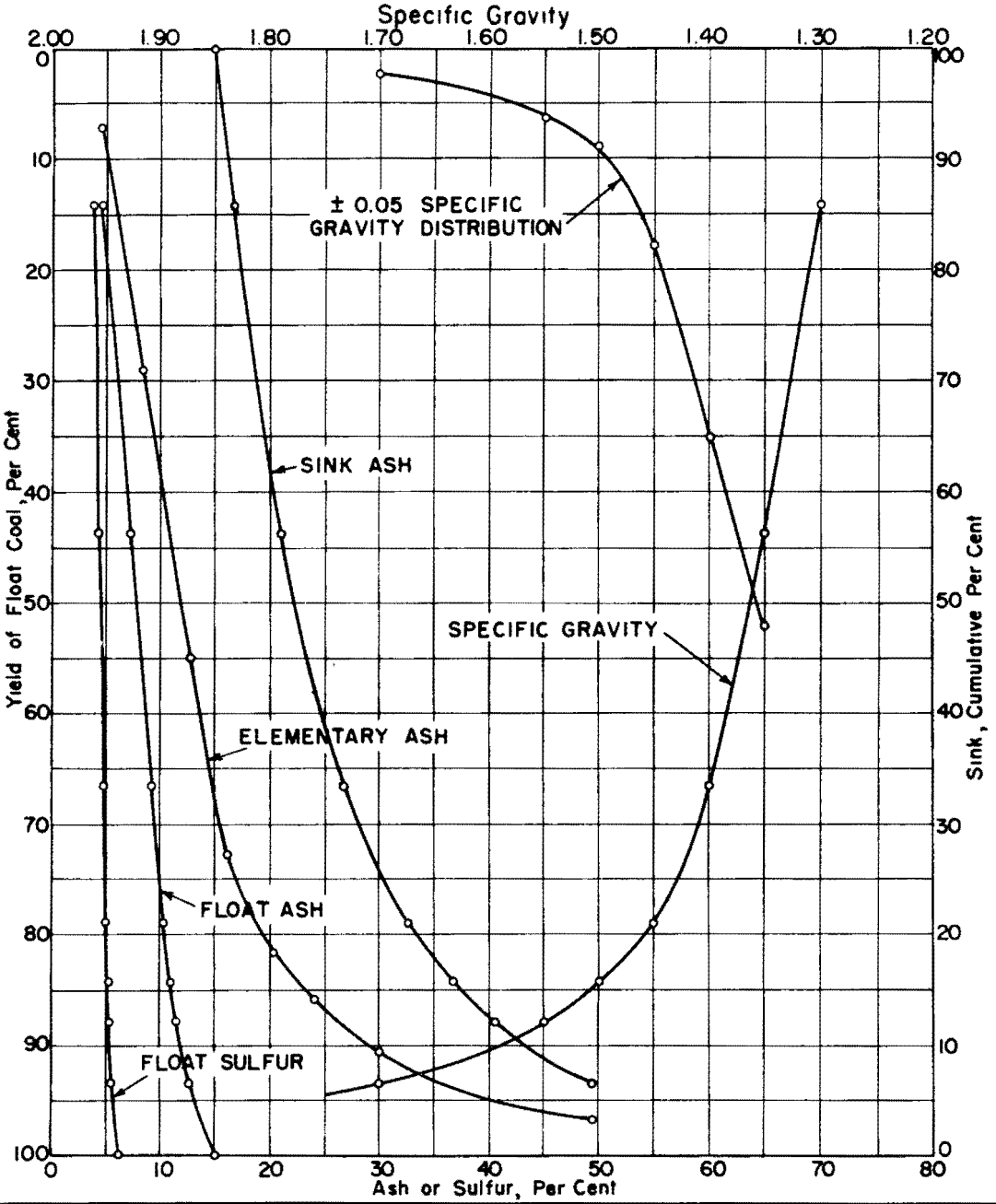


Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	1096	12.2	2.17	5.37	3.71	12.2	5.37	3.71	100.0	14.99	6.30	
1.30 - 1.35	2416	26.8	2.25	8.54	4.43	39.0	7.55	4.20	87.8	16.33	6.66	54.8
1.35 - 1.40	2521	28.0	2.12	12.39	5.66	67.0	9.57	4.81	61.0	19.75	7.64	39.8
1.40 - 1.45	1062	11.8	2.06	16.88	6.50	78.8	10.67	5.07	33.0	25.99	9.33	17.6
1.45 - 1.50	520	5.8	2.29	20.19	7.39	84.6	11.32	5.22	21.2	31.05	10.87	9.3
1.50 - 1.55	321	3.5	2.31	23.74	7.79	88.1	11.81	5.33	15.4	35.15	12.23	6.0
1.55 - 1.70	509	5.6	1.88	29.76	9.18	93.7	12.89	5.56	11.9	38.53	13.48	2.6
Sink 1.70	572	6.3	1.62	46.35	17.28	100.0	14.99	6.30	6.3	46.35	17.28	
Totals	9017	100.0										

* Moisture-free basis.

DATA SHEET 43. - Float-and-sink tests data sheet and washability curves; coal sample from Central Ohio Coal Company strip mine, SE SW Sec. 4, Brookfield Township, Noble County, Ohio. Screen size: -3/8 to +1/4 inches.

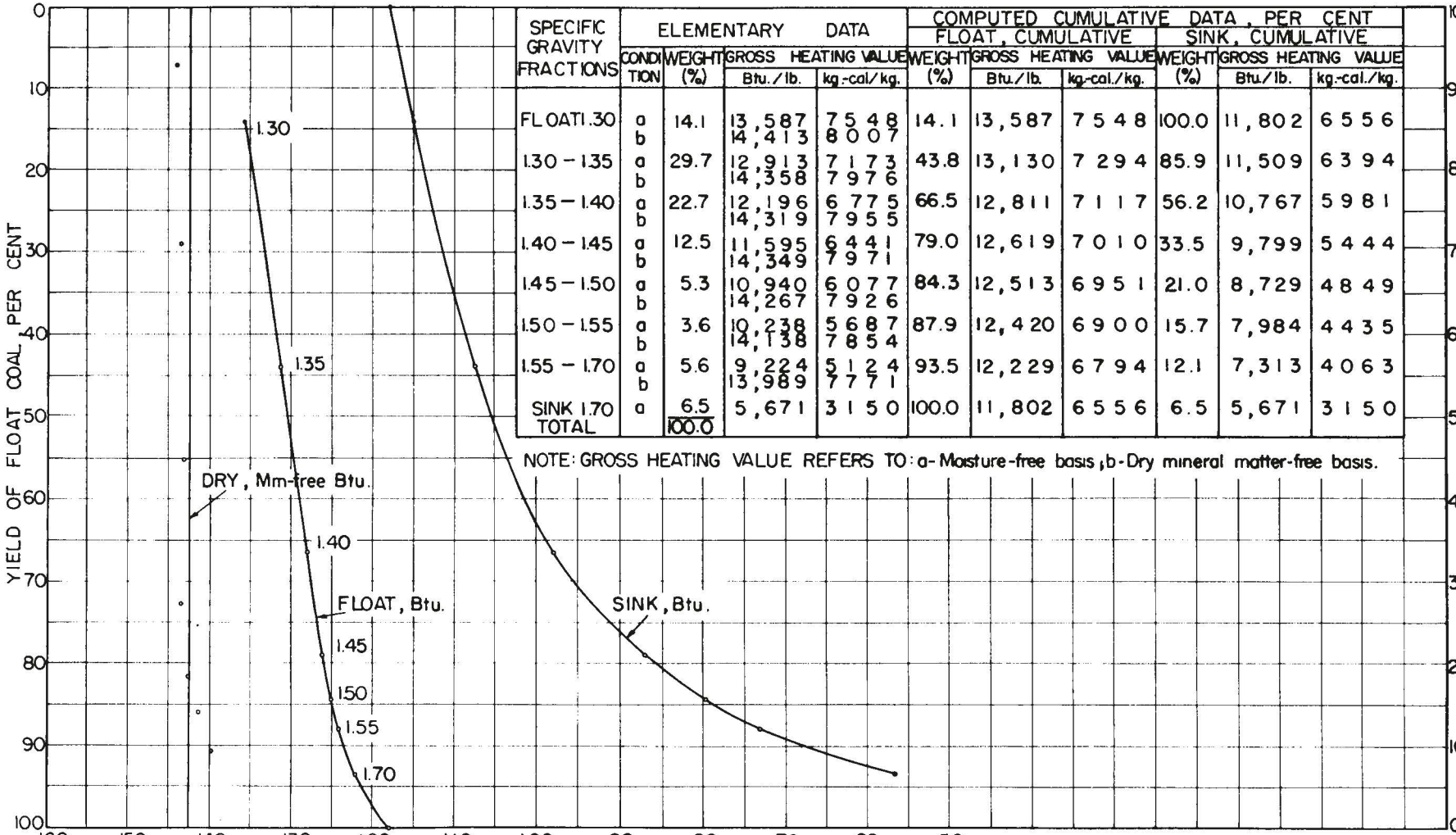
MEIGS CREEK NO. 9 COAL, EXPERIMENTAL RESULTS



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	1370	14.1	2.25	4.60	3.76	14.1	4.60	3.76	100.0	14.95	6.10	
1.30 - 1.35	2886	29.7	2.24	8.46	4.60	43.8	7.22	4.33	85.9	16.65	6.22	52.4
1.35 - 1.40	2202	22.7	2.00	12.70	5.53	66.5	9.09	4.74	56.2	20.97	7.48	35.2
1.40 - 1.45	1214	12.5	1.92	16.57	6.43	79.0	10.27	5.01	33.5	26.58	8.80	17.8
1.45 - 1.50	512	5.3	1.99	20.23	7.37	84.3	10.90	5.16	21.0	32.56	10.20	8.9
1.50 - 1.55	349	3.6	1.87	24.16	7.61	87.9	11.44	5.26	15.7	36.70	11.15	6.2
1.55 - 1.70	542	5.6	1.98	29.96	8.86	93.5	12.55	5.47	12.1	40.45	12.20	2.3
Sink 1.70	638	6.5	1.91	49.44	15.18	100.0	14.95	6.10	6.5	49.44	15.18	
Totals	9713	100.0										

* Moisture-free basis.

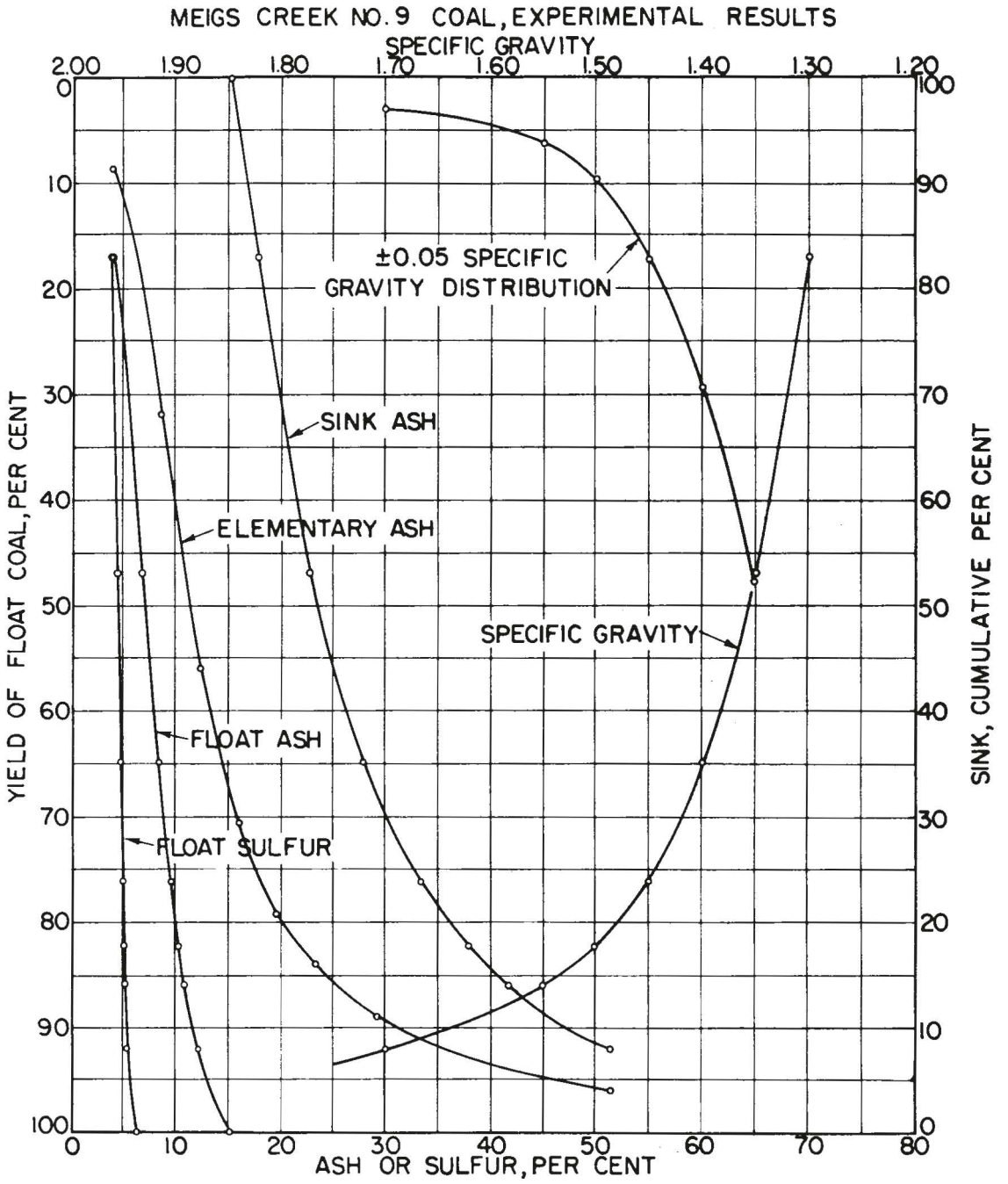
DATA SHEET 44. - Float-and-sink tests data sheet and washability curves; coal sample from Central Ohio Coal Company strip mine, SE SW Sec. 4, Brookfield Township, Noble County, Ohio. Screen size: -1/4 to +1/8 inches.



SPECIFIC GRAVITY FRACTIONS	ELEMENTARY DATA				COMPUTED CUMULATIVE DATA, PER CENT					
					FLOAT, CUMULATIVE			SINK, CUMULATIVE		
	CONDITION	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.
FLOAT 1.30	a	14.1	13,587	7548	14.1	13,587	7548	100.0	11,802	6556
	b		14,413	8007						
1.30 – 1.35	a	29.7	12,913	7173	43.8	13,130	7294	85.9	11,509	6394
	b		14,358	7976						
1.35 – 1.40	a	22.7	12,196	6775	66.5	12,811	7117	56.2	10,767	5981
	b		14,319	7955						
1.40 – 1.45	a	12.5	11,595	6441	79.0	12,619	7010	33.5	9,799	5444
	b		14,349	7971						
1.45 – 1.50	a	5.3	10,940	6077	84.3	12,513	6951	21.0	8,729	4849
	b		14,267	7926						
1.50 – 1.55	a	3.6	10,238	5687	87.9	12,420	6900	15.7	7,984	4435
	b		14,138	7854						
1.55 – 1.70	a	5.6	9,224	5124	93.5	12,229	6794	12.1	7,313	4063
	b		13,989	7771						
SINK 1.70	a	6.5	5,671	3150	100.0	11,802	6556	6.5	5,671	3150
TOTAL		100.0								

NOTE: GROSS HEATING VALUE REFERS TO: a-Moisture-free basis, b-Dry mineral matter-free basis.

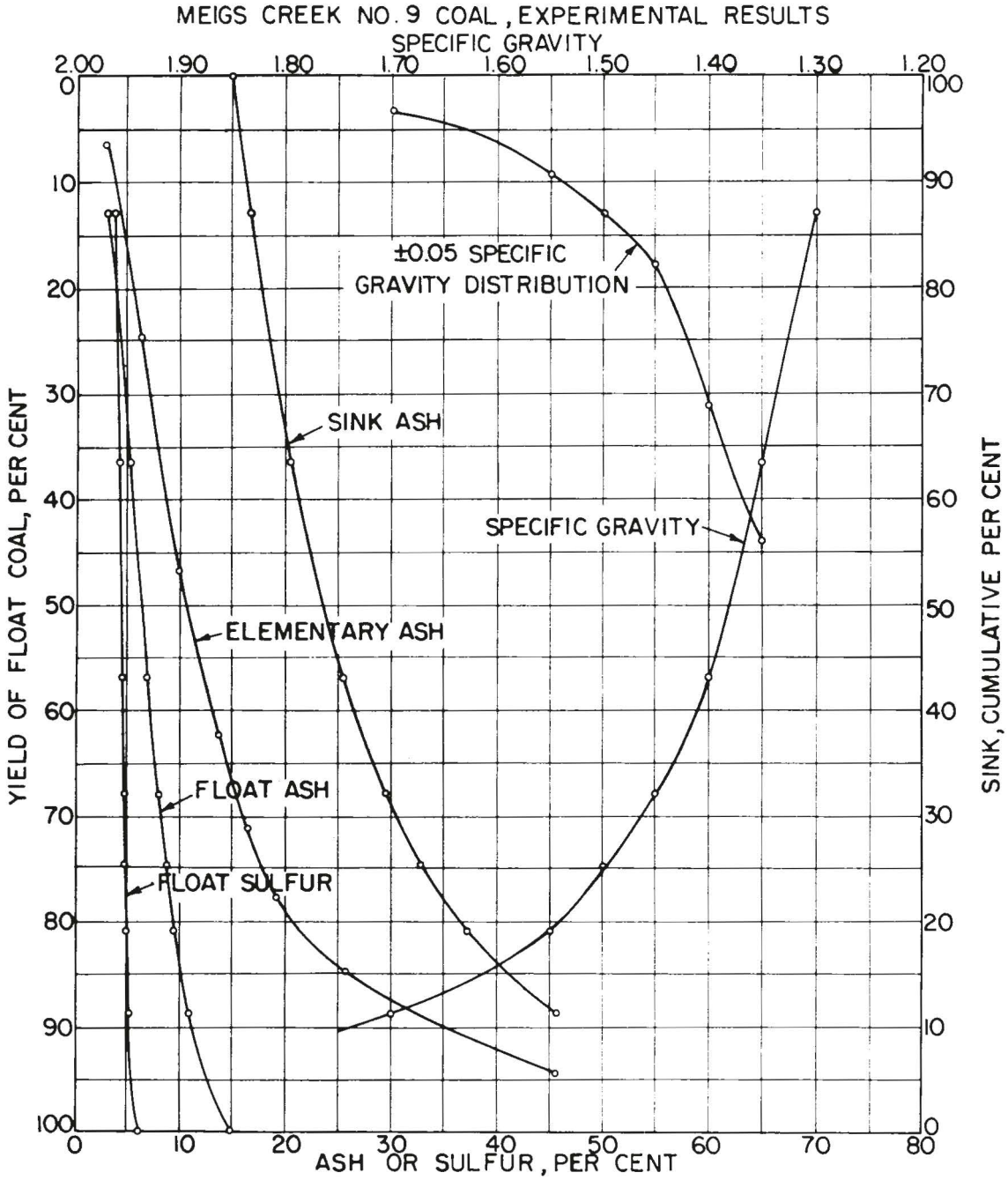
DATA SHEET 45.—
FLOAT AND SINK TESTS DATA SHEET AND B.T.U. CURVES SHOWING GROSS HEATING VALUE OF VARIOUS SPECIFIC GRAVITY FRACTIONS; COAL SAMPLE FROM CENTRAL OHIO COAL COMPANY STRIP MINE, SE SW SEC. 4, BROOKFIELD TWP. NOBLE CO., OHIO. SCREEN SIZE: $-\frac{1}{4}$ to $+\frac{1}{8}$.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	1155	17.1	2.16	3.93	3.81	17.1	3.93	3.81	100.0	15.20	6.18	
1.30 - 1.35	2008	29.8	2.03	8.56	4.73	46.9	6.87	4.39	82.9	17.52	6.67	47.7
1.35 - 1.40	1209	17.9	2.10	12.41	5.65	64.8	8.40	4.74	53.1	22.56	7.76	29.4
1.40 - 1.45	772	11.5	2.16	16.09	6.29	76.3	9.56	4.97	35.2	27.72	8.83	17.4
1.45 - 1.50	398	5.9	2.16	19.60	6.80	82.2	10.28	5.11	23.7	33.36	10.08	9.7
1.50 - 1.55	258	3.8	2.26	23.38	7.24	86.0	10.86	5.20	17.8	37.92	11.12	6.3
1.55 - 1.70	413	6.1	2.39	29.31	8.39	92.1	12.08	5.41	14.0	41.86	12.20	3.0
Sink 1.70	530	7.9	2.11	51.49	15.12	100.0	15.20	6.18	7.9	51.49	15.12	
Totals	6743	100.0										

* Moisture-free basis.

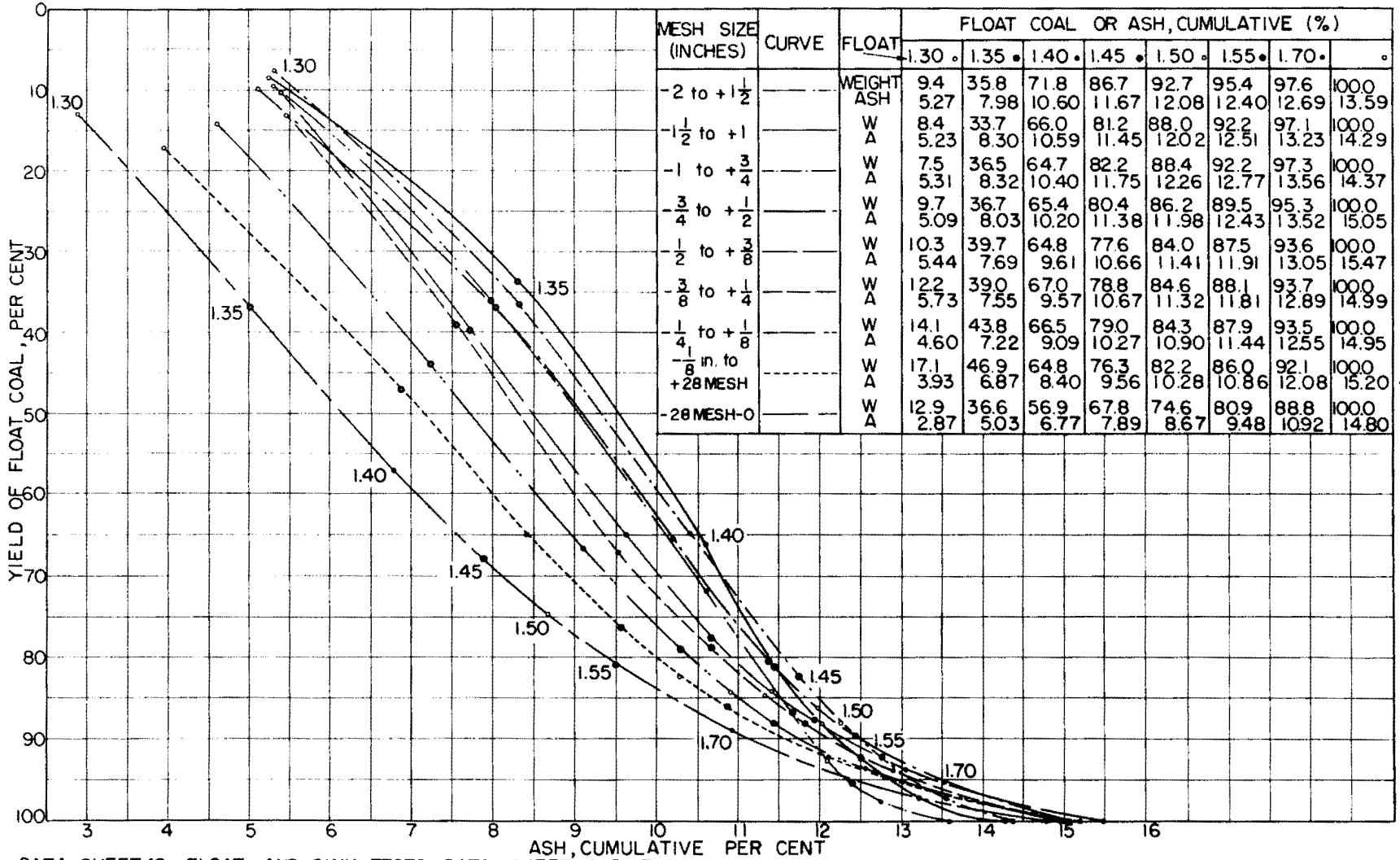
DATA SHEET 46. - Float-and-sink tests data sheet and washability curves; coal sample from Central Ohio Coal Company strip mine, SE SW Sec. 4, Brookfield Township, Noble County, Ohio. Screen size: -1/8 inches to +28 mesh.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	280	12.9	1.81	2.87	3.71	12.9	2.87	3.71	100.0	14.80	6.03	
1.30 - 1.35	516	23.7	1.93	6.20	4.34	36.6	5.03	4.12	87.1	16.57	6.37	44.0
1.35 - 1.40	442	20.3	2.01	9.90	5.19	56.9	6.77	4.50	63.4	20.44	7.13	31.2
1.40 - 1.45	236	10.9	2.36	13.78	5.54	67.8	7.89	4.67	43.1	25.40	8.05	17.7
1.45 - 1.50	149	6.8	2.43	16.40	5.88	74.6	8.67	4.78	32.2	29.35	8.89	13.1
1.50 - 1.55	137	6.3	2.72	19.04	5.90	80.9	9.48	4.87	25.4	32.80	9.70	9.4
1.55 - 1.70	171	7.9	2.96	25.71	6.95	88.8	10.92	5.05	19.1	37.33	10.94	3.3
Sink 1.70	244	11.2	2.72	45.58	13.80	100.0	14.80	6.03	11.2	45.58	13.80	
Totals	2175	100.0										

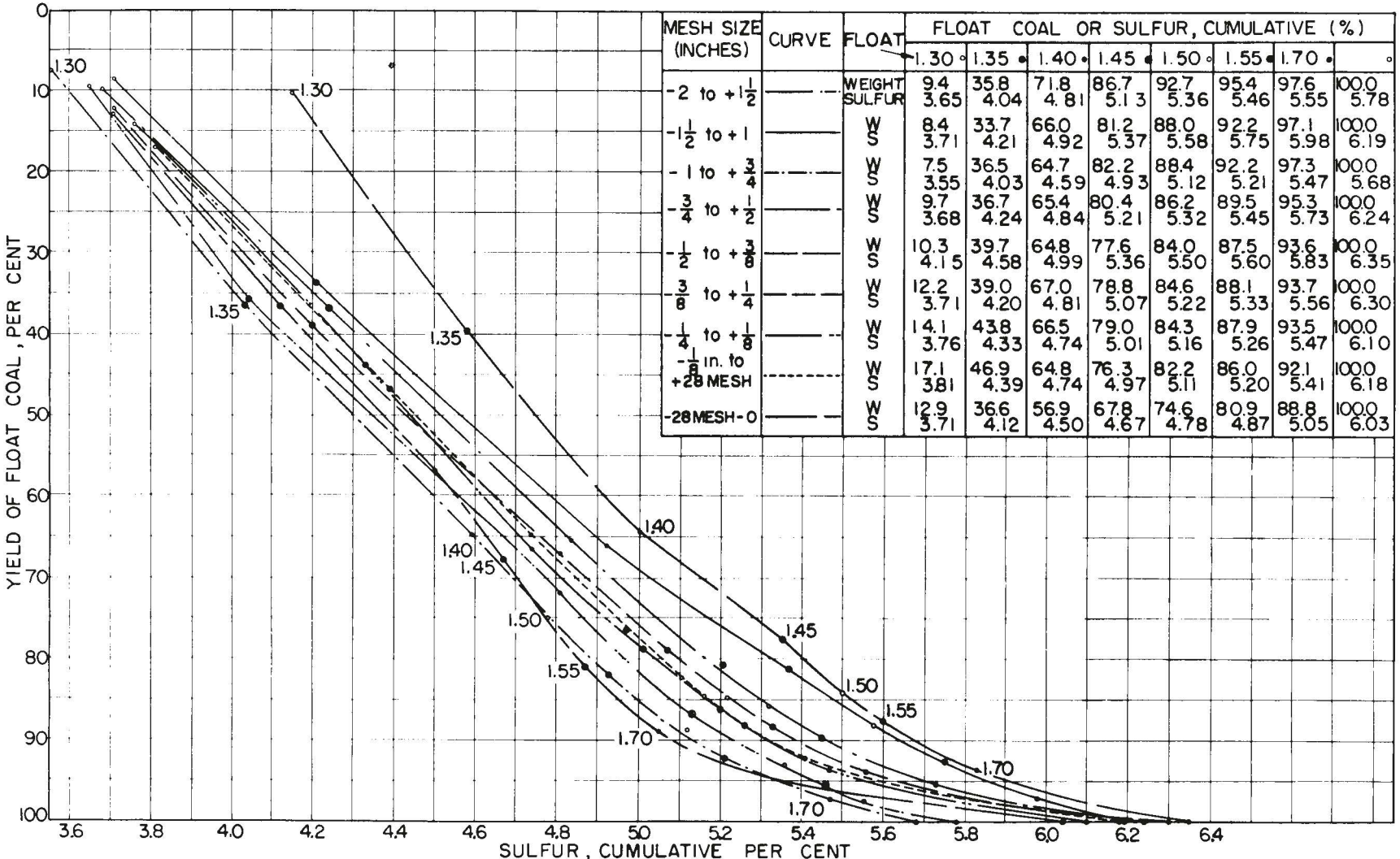
* Moisture-free basis.

DATA SHEET 47. - Float-and-sink tests data sheet and washability curves; coal sample from Central Ohio Coal Company strip mine, SE SW Sec. 4, Brookfield Township, Noble County, Ohio. Screen size: -28 mesh to 0.



MESH SIZE (INCHES)	CURVE	FLOAT	FLOAT COAL OR ASH, CUMULATIVE (%)							
			1.30 ◦	1.35 •	1.40 •	1.45 •	1.50 ◦	1.55 •	1.70 •	◦
-2 to +1½	—·—	WEIGHT	9.4	35.8	71.8	86.7	92.7	95.4	97.6	100.0
		ASH	5.27	7.98	10.60	11.67	12.08	12.40	12.69	13.59
-1½ to +1	———	W	8.4	33.7	66.0	81.2	88.0	92.2	97.1	100.0
		A	5.23	8.30	10.59	11.45	12.02	12.51	13.23	14.29
-1 to +¾	—·—	W	7.5	36.5	64.7	82.2	88.4	92.2	97.3	100.0
		A	5.31	8.32	10.40	11.75	12.26	12.77	13.56	14.37
-¾ to +½	———	W	9.7	36.7	65.4	80.4	86.2	89.5	95.3	100.0
		A	5.09	8.03	10.20	11.38	11.98	12.43	13.52	15.05
-½ to +⅜	— —	W	10.3	39.7	64.8	77.6	84.0	87.5	93.6	100.0
		A	5.44	7.69	9.61	10.66	11.41	11.91	13.05	15.47
-⅜ to +¼	— —	W	12.2	39.0	67.0	78.8	84.6	88.1	93.7	100.0
		A	5.73	7.55	9.57	10.67	11.32	11.81	12.89	14.99
-¼ to +⅛	— —	W	14.1	43.8	66.5	79.0	84.3	87.9	93.5	100.0
		A	4.60	7.22	9.09	10.27	10.90	11.44	12.55	14.95
-⅛ in. to +28 MESH	- - -	W	17.1	46.9	64.8	76.3	82.2	86.0	92.1	100.0
		A	3.93	6.87	8.40	9.56	10.28	10.86	12.08	15.20
-28 MESH-0	— —	W	12.9	36.6	56.9	67.8	74.6	80.9	88.8	100.0
		A	2.87	5.03	6.77	7.89	8.67	9.48	10.92	14.80

DATA SHEET 48:- FLOAT AND SINK TESTS DATA SHEET, AND FLOAT ASH CURVES SHOWING YIELD OF FLOAT COAL VS. CUMULATIVE ASH CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COMPOSITE COAL SAMPLE (SECTIONS NO. 15 TO 18) FROM CENTRAL OHIO COAL COMPANY STRIP MINE, BROOKFIELD TWP., SE SW SEC. 4, NOBLE CO., OHIO.

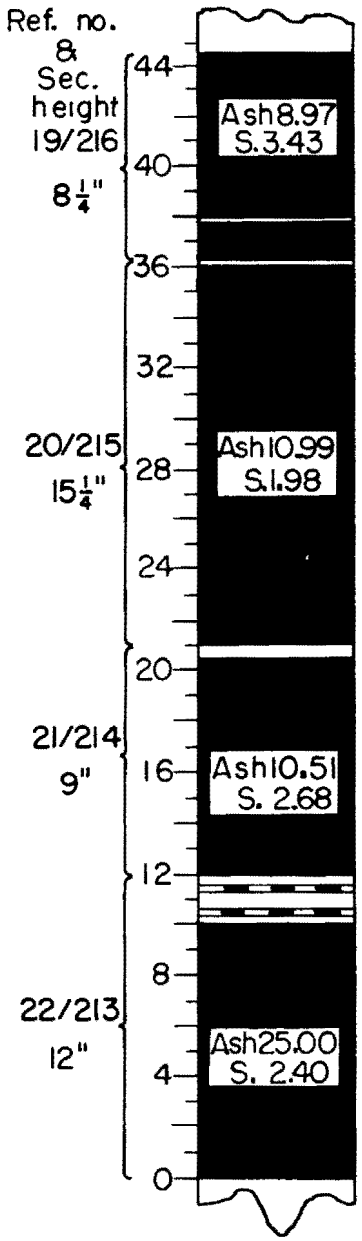


MESH SIZE (INCHES)	CURVE	FLOAT	FLOAT COAL OR SULFUR, CUMULATIVE (%)							
			1.30 ○	1.35 ●	1.40 ●	1.45 ●	1.50 ○	1.55 ●	1.70 ●	○
-2 to +1 1/2	—·—	WEIGHT	9.4	35.8	71.8	86.7	92.7	95.4	97.6	100.0
		SULFUR	3.65	4.04	4.81	5.13	5.36	5.46	5.55	5.78
-1 1/2 to +1	———	W	8.4	33.7	66.0	81.2	88.0	92.2	97.1	100.0
		S	3.71	4.21	4.92	5.37	5.58	5.75	5.98	6.19
-1 to +3/4	—·—·—	W	7.5	36.5	64.7	82.2	88.4	92.2	97.3	100.0
		S	3.55	4.03	4.59	4.93	5.12	5.21	5.47	5.68
-3/4 to +1/2	———	W	9.7	36.7	65.4	80.4	86.2	89.5	95.3	100.0
		S	3.68	4.24	4.84	5.21	5.32	5.45	5.73	6.24
-1/2 to +3/8	———	W	10.3	39.7	64.8	77.6	84.0	87.5	93.6	100.0
		S	4.15	4.58	4.99	5.36	5.50	5.60	5.83	6.35
-3/8 to +1/4	— — —	W	12.2	39.0	67.0	78.8	84.6	88.1	93.7	100.0
		S	3.71	4.20	4.81	5.07	5.22	5.33	5.56	6.30
-1/4 to +1/8	—·—	W	14.1	43.8	66.5	79.0	84.3	87.9	93.5	100.0
		S	3.76	4.33	4.74	5.01	5.16	5.26	5.47	6.10
-1/8 in. to +28 MESH	-------	W	17.1	46.9	64.8	76.3	82.2	86.0	92.1	100.0
		S	3.81	4.39	4.74	4.97	5.11	5.20	5.41	6.18
-28 MESH-0	———	W	12.9	36.6	56.9	67.8	74.6	80.9	88.8	100.0
		S	3.71	4.12	4.50	4.67	4.78	4.87	5.05	6.03

DATA SHEET 49.-FLOAT AND SINK TESTS DATA SHEET, AND FLOAT SULFUR CURVES SHOWING YIELD OF FLOAT COAL VS. CUMULATIVE SULFUR CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COMPOSITE COAL SAMPLE (SECTIONS NO. 15 TO 18) FROM CENTRAL OHIO COAL COMPANY STRIP MINE, BROOKFIELD TWP., SE SW SEC. 4, NOBLE CO., OHIO.

Blank Page

INVESTIGATION RESULTS OF COAL SAMPLES FROM HANNA COAL COMPANY BARTON NO. 1 STRIP MINE



15'10" Overburden, lower 3' contains much carbonaceous shale and thin bony coal overlain by gray to buff shale, upper 3' weathered to soil.

6½" Coal, bright, blocky, with pyrite along bedding planes and some thin lenses of pyrite.

¼" Parting, clay, soft, carbonaceous

1½" Coal, bright, blocky.

¼" Parting, shale, carbonaceous.

15" Coal, alternately bright and dull, occasional thin pyrite lenses.

½" Parting, shale, soft, carbonaceous, considerable pyrite.

8½" Coal, bright, blocky, some thin fusain partings with fine pyrite laminae and occasional pyrite lenses.

2" Parting, shale, tough, carbonaceous

10" Coal, bright, some pyrite balls and lenses, somewhat bony at base.

Underclay

Fig. 10.– Cross section of coal bed at sampling face (Ref. No. 19/216 to 22/213) in SW SE Sec. 33, Wheeling Township, Belmont County, Ohio, of the Hanna Coal Company Barton No. 1 strip mine.

TABLE XIII. Analysis of coal samples (Ref. No. 19/216 to 22/213) from Hanna Coal Company, Barton No. 1 strip mine, SW SE Sec. 33, Wheeling Township, Belmont County, Ohio

Sample				Proximate analysis (% by wt.)					Gross heating value		Carbonization assay						
												Yields					
Reference number												cc./100 gm. charge		% by wt.		gal./ton	
E.E.S Laboratory	G.S.O. Locality	Thickness (in.)	Condition *	Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Btu./lb.	kg.-cal./kg.	Charge (gm.)	Tar	Liquor	Coke	Gas & loss	Tar	Liquor
19/216	585-4	8¼	a	2.19	39.45	49.59	8.77	3.35	12,869	7149	150.0	16.0	5.2	66.4	12.4	38.3	12.5
			b	0.00	40.33	50.70	8.97	3.43	13,157	7309	146.7	16.4	3.0	67.9	12.7	39.3	7.2
20/215	585-3	15¼	a	2.42	34.53	52.33	10.72	1.93	12,533	6962	150.0	13.2	4.8	69.9	12.1	31.6	11.5
			b	0.00	35.38	53.63	10.99	1.98	12,844	7135	146.4	13.5	2.5	71.6	12.4	32.4	6.0
21/214	585-2	9	a	2.45	34.57	52.73	10.25	2.61	12,488	6937	150.0	11.8	5.5	70.9	11.8	28.3	13.2
			b	0.00	35.44	54.05	10.51	2.68	12,801	7111	146.3	12.1	3.1	72.7	12.1	29.0	7.4
22/213	585-1	12	a	2.35	31.43	41.81	24.41	2.34	10,363	5757	150.0	10.7	5.2	74.0	10.1	25.6	12.5
			b	0.00	32.19	42.81	25.00	2.40	10,615	5897	146.5	11.0	2.9	75.8	10.3	26.4	7.0
Total or average (Calculated upon thickness)		44½	a	2.37	34.76	49.41	13.46	2.45	12,078	6710	150.0	12.9	5.1	70.4	11.6	30.9	12.2
			b	0.00	35.60	50.61	13.79	2.51	12,371	6872	146.5	13.2	2.8	72.1	11.9	31.6	6.7
Head sample **			a	2.06	35.42	49.75	12.77	2.51									
			b	0.00	36.16	50.80	13.04	2.56									

* Condition a refers to the air-dry sample; condition b refers to moisture-free sample.

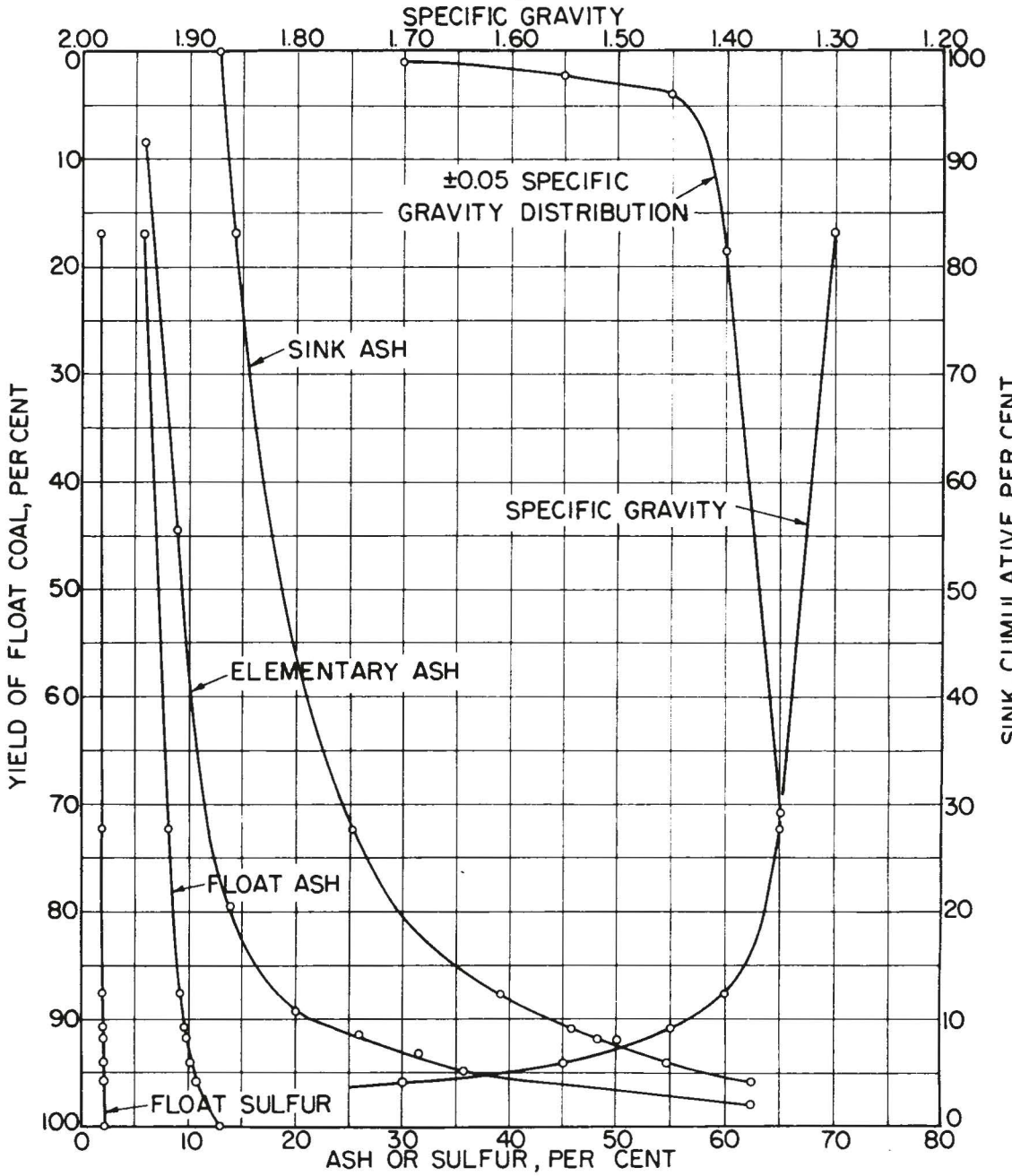
** A composite sample containing the same weight per cent (10%) from the total weight of each bench sample collected separately (No. 19 to 22); mineral CO_2 content in the "head sample": 0.11 per cent.

TABLE XIV. Screen tests and analysis data of various screen sizes of the composite coal sample (Ref. 19/216 to 22/213 from Hanna Coal Company, Barton No. 1 strip mine, SW SE Sec. 33, Wheeling Township, Belmont County, Ohio

Reference number		Screen size (in.)	Condition*	Weight (gm.)	Elementary data (%)				Computed cumulative data, (%)		
E.E.S. Lab.	G.S.O. Locality				Weight	Moisture	Ash	Sulfur	Weight	Ash	Sulfur
19/216 to 22/213 (Composite sample)	585-1 to 4	−1¼ to +1	a	19,067	37.9	1.54	12.31	2.30	37.9	12.31	2.30
			b			0.00	12.50	2.34		12.50	2.34
		−1 to +½	a	8,075	16.0	1.37	12.20	2.32	53.9	12.28	2.31
			b			0.00	12.37	2.35		12.45	2.34
		−½ to +½	a	9,684	19.2	1.38	12.36	2.28	73.1	12.30	2.30
			b			0.00	12.53	2.31		12.47	2.33
		−½ to +⅜	a	1,805	3.6	1.42	14.48	2.64	76.7	12.40	2.31
			b			0.00	14.69	2.68		12.58	2.34
		−⅜ to +¼	a	4,287	8.5	1.44	12.86	2.32	85.2	12.45	2.31
			b			0.00	13.05	2.35		12.63	2.34
		−¼ to +⅛	a	3,155	6.3	1.47	12.97	2.39	91.5	12.48	2.32
			b			0.00	13.16	2.43		12.67	2.35
		−⅛ inches to + 28 mesh	a	2,735	5.4	1.51	13.08	2.29	96.9	12.52	2.32
			b			0.00	13.28	2.33		12.71	2.35
		−28 mesh to 0	a	1,562	3.1	1.50	15.07	2.61	100.0	12.60	2.33
			b			0.00	15.30	2.65		12.78	2.36
Total or average (calculated upon weights)		−1¼ to 0	a	50,370	100.0	1.46	12.60	2.33			
			b			0.00	12.78	2.36			

* Condition a refers to air-dry sample; condition b refers to moisture-free sample.

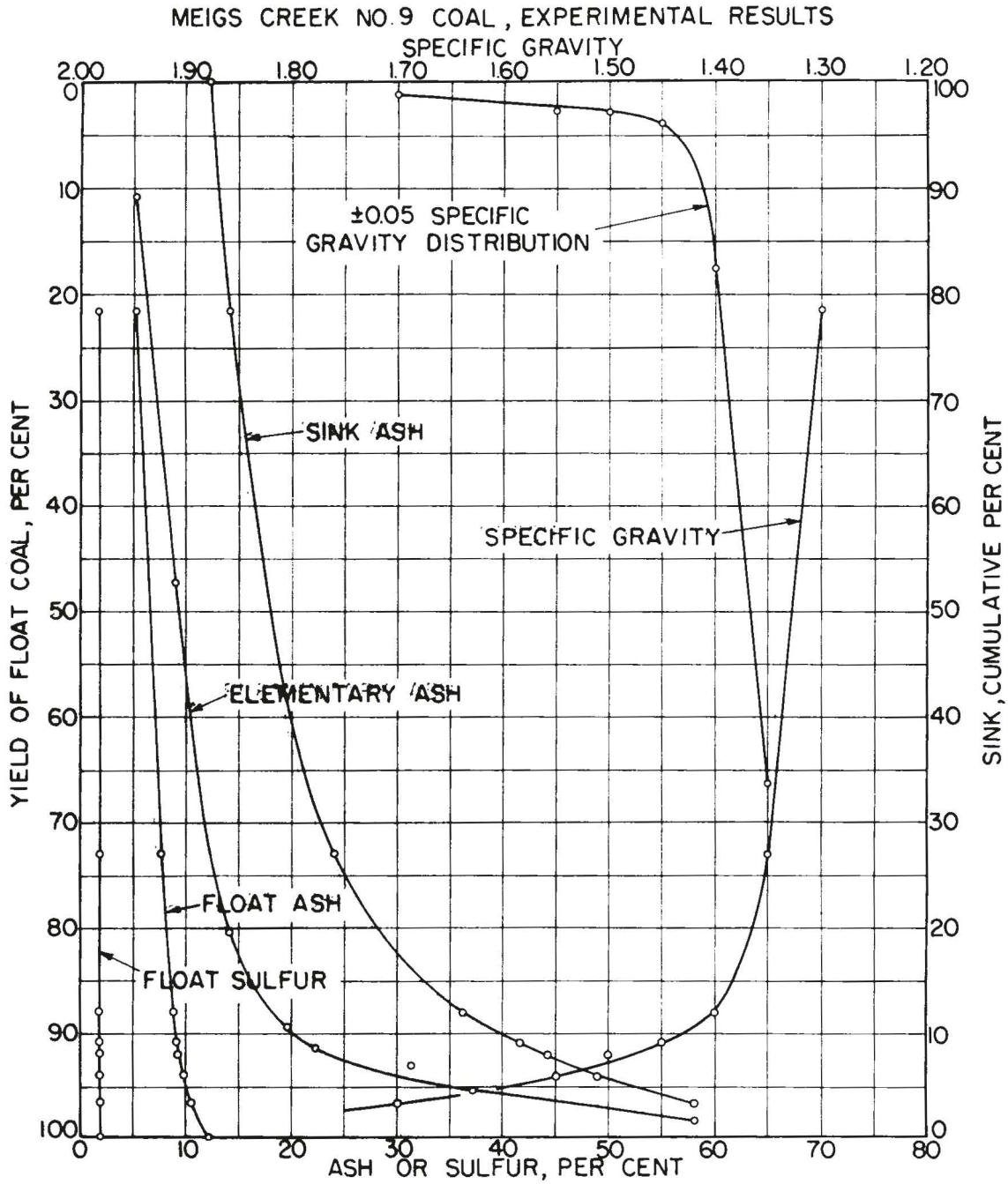
MEIGS CREEK NO. 9 COAL, EXPERIMENTAL RESULTS



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	2893	16.9	1.79	5.82	1.72	16.9	5.82	1.72	100.0	12.92	2.30	
1.30 - 1.35	9494	55.4	1.83	8.91	1.96	72.3	8.19	1.90	83.1	14.36	2.42	70.7
1.35 - 1.40	2613	15.3	1.75	14.08	2.25	87.6	9.22	1.96	27.7	25.27	3.34	18.5
1.40 - 1.45	554	3.2	1.61	20.01	2.31	90.8	9.60	1.98	12.4	39.06	4.70	4.2
1.45 - 1.50	176	1.0	1.41	25.97	2.81	91.8	9.78	1.99	9.2	45.69	5.46	3.3
1.50 - 1.55	391	2.3	1.30	31.49	3.17	94.1	10.31	2.01	8.2	48.07	5.77	2.2
1.55 - 1.70	295	1.7	1.35	35.68	3.97	95.8	10.76	2.05	5.9	54.55	6.93	1.0
Sink 1.70	724	4.2	1.36	62.28	8.06	100.0	12.92	2.30	4.2	62.28	8.06	
Totals	17,140	100.0										

* Moisture-free basis.

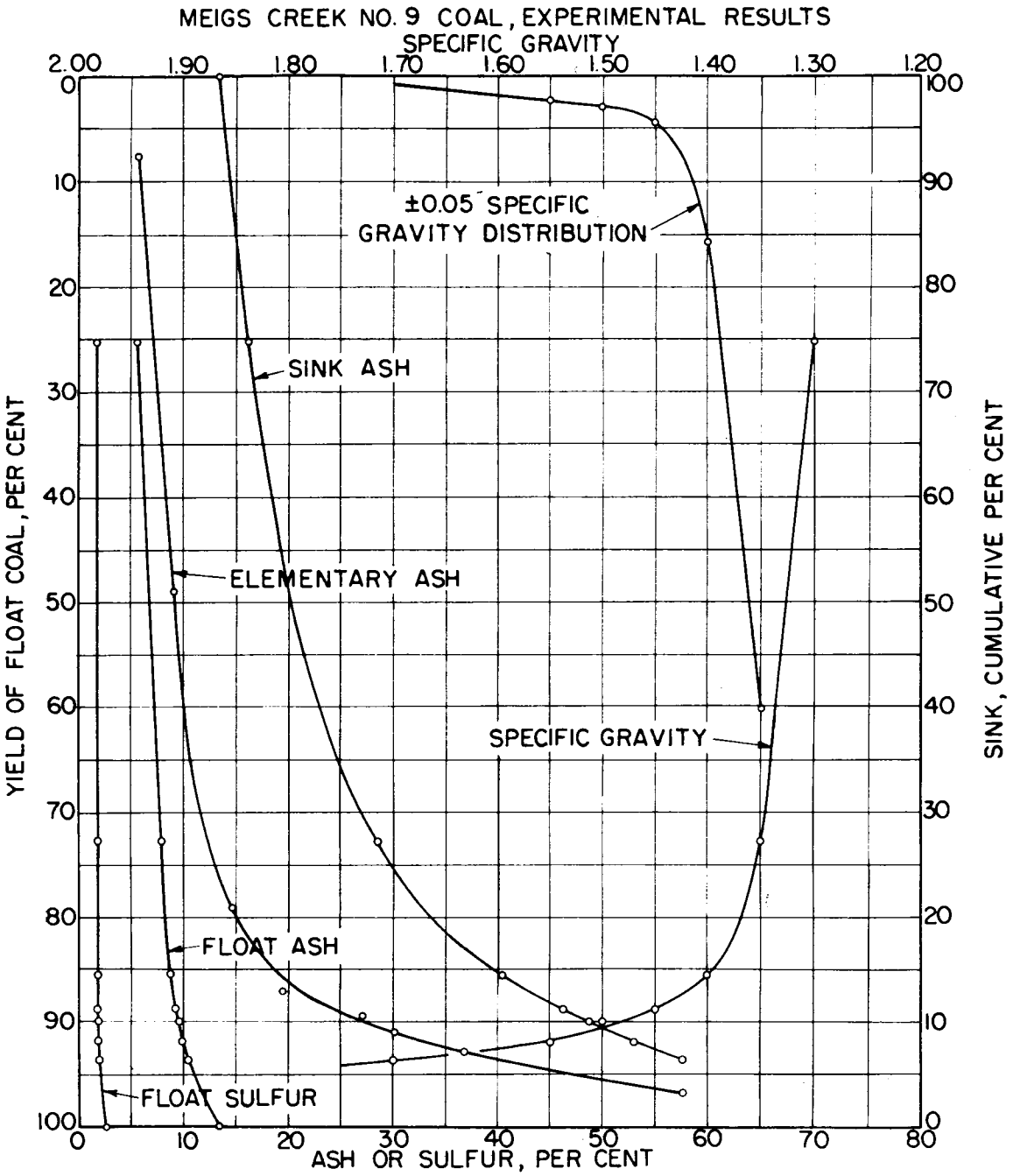
DATA SHEET 50. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Barton No. 1 strip mine, SW SE Sec. 33, Wheeling Township, Belmont County, Ohio. Screen size: $-1\frac{1}{4}$ to +1 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	1686	21.7	1.76	5.18	1.59	21.7	5.18	1.59	100.0	12.14	2.15	
1.30 - 1.35	4008	51.5	1.71	8.92	1.82	73.2	7.81	1.75	78.3	14.07	2.31	66.4
1.35 - 1.40	1158	14.9	1.68	14.17	2.11	88.1	8.89	1.81	26.8	23.97	3.24	17.8
1.40 - 1.45	227	2.9	1.59	19.66	2.36	91.0	9.23	1.83	11.9	36.20	4.67	4.0
1.45 - 1.50	86	1.1	1.43	22.45	2.68	92.1	9.39	1.84	9.0	41.56	5.39	3.2
1.50 - 1.55	160	2.1	1.33	31.43	3.63	94.2	9.88	1.88	7.9	44.20	5.76	3.0
1.55 - 1.70	201	2.6	1.37	37.24	4.49	96.8	10.61	1.95	5.8	48.85	6.54	1.5
Sink 1.70	249	3.2	1.34	58.24	8.20	100.0	12.14	2.15	3.2	58.24	8.20	
Totals	7775	100.0										

*Moisture-free basis.

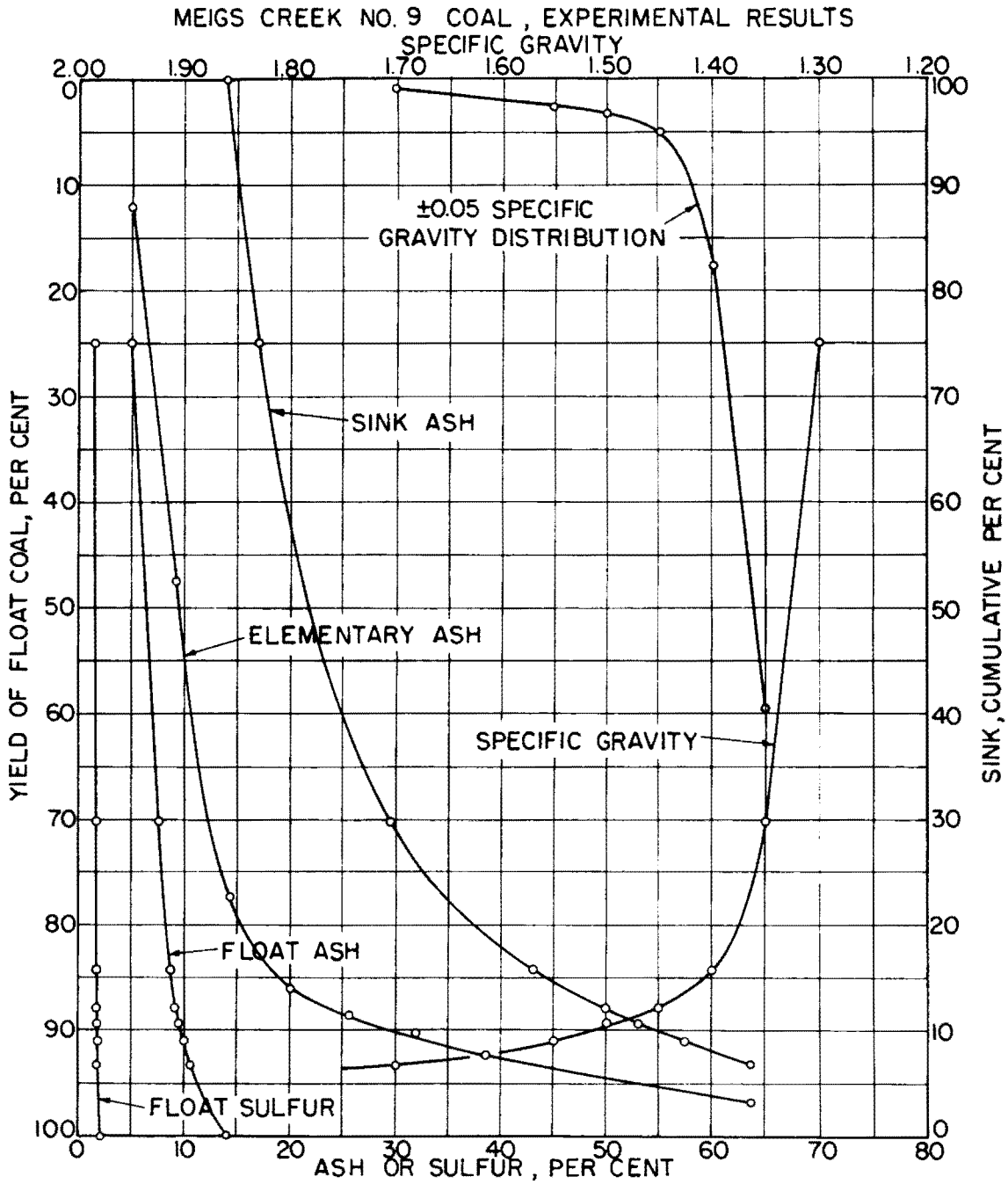
DATA SHEET 51. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Barton No. 1 strip mine, SW SE Sec. 33, Wheeling Township, Belmont County, Ohio. Screen size: -1 to +3/4 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	3727	25.3	1.69	5.53	1.62	25.3	5.53	1.62	100.0	13.46	2.54	
1.30 - 1.35	7017	47.5	1.65	9.08	1.85	72.8	7.85	1.77	74.7	16.15	2.85	60.2
1.35 - 1.40	1878	12.7	1.46	14.79	2.04	85.5	8.88	1.81	27.2	28.48	4.60	15.9
1.40 - 1.45	470	3.2	1.31	19.39	2.36	88.7	9.26	1.83	14.5	40.47	6.84	4.4
1.45 - 1.50	180	1.2	1.53	27.30	2.58	89.9	9.50	1.84	11.3	46.43	8.11	3.1
1.50 - 1.55	276	1.9	1.32	30.18	2.81	91.8	9.93	1.86	10.1	48.71	8.77	2.4
1.55 - 1.70	264	1.8	1.40	36.74	3.93	93.6	10.44	1.90	8.2	52.98	10.15	0.7
Sink 1.70	948	6.4	1.18	57.64	11.90	100.0	13.46	2.54	6.4	57.64	11.90	
Totals	14,760	100.0										

* Moisture-free basis.

DATA SHEET 52. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Barton No. 1 strip mine, SW SE Sec. 33, Wheeling Township, Belmont County, Ohio. Screen size: -3/4 to +1/2 inches.

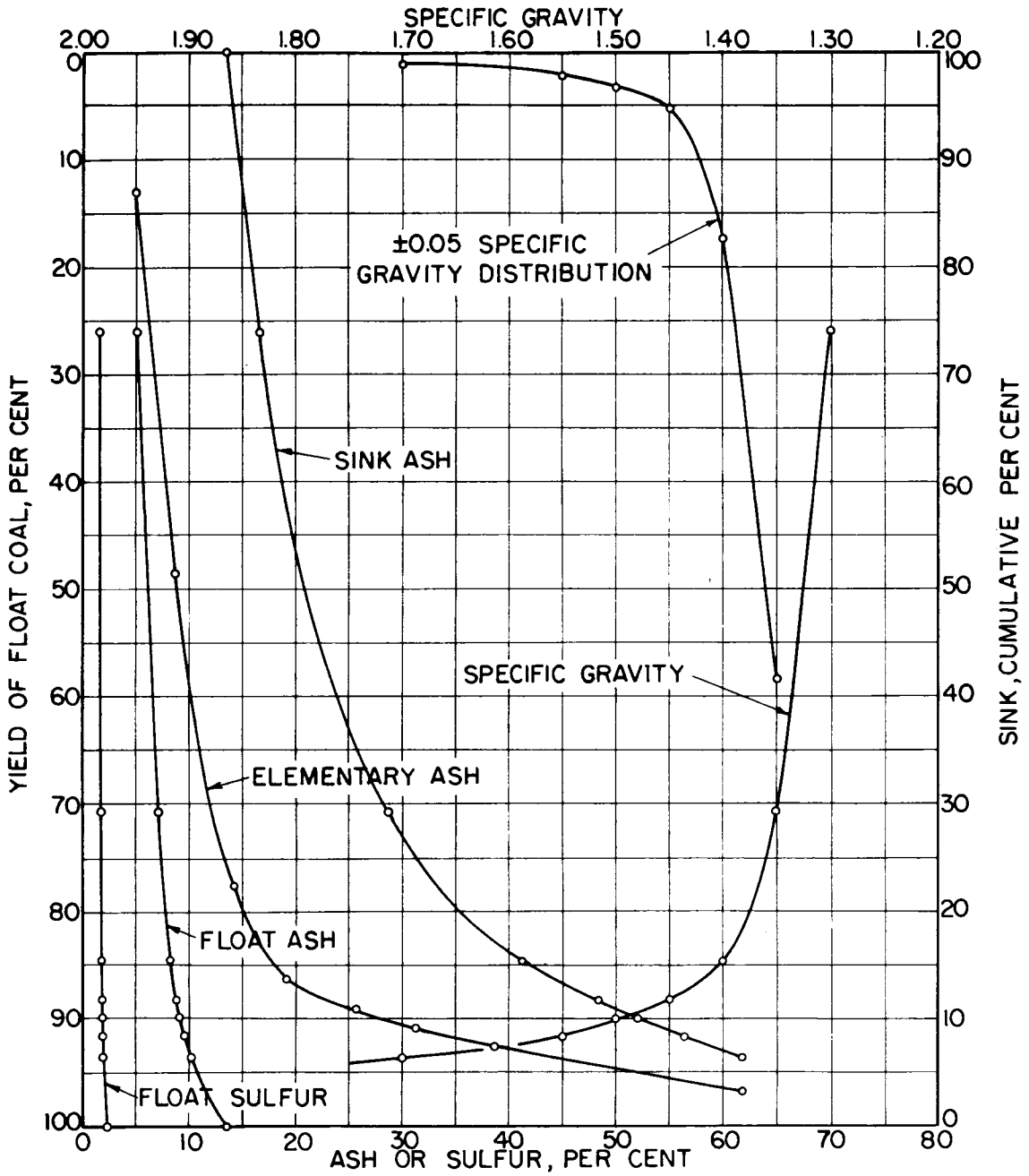


Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	1342	24.8	1.72	5.10	1.53	24.8	5.10	1.53	100.0	14.16	2.14	
1.30 - 1.35	2451	45.4	1.72	9.03	1.76	70.2	7.64	1.68	75.2	17.15	2.34	59.5
1.35 - 1.40	763	14.1	1.75	14.36	1.99	84.3	8.77	1.73	29.8	29.52	3.22	17.7
1.40 - 1.45	195	3.6	1.54	20.16	2.28	87.9	9.23	1.75	15.7	43.10	4.34	5.0
1.45 - 1.50	78	1.4	1.47	25.71	1.90	89.3	9.49	1.75	12.1	49.97	4.97	3.2
1.50 - 1.55	96	1.8	1.41	32.02	1.91	91.1	9.94	1.76	10.7	53.13	5.39	2.6
1.55 - 1.70	116	2.2	1.52	38.57	2.38	93.3	10.61	1.77	8.9	57.36	6.03	0.9
Sink 1.70	363	6.7	1.36	63.56	7.29	100.0	14.16	2.14	6.7	63.56	7.29	
Totals	5404	100.0										

* Moisture-free basis.

DATA SHEET 53. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Barton No. 1 strip mine, SW SE Sec. 33, Wheeling Township, Belmont County, Ohio. Screen size: -1/2 to +3/8 inches.

MEIGS CREEK NO. 9 COAL, EXPERIMENTAL RESULTS

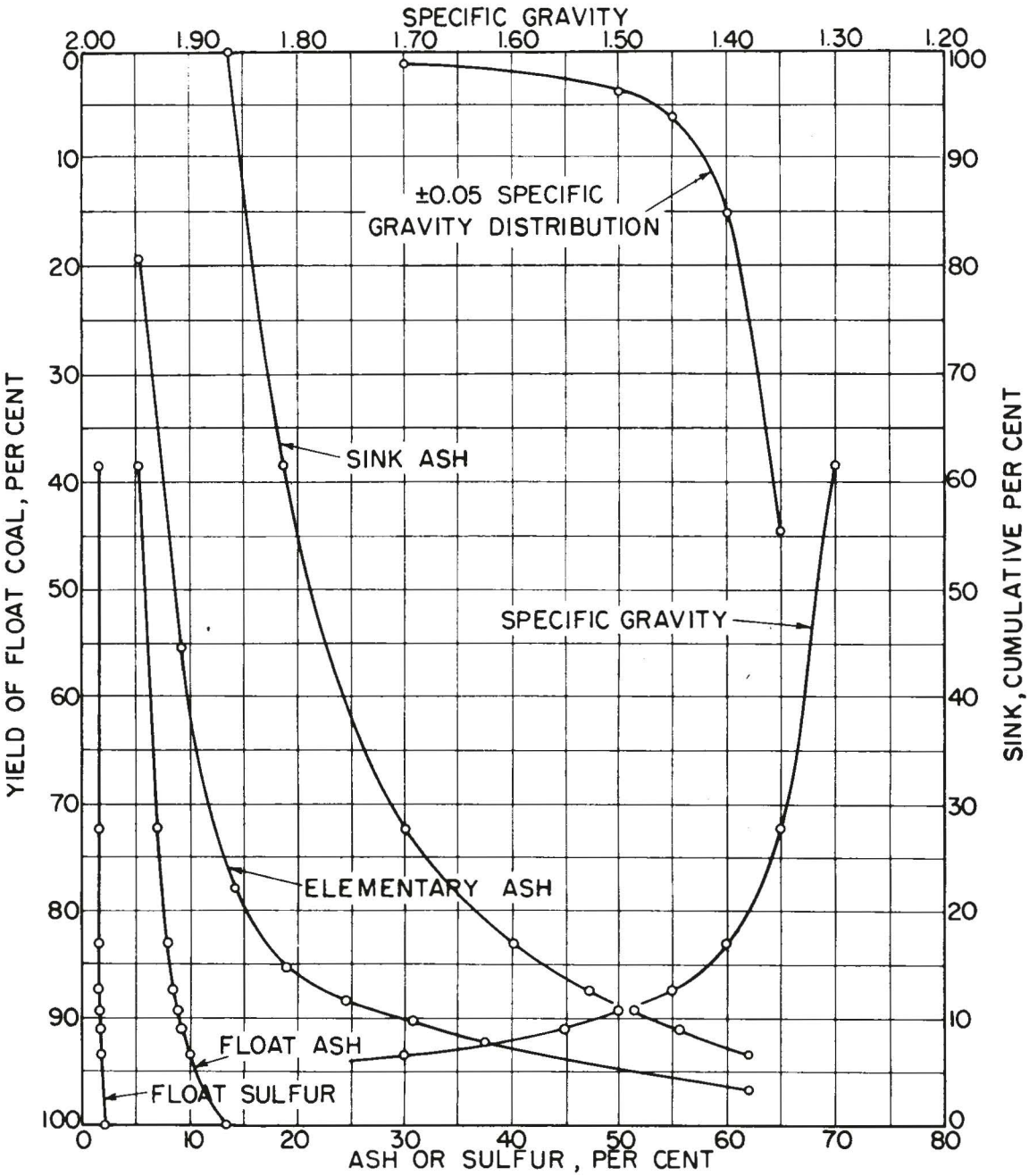


Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	3429	26.1	1.81	4.98	1.50	26.1	4.98	1.50	100.0	13.48	2.21	
1.30 - 1.35	5866	44.6	1.69	8.52	1.82	70.7	7.21	1.70	73.9	16.48	2.46	58.4
1.35 - 1.40	1808	13.8	1.50	14.16	2.18	84.5	8.35	1.78	29.3	28.61	3.44	17.5
1.40 - 1.45	485	3.7	1.44	19.18	2.26	88.2	8.80	1.80	15.5	41.45	4.55	5.3
1.45 - 1.50	207	1.6	1.53	25.67	2.36	89.8	9.10	1.81	11.8	48.46	5.27	3.4
1.50 - 1.55	242	1.8	1.47	31.29	2.59	91.6	9.54	1.83	10.2	52.04	5.73	2.4
1.55 - 1.70	256	1.9	1.37	38.63	3.01	93.5	10.13	1.85	8.4	56.44	6.35	1.1
Sink 1.70	851	6.5	1.33	61.74	7.43	100.0	13.48	2.21	6.5	61.74	7.43	
Totals	13,144	100.0										

* Moisture-free basis.

DATA SHEET 54. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Barton No. 1 strip mine, SW SE Sec. 33, Wheeling Township, Belmont County, Ohio. Screen size: -3/8 to +1/4 inches.

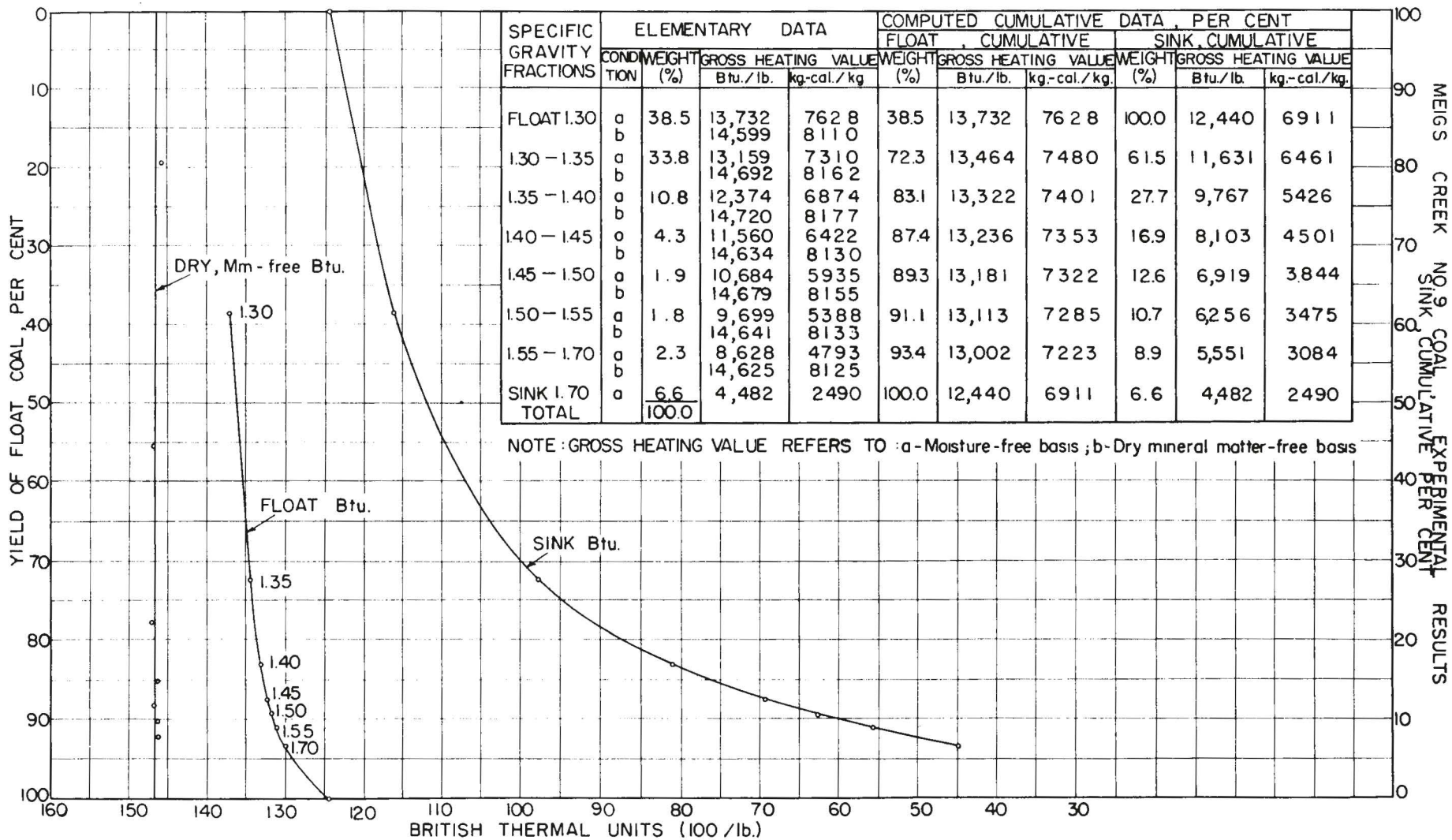
MEIGS CREEK NO. 9 COAL, EXPERIMENTAL RESULTS



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	4835	38.5	1.68	5.21	1.50	38.5	5.21	1.50	100.0	13.50	2.23	
1.30 - 1.35	4250	33.8	1.62	9.30	1.85	72.3	7.12	1.66	61.5	18.69	2.70	44.6
1.35 - 1.40	1360	10.8	1.54	14.33	2.19	83.1	8.06	1.73	27.7	30.15	3.72	15.1
1.40 - 1.45	534	4.3	1.60	18.95	2.58	87.4	8.59	1.77	16.9	40.25	4.69	6.2
1.45 - 1.50	241	1.9	1.55	24.69	2.64	89.3	8.94	1.79	12.6	47.33	5.42	3.7
1.50 - 1.55	221	1.8	1.51	30.80	2.35	91.1	9.37	1.80	10.7	51.56	5.90	2.6
1.55 - 1.70	294	2.3	1.47	37.52	2.32	93.4	10.06	1.82	8.9	55.77	6.63	1.1
Sink 1.70	829	6.6	1.29	62.13	8.04	100.0	13.50	2.23	6.6	62.13	8.04	
Totals	12,564	100.0										

* Moisture-free basis.

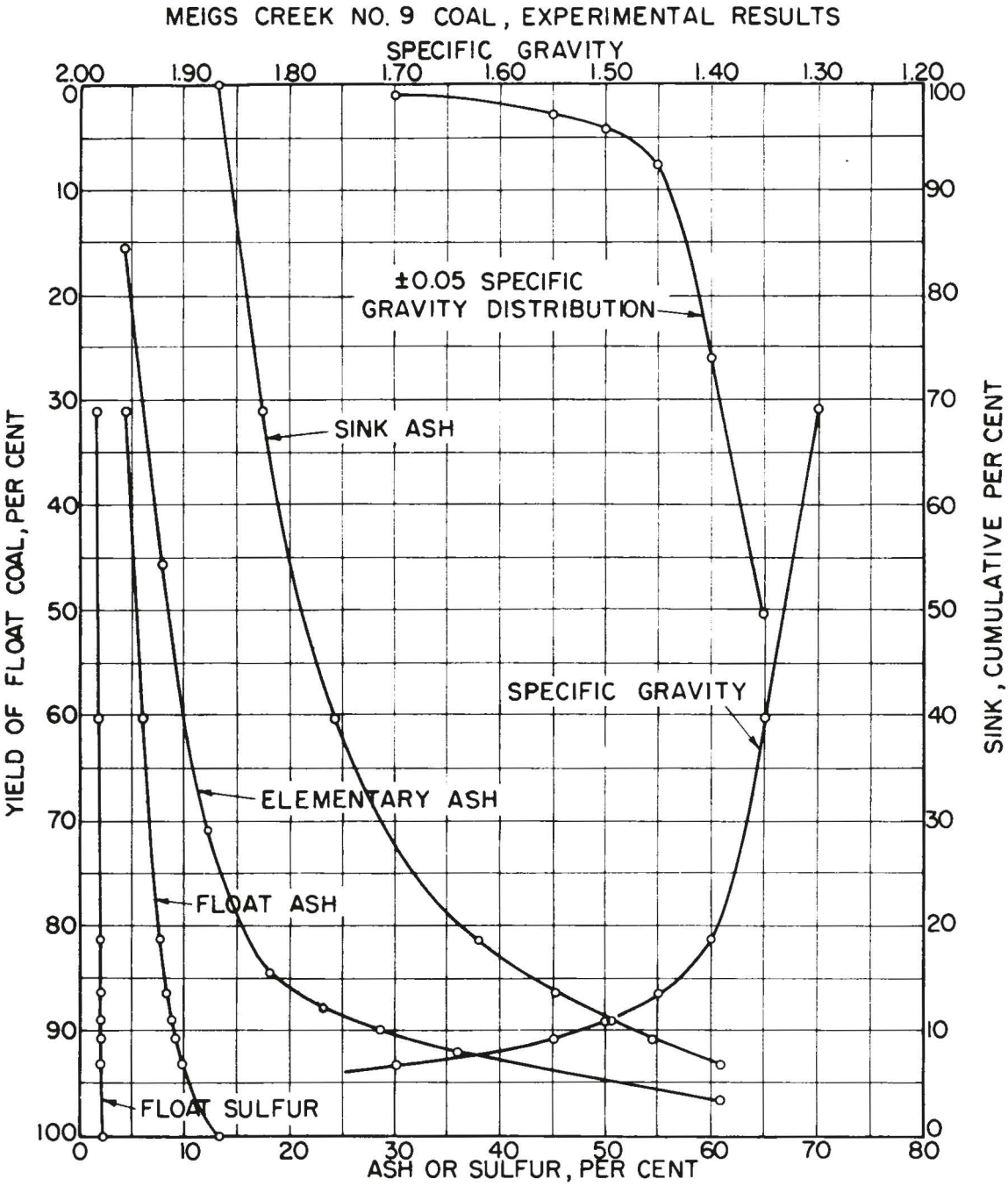
DATA SHEET 55. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Barton No. 1 strip mine. SW SE Sec. 33, Wheeling Township, Belmont County, Ohio. Screen size: -1/4 to +1/8 inches.



SPECIFIC GRAVITY FRACTIONS	ELEMENTARY DATA				COMPUTED CUMULATIVE DATA, PER CENT					
					FLOAT, CUMULATIVE			SINK, CUMULATIVE		
	CONDITION	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.	WEIGHT (%)	GROSS HEATING VALUE Btu./lb.	GROSS HEATING VALUE kg.-cal./kg.
FLOAT 1.30	a	38.5	13,732	7628	38.5	13,732	7628	100.0	12,440	6911
	b		14,599	8110						
1.30 – 1.35	a	33.8	13,159	7310	72.3	13,464	7480	61.5	11,631	6461
	b		14,692	8162						
1.35 – 1.40	a	10.8	12,374	6874	83.1	13,322	7401	27.7	9,767	5426
	b		14,720	8177						
1.40 – 1.45	a	4.3	11,560	6422	87.4	13,236	7353	16.9	8,103	4501
	b		14,634	8130						
1.45 – 1.50	a	1.9	10,684	5935	89.3	13,181	7322	12.6	6,919	3844
	b		14,679	8155						
1.50 – 1.55	a	1.8	9,699	5388	91.1	13,113	7285	10.7	6,256	3475
	b		14,641	8133						
1.55 – 1.70	a	2.3	8,628	4793	93.4	13,002	7223	8.9	5,551	3084
	b		14,625	8125						
SINK 1.70	a	6.6	4,482	2490	100.0	12,440	6911	6.6	4,482	2490
TOTAL		100.0								

NOTE: GROSS HEATING VALUE REFERS TO: a-Moisture-free basis; b-Dry mineral matter-free basis

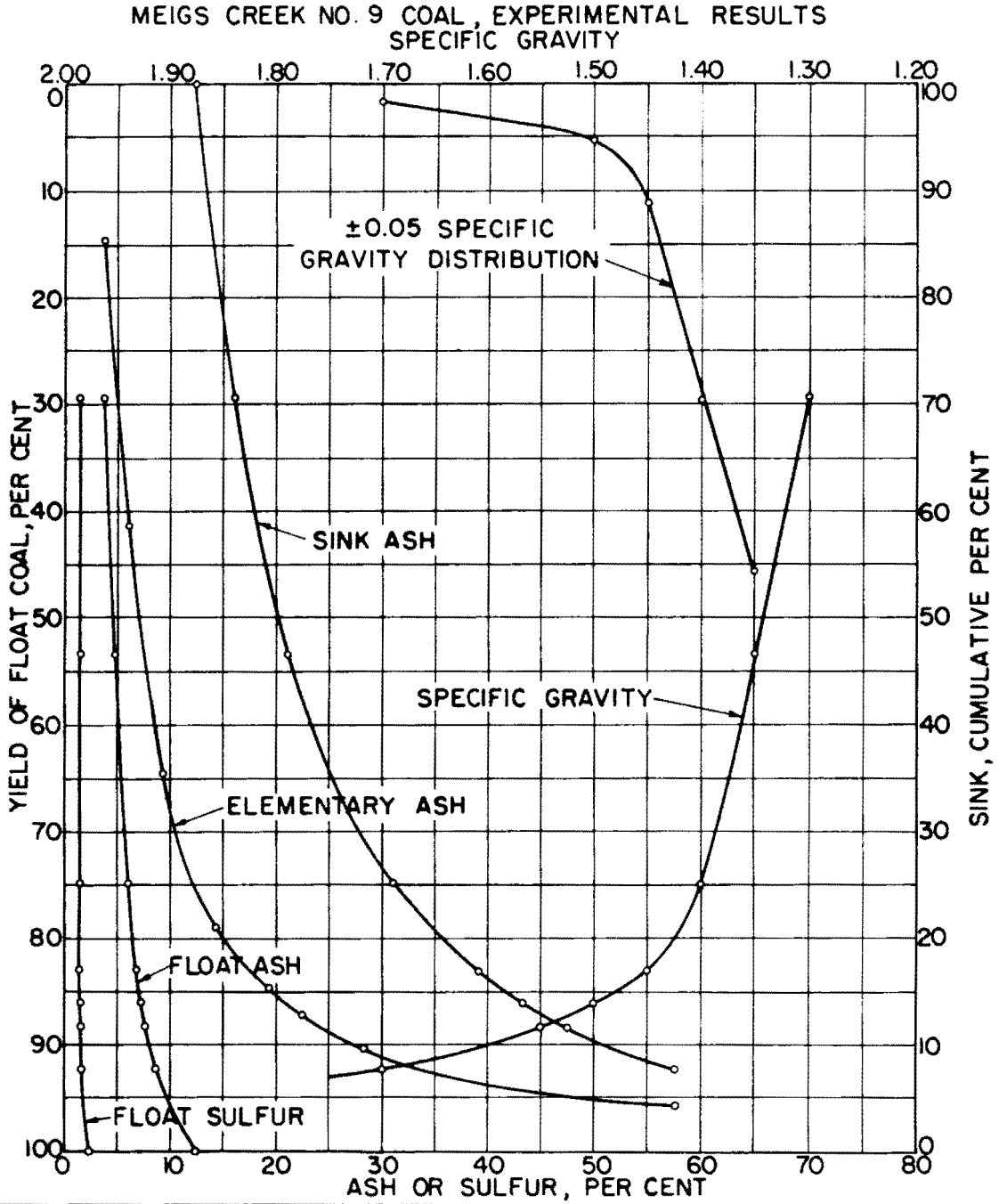
DATA SHEET 56.-FLOAT AND SINK TESTS DATA SHEET AND B.T.U. CURVES SHOWING GROSS HEATING VALUE OF VARIOUS SPECIFIC GRAVITY FRACTIONS; COAL SAMPLE FROM HANNA COAL COMPANY BARTON NO. 1 STRIP MINE, SW SE SEC. 33, WHEELING TWP., BELMONT CO., OHIO. SCREEN SIZE:- $\frac{1}{4}$" to + $\frac{1}{8}$".



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	948	31.0	1.80	4.20	1.44	31.0	4.20	1.44	100.0	13.15	2.19	
1.30 - 1.35	894	29.2	1.80	7.67	1.67	60.2	5.88	1.55	69.0	17.17	2.53	50.3
1.35 - 1.40	644	21.1	1.62	12.07	1.89	81.3	7.49	1.64	39.8	24.15	3.16	26.2
1.40 - 1.45	155	5.1	1.68	17.98	2.38	86.4	8.11	1.68	18.7	37.76	4.58	7.7
1.45 - 1.50	80	2.6	1.77	23.04	2.57	89.0	8.54	1.71	13.6	45.17	5.43	4.3
1.50 - 1.55	51	1.7	1.83	28.40	2.42	90.7	8.92	1.72	11.0	50.45	6.07	2.8
1.55 - 1.70	74	2.4	2.34	35.80	2.43	93.1	9.61	1.74	9.3	54.40	6.77	0.9
Sink 1.70	210	6.9	2.08	60.89	8.27	100.0	13.15	2.19	6.9	60.89	8.27	
Totals	3056	100.0										

* Moisture-free basis.

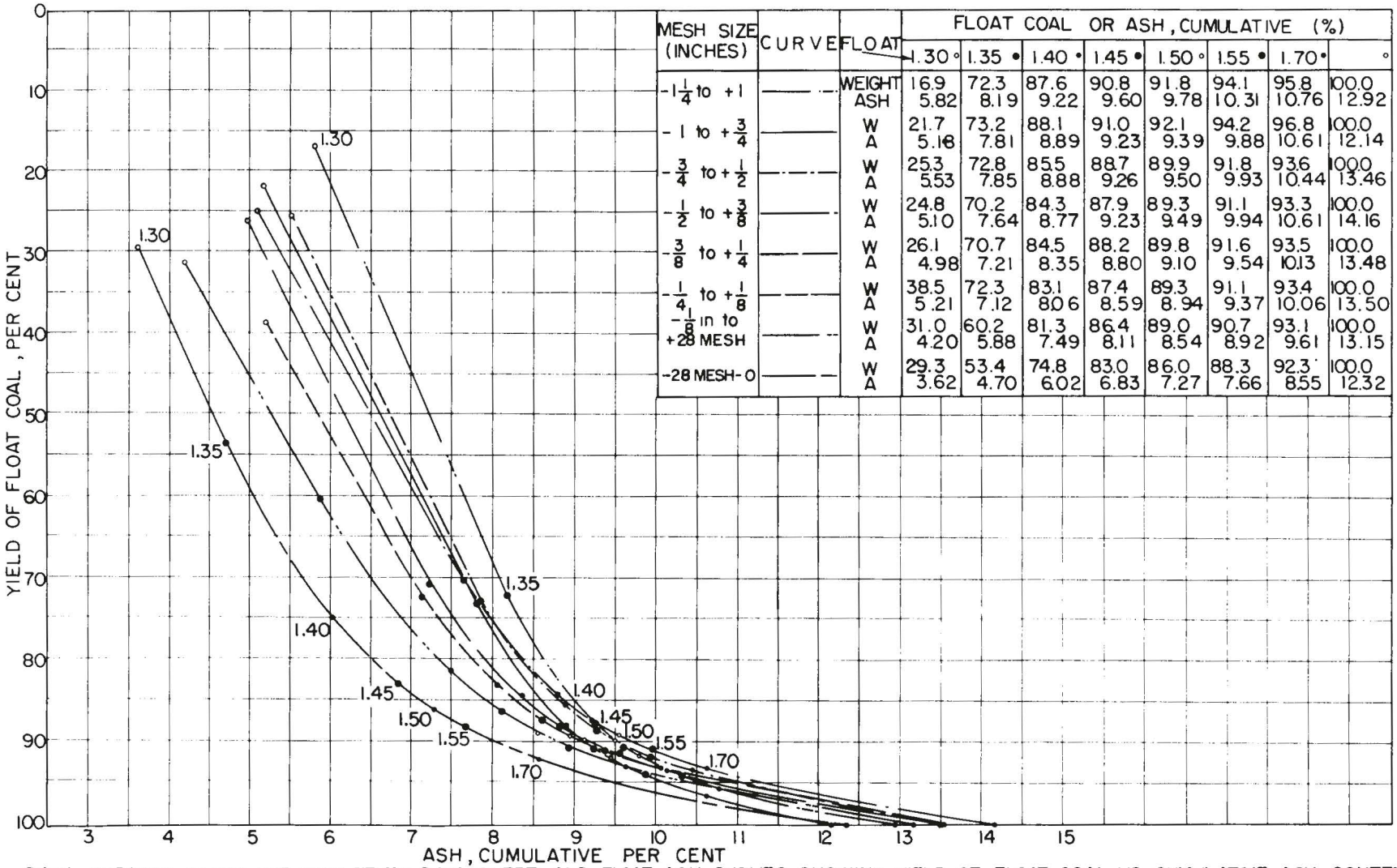
DATA SHEET 57. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Barton No. 1 strip mine, SW SE Sec. 33, Wheeling Township, Belmont County, Ohio. Screen size: -1/8 inches to +28 mesh.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	909	29.3	2.01	3.62	1.37	29.3	3.62	1.37	100.0	12.32	2.21	
1.30 - 1.35	748	24.1	2.05	6.02	1.44	53.4	4.70	1.40	70.7	15.93	2.56	45.5
1.35 - 1.40	664	21.4	2.22	9.31	1.53	74.8	6.02	1.44	46.6	21.05	3.14	29.6
1.40 - 1.45	253	8.2	2.66	14.19	1.70	83.0	6.83	1.46	25.2	31.02	4.50	11.2
1.45 - 1.50	93	3.0	2.49	19.43	1.95	86.0	7.27	1.48	17.0	39.12	5.87	5.3
1.50 - 1.55	70	2.3	2.34	22.48	2.16	88.3	7.66	1.50	14.0	43.34	6.69	4.0
1.55 - 1.70	124	4.0	2.90	28.15	2.37	92.3	8.55	1.54	11.7	47.49	7.57	1.6
Sink 1.70	239	7.7	2.27	57.55	10.33	100.0	12.32	2.21	7.7	57.55	10.33	
Totals	3100	100.0										

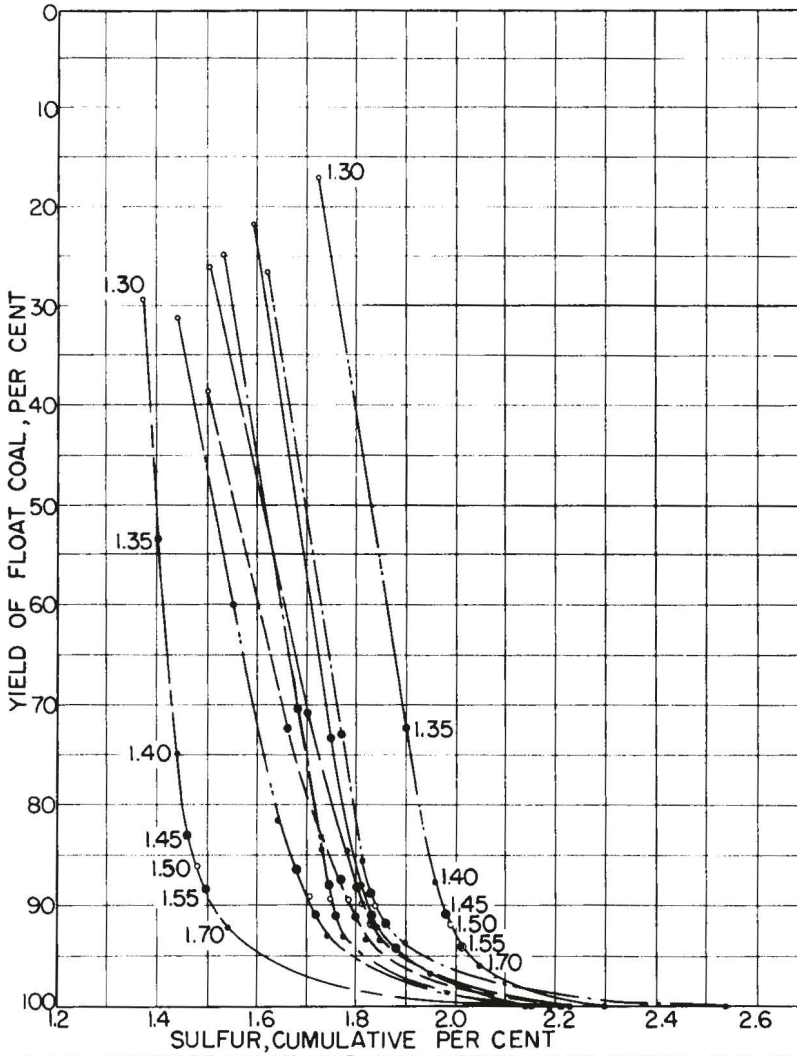
* Moisture-free basis.

DATA SHEET 58. - Float-and-sink tests data sheet and washability curves; coal sample from Hanna Coal Company Barton No. 1 strip mine, SW SE Sec. 33, Wheeling Township, Belmont County, Ohio. Screen size: -28 mesh to 0.



MESH SIZE (INCHES)	CURVE	FLOAT	FLOAT COAL OR ASH, CUMULATIVE (%)							
			1.30 °	1.35 •	1.40 •	1.45 •	1.50 °	1.55 •	1.70 •	°
-1 1/4 to +1	———	WEIGHT	16.9	72.3	87.6	90.8	91.8	94.1	95.8	100.0
		ASH	5.82	8.19	9.22	9.60	9.78	10.31	10.76	12.92
-1 to +3/4	———	W	21.7	73.2	88.1	91.0	92.1	94.2	96.8	100.0
		A	5.18	7.81	8.89	9.23	9.39	9.88	10.61	12.14
-3/4 to +1/2	———	W	25.3	72.8	85.5	88.7	89.9	91.8	93.6	100.0
		A	5.53	7.85	8.88	9.26	9.50	9.93	10.44	13.46
-1/2 to +3/8	———	W	24.8	70.2	84.3	87.9	89.3	91.1	93.3	100.0
		A	5.10	7.64	8.77	9.23	9.49	9.94	10.61	14.16
-3/8 to +1/4	———	W	26.1	70.7	84.5	88.2	89.8	91.6	93.5	100.0
		A	4.98	7.21	8.35	8.80	9.10	9.54	10.13	13.48
-1/4 to +1/8	———	W	38.5	72.3	83.1	87.4	89.3	91.1	93.4	100.0
		A	5.21	7.12	8.06	8.59	8.94	9.37	10.06	13.50
-1/8 in to +28 MESH	———	W	31.0	60.2	81.3	86.4	89.0	90.7	93.1	100.0
		A	4.20	5.88	7.49	8.11	8.54	8.92	9.61	13.15
-28 MESH-0	———	W	29.3	53.4	74.8	83.0	86.0	88.3	92.3	100.0
		A	3.62	4.70	6.02	6.83	7.27	7.66	8.55	12.32

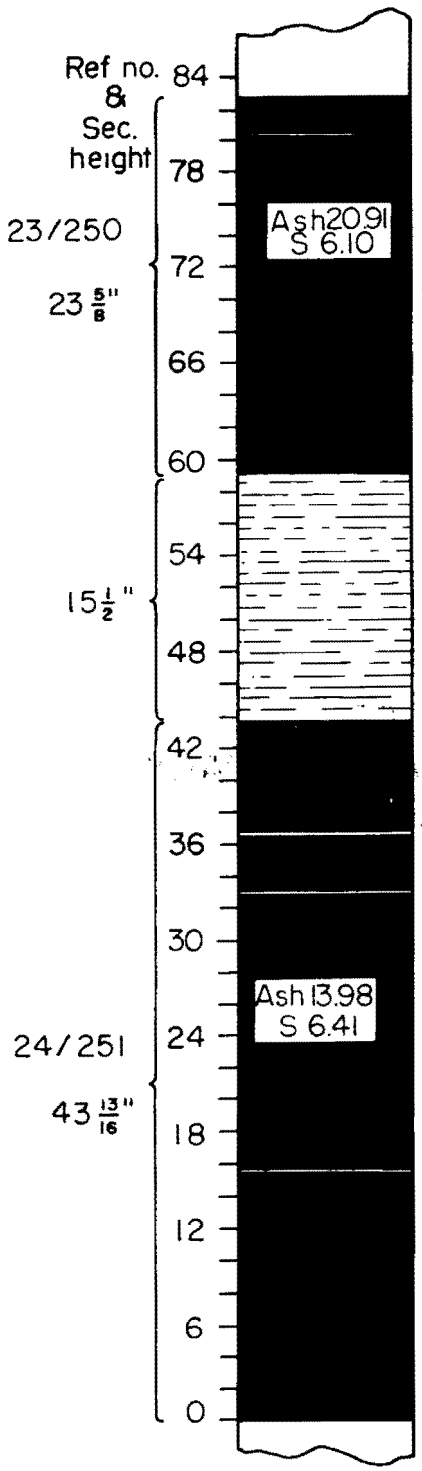
DATA SHEET 59:- FLOAT AND SINK TESTS DATA SHEET, AND FLOAT ASH CURVES SHOWING YIELD OF FLOAT COAL VS. CUMULATIVE ASH CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COMPOSITE COAL SAMPLE (SECTIONS NO. 19 TO 22) FROM HANNA COAL COMPANY BARTON NO.1 STRIP MINE, SW SE SEC. 33, WHEELING TWP., BELMONT CO., OHIO.



MESH SIZE (INCHES)	CURVE	FLOAT	FLOAT COAL OR SULFUR CUMULATIVE (%)							
			1.30 ◦	1.35 •	1.40 •	1.45 •	1.50 ◦	1.55 •	1.70 •	◦
$-1\frac{1}{4}$ to +1	——·——	WEIGHT	16.9	72.3	87.6	90.8	91.8	94.1	95.8	100.0
		SULFUR	1.72	1.90	1.96	1.98	1.99	2.01	2.05	2.30
-1 to $+\frac{3}{4}$	———	W	21.7	73.2	88.1	91.0	92.1	94.2	96.8	100.0
		S	1.59	1.75	1.81	1.83	1.84	1.88	1.95	2.15
$-\frac{3}{4}$ to $+\frac{1}{2}$	——·——	W	25.3	72.8	85.5	88.7	89.9	91.8	93.6	100.0
		S	1.62	1.77	1.81	1.83	1.84	1.86	1.90	2.54
$-\frac{1}{2}$ to $+\frac{3}{8}$	——·——	W	24.8	70.2	84.3	87.9	89.3	91.1	93.3	100.0
		S	1.53	1.68	1.73	1.75	1.75	1.76	1.77	2.14
$-\frac{3}{8}$ to $+\frac{1}{4}$	—— ——	W	26.1	70.7	84.5	88.2	89.8	91.6	93.5	100.0
		S	1.50	1.70	1.78	1.80	1.81	1.83	1.85	2.21
$-\frac{1}{4}$ to $+\frac{1}{8}$	—— ——	W	38.5	72.3	83.1	87.4	89.3	91.1	93.4	100.0
		S	1.50	1.66	1.73	1.77	1.79	1.80	1.82	2.23
$-\frac{1}{8}$ in to +28 MESH	——·——	W	31.0	60.2	81.3	86.4	89.0	90.7	93.1	100.0
		S	1.44	1.55	1.64	1.68	1.71	1.72	1.74	2.19
-28 MESH-0	—— ——	W	29.3	53.4	74.8	83.0	86.0	88.3	92.3	100.0
		S	1.37	1.40	1.44	1.46	1.48	1.50	1.54	2.21

DATA SHEET 60-FLOAT AND SINK TESTS DATA SHEET, AND FLOAT SULFUR CURVES SHOWING THE YIELD OF FLOAT COAL VS. CUMULATIVE SULFUR CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COMPOSITE COAL SAMPLE (SECTIONS NO. 19 TO 22) FROM HANNA COAL COMPANY BARTON NO. 1 STRIP MINE, SW SE SEC. 33, WHEELING TWP., BELMONT CO., OHIO.

INVESTIGATION RESULTS OF COAL SAMPLES FROM KOONTZ COAL COMPANY STRIP MINE NEAR HARRIETSVILLE



5'6" Shale gray hard massive where fresh.

2½" Bony cooly shale, black, hard.

3⅛" Coal, thin-banded, rather bony.

⅛" Parting, shale, pyritic, with lenticular masses of pyrite, varies 1/16" to ⅛" in thickness.

6¼" Coal, medium to thick banded, tough, rather bony.

⅛" Parting, shale, much fusain.

11½" Coal, blocky, tough, rather bony throughout.

15½" Clay shale, gray, hard, tough, persistent parting.

7" Coal, medium banded, very blocky.

⅛" Carbonaceous shale, with much pyrite in lenticular masses.

3½" Coal, blocky, with many thin discontinuous shaly streaks and partings.

⅛" Coal, shaly.

17½" Coal, blocky, bright, medium to thick banded.

1/16" Shale, pyrite.

15½" Coal, medium bright, thinbanded.

Fig. 11.— Cross section of coal bed at sampling face (Ref. No. 23/250 to 24/251) in SE ¼ SE ¼ Sec. 25, Elk Township, Noble County, Ohio, of the Koontz Coal Company strip mine near Harriettsville.

TABLE XV. Analysis of coal samples (Ref. No. 23/250 to 24/251) from Koontz Coal Company strip mine near Harriettaville, SE ¼ SE ¼ Sec. 25, Elk Township, Noble County, Ohio.

Sample				Proximate analysis (% by wt.)					Gross heating value		Carbonization assay								
Reference number												Yields							
												(% by wt.)				(per short ton)			
E.E.S. Laboratory	G.S.O. Locality	Thickness (in.)	Condition *	Moisture	Volatile matter**	Fixed carbon	Ash	Sulfur	Btu./lb.	kg-cal/kg.	Charge (gm.)	Tar	Liquor	Coke	Gas, air free †	Tar (gal.)	Liquor (gal.)	Gas ‡ (cu.ft.)	Sulfur (lb.)
23/250	572-1	23⅜	a	2.79	36.33	40.56	20.32	5.93	11,160	6200	97.1	16.9	6.0	69.3	7.8	40.5	14.4	2280	33.4
			b	1.28	36.89	41.19	20.64	6.02	11,334	6296	95.6	17.2	4.5	70.4	7.9	41.2	10.8	2315	33.9
			c	0.00	37.37	41.72	20.91	6.10	11,480	6378	94.4	17.4	3.3	71.3	8.0	41.7	7.9	2345	34.3
24/251	572-2	43¹³/₁₆	a	2.24	40.36	43.74	13.66	6.27	12,125	6736	75.8	17.4	6.0	67.4	9.2	41.7	14.4	2595	37.7
			b	1.41	40.70	44.11	13.78	6.32	12,228	6793	75.2	17.5	5.2	68.0	9.3	41.9	12.5	2617	38.0
			c	0.00	41.28	44.74	13.98	6.41	12,403	6890	74.1	17.8	3.8	69.0	9.4	42.7	9.1	2654	38.5

* Condition a refers to the sample as received; condition b refers to the air-dry sample; condition c refers to moisture-free sample.

** Mineral CO_2 content of the sample (Ref. No. 23/250): 0.11 per cent; (Ref. No. 24/251): 0.07 per cent, both on air-dry basis.

† Includes H_2S in per cent by weight of charge: sample No. 23/250 – 1.75%; sample No. 24/251 – 1.96%.

‡ 30 in. 60°F, wet.

TABLE XVI. Gas analysis of assay carbonization test of the coal samples (Ref. No. 23/250 to 24/251) from Koontz Coal Company strip mine near Harriettaville, SE ¼ SE ¼ Sec. 25. Elk Township, Noble County, Ohio

	Composition, dry (% by vol.)									
Condition*	H_2S	CO_2	Illuminants	O_2	CO	H_2	Saturated hydrocarbons	N_2	Carbon number	Total H_2S (gr/100 cu.ft.)
a	25.5	5.9	4.4	0.0	4.1	6.5	50.7	2.9	1.29	15,983
b	0.0	7.9	5.9	0.0	5.5	8.7	68.1	3.9		
a	27.0	6.0	4.5	0.0	4.1	6.8	49.0	2.6	1.33	16,924
b	0.0	8.2	6.2	0.0	5.6	9.3	67.1	3.6		

* a air-free; b air- and H_2S-free gas.

TABLE XVII. Screen tests and analysis data of various screen sizes of the coal sample (Ref. No. 23/250) from upper bench of Koontz Coal Company strip mine near Harriettsville, SE ¼ SE ¼ Sec. 25, Elk Township, Noble County, Ohio.

Screen size (in)	Condition*	Weight (gm.)	Elementary data (%)				Computed, cumulative data (%)		
			Weight	Moisture	Ash	Sulfur	Weight	Ash	Sulfur
−2 to +1½	a	11,532	17.0	1.49	19.24	5.25	17.0	19.24	5.25
	b			0.00	19.53	5.33		19.53	5.33
−1½ to +1	a	15,994	23.6	1.48	19.63	4.59	40.6	19.47	4.87
	b			0.00	19.92	4.66		19.76	4.94
−1 to +¾	a	9,075	13.4	1.63	19.57	5.74	54.0	19.47	5.08
	b			0.00	19.89	5.84		19.79	5.16
−¾ to +½	a	12,097	17.8	1.44	20.73	6.85	71.8	19.81	5.53
	b			0.00	21.03	6.95		20.10	5.61
−½ to +⅜	a	2,359	3.5	1.31	20.45	6.06	75.3	19.87	5.56
	b			0.00	20.72	6.14		20.13	5.63
−⅜ to +¼	a	5,862	8.7	1.24	19.78	6.07	84.0	19.87	5.62
	b			0.00	20.03	6.15		20.12	5.69
−¼ to +⅛	a	4,410	6.5	1.25	20.04	6.22	90.5	19.88	5.66
	b			0.00	20.29	6.30		20.13	5.73
−⅛ inch to +28 mesh	a	4,365	6.4	1.25	21.27	6.90	96.9	19.97	5.74
	b			0.00	21.54	6.99		20.22	5.81
+28 mesh to 0	a	2,102	3.1	1.50	25.08	7.65	100.0	20.08	5.78
	b			0.00	25.47	7.77		20.38	5.87
Total or average	a	67,796	100.0	1.44	20.08	5.78			
	b			0.00	20.38	5.87			
Head sample**	a	6,780	10.0	1.28	20.64	6.02			
	b			0.00	20.91	6.10			

* Condition a refers to the air dry sample; condition b refers to the moisture-free sample.

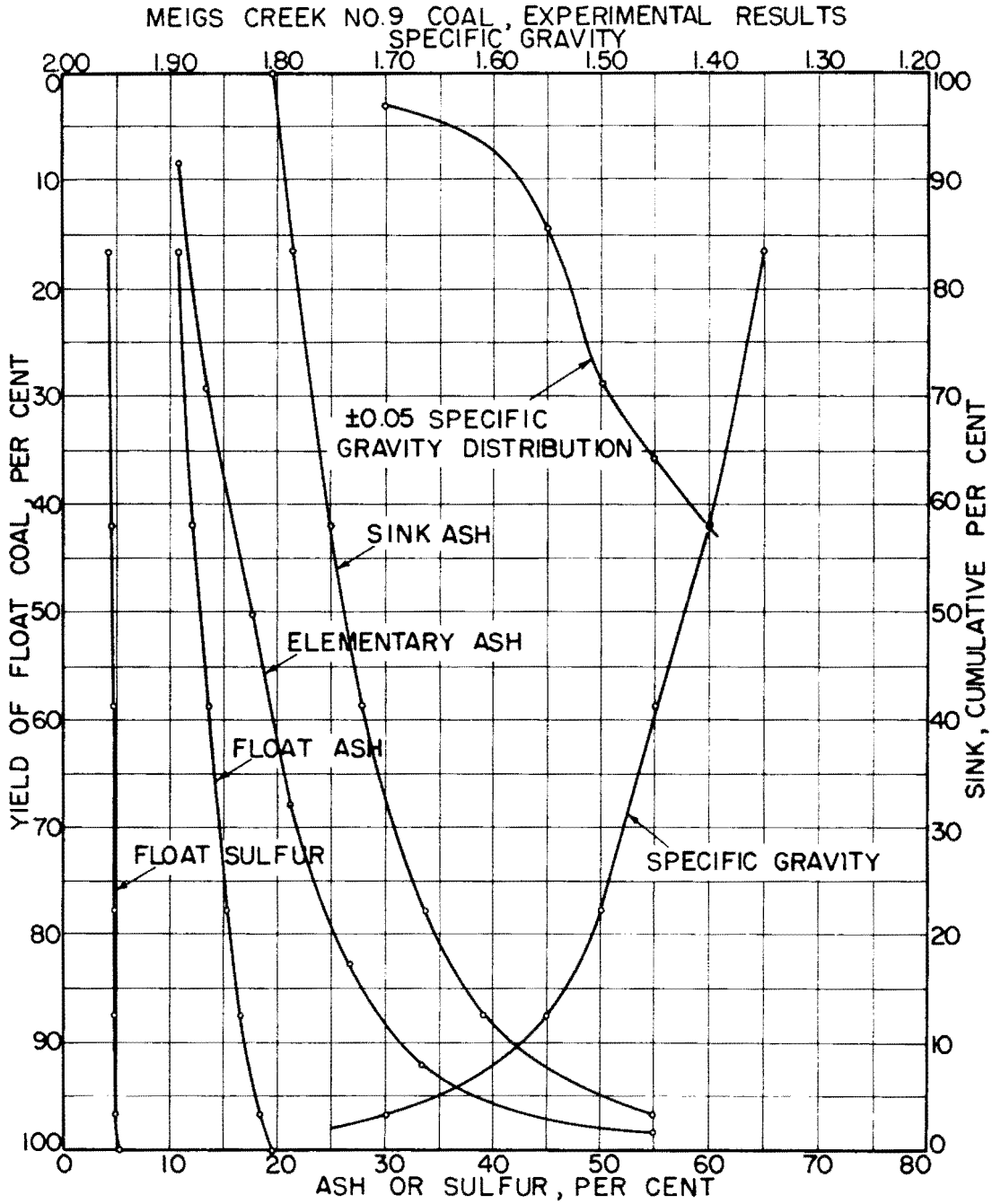
** Gross heating value of the head sample Btu/lb. (kg-cal/kg): a - 11,334 (6296): b - 11,481 (6,378)

TABLE XVIII - Screen tests and analysis data of various screen sizes of the coal sample (Ref. No. 24/251) from lower bench of Koontz Coal Company strip mine near Harriettsville, SE ¼ SE ¼ Sec. 25, Elk Township, Noble County, Ohio.

Screen size (in)	Condition*	Weight (gm.)	Elementary data (%)				Computed cumulative data, (%)		
			Weight	Moisture	Ash	Sulfur	Weight	Ash	Sulfur
−2 to +1½	a	64,070	27.1	1.74	13.00	5.74	27.1	13.00	5.74
	b			0.00	13.23	5.84		13.23	5.84
−1½ to + 1	a	50,179	21.2	1.73	13.86	6.00	48.3	13.37	5.86
	b			0.00	14.10	6.11		13.61	5.96
−1 to +¾	a	29,370	12.4	1.74	13.66	5.81	60.7	13.43	5.85
	b			0.00	13.90	5.91		13.67	5.95
−¾ to +½	a	27,074	11.5	1.78	14.52	6.60	72.2	13.60	5.96
	b			0.00	14.78	6.72		13.85	6.07
−½ to +⅜	a	13,336	5.7	1.88	13.86	6.38	77.9	13.62	5.99
	b			0.00	14.13	6.50		13.87	6.10
−⅜ to +¼	a	16,950	7.2	1.82	13.27	6.21	85.1	13.59	6.01
	b			0.00	13.52	6.33		13.84	6.12
−¼ to +⅛	a	12,964	5.5	1.86	14.11	6.65	90.6	13.61	6.05
	b			0.00	14.38	6.78		13.87	6.16
−⅛ inches to +28 mesh	a	12,349	5.2	1.78	15.22	6.88	95.8	13.71	6.10
	b			0.00	15.50	7.00		13.96	6.21
−28 mesh to 0	a	9,860	4.2	1.94	17.44	6.87	100.0	13.86	6.12
	b			0.00	17.79	7.01		14.12	6.24
Total or average	a	236,152	100.0	1.77	13.86	6.13			
	b			0.00	14.12	6.24			
Head sample**	a	23,615	10.0	1.41	13.78	6.32			
	b			0.00	13.98	6.41			

* Condition a refers to the air-dry sample; condition b refers to the moisture-free sample.

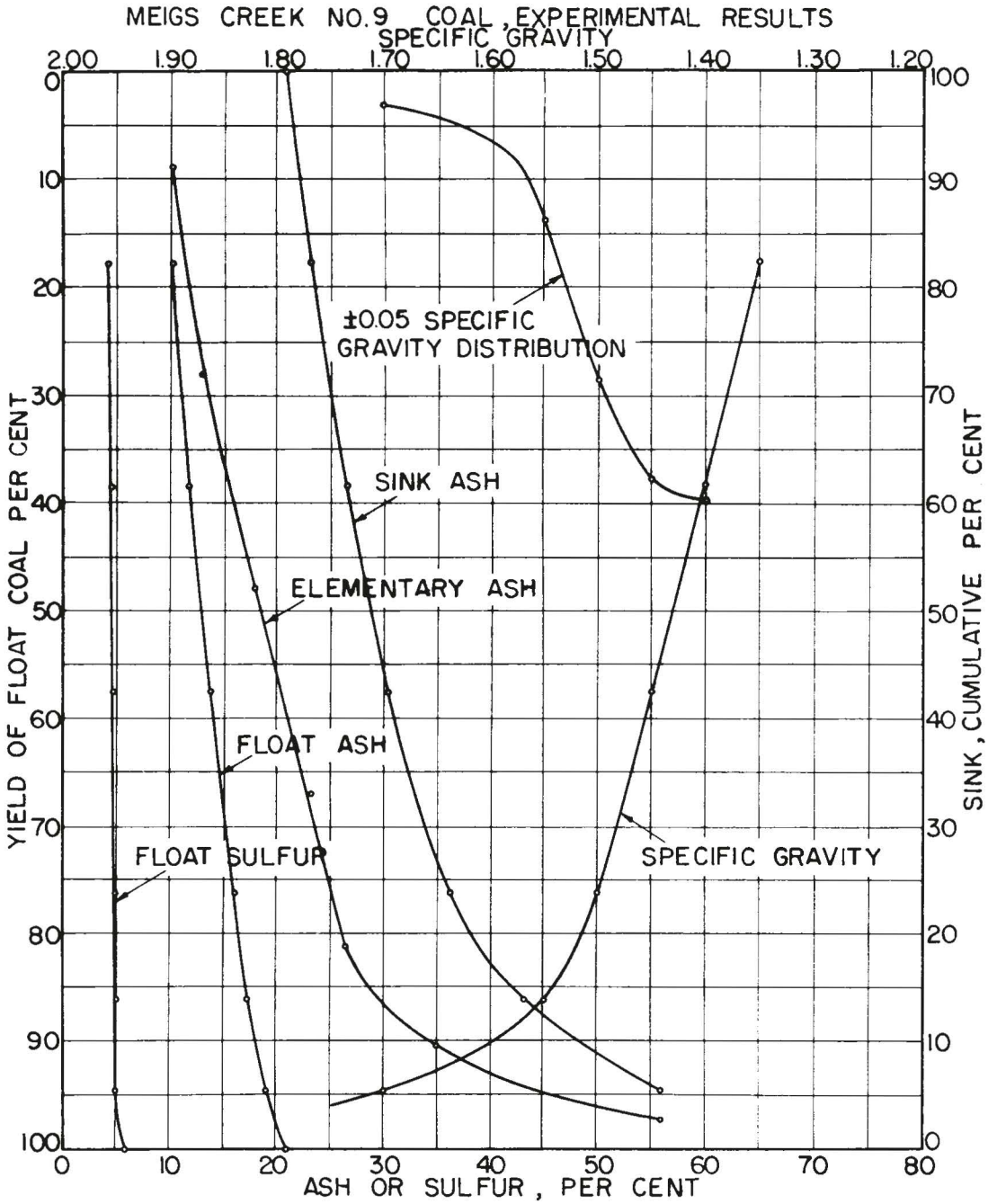
** Gross heating value of the head sample Btu/lb (kg-cal/kg): a - 12,228 (6,793); b - 12,403 (6,890)



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	0	--	--	--	--	--	--	--	--	--	--	--
1.30 - 1.35	1898	16.6	1.46	10.59	4.21	16.6	10.59	4.21	100.0	19.53	5.33	
1.35 - 1.40	2887	25.3	1.56	13.17	4.66	41.9	12.15	4.48	83.4	21.31	5.55	42.1
1.40 - 1.45	1916	16.8	1.45	17.55	5.27	58.7	13.69	4.71	58.1	24.85	5.94	35.8
1.45 - 1.50	2163	19.0	1.72	21.01	5.43	77.7	15.48	4.88	41.3	27.83	6.21	28.8
1.50 - 1.55	1123	9.8	1.67	26.72	4.83	87.5	16.74	4.88	22.3	33.64	6.90	14.3
1.55 - 1.70	1046	9.2	1.48	33.44	5.35	96.7	18.33	4.92	12.5	39.09	8.48	3.0
Sink 1.70	371	3.3	1.05	54.80	17.26	100.0	19.53	5.33	3.3	54.80	17.26	
Totals	11,404	100.0										

* Moisture-free basis.

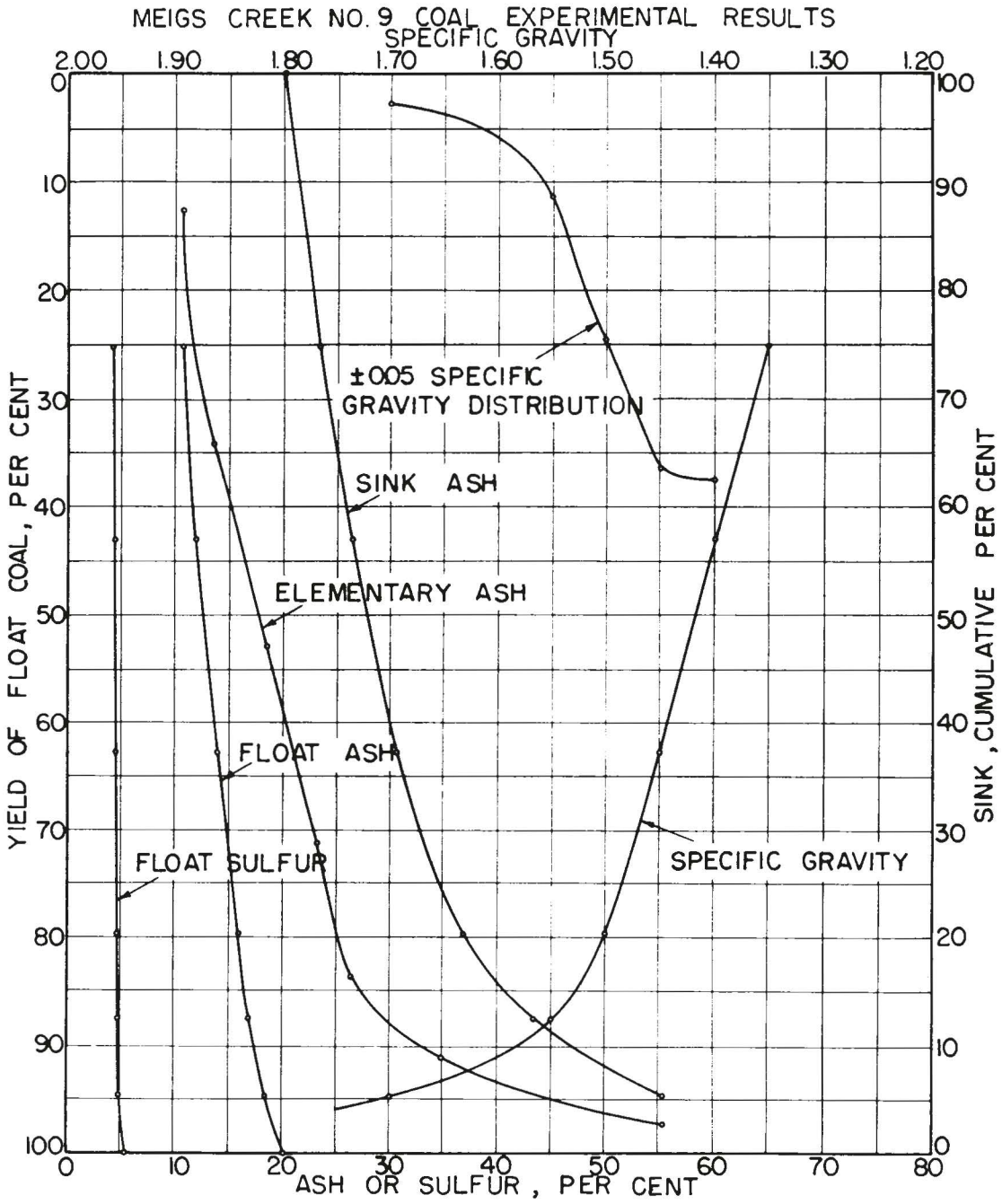
DATA SHEET 61. - Float-and-sink tests data sheet and washability curves; coal sample from upper bench of Koontz Coal Company strip mine near Harriettsville, SE 1/4 SE 1/4 Sec. 25, Elk Township, Noble County, Ohio. Screen size: -2 to +1½ inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	16	0.1	--	--	--	0.1	--	--	--	--	--	
1.30 - 1.35	3469	17.6	1.67	10.23	4.26	17.7	10.23	4.26	100.0	20.84	5.75	
1.35 - 1.40	4090	20.7	1.68	12.94	4.72	38.4	11.69	4.51	82.3	23.12	6.07	39.8
1.40 - 1.45	3783	19.1	1.60	17.83	5.46	57.5	13.73	4.82	61.6	26.54	6.52	37.8
1.45 - 1.50	3697	18.7	1.67	23.16	5.37	76.2	16.04	4.96	42.5	30.46	7.01	28.6
1.50 - 1.55	1948	9.9	1.67	26.48	5.62	86.1	17.24	5.03	23.8	36.21	8.28	13.8
1.55 - 1.70	1689	8.5	1.82	34.98	5.32	94.6	18.84	5.06	13.9	43.14	10.21	3.1
Sink 1.70	1068	5.4	1.30	55.95	17.92	100.0	20.84	5.75	5.4	55.95	17.92	
Totals	19,760	100.0										

* Moisture-free basis.

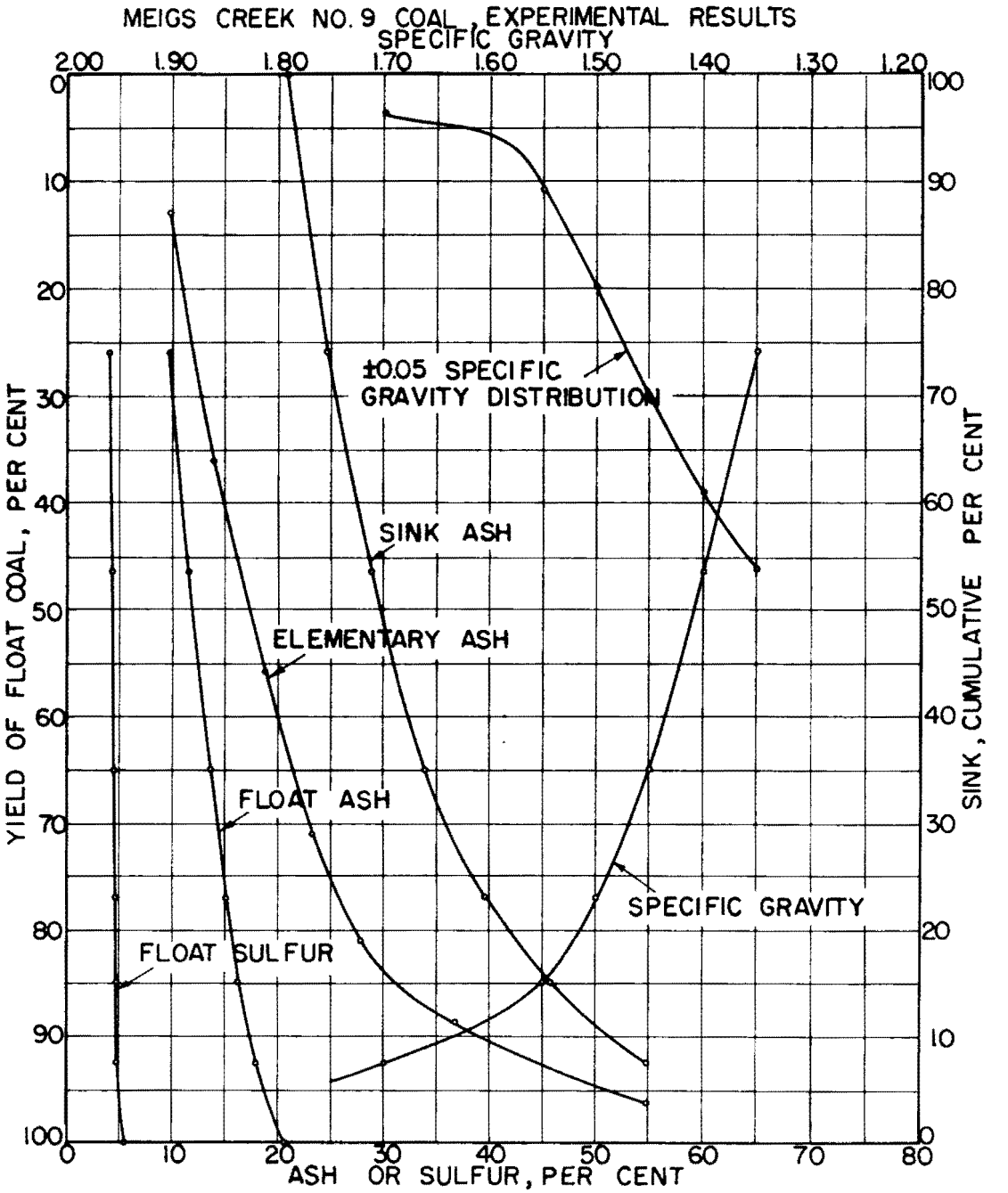
DATA SHEET 62. - Float-and-sink tests data sheet and washability curves; coal sample from upper bench of Koontz Coal Company strip mine near Harriettsville, SE ¼ SF ¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -1½ to +1 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	19	0.1	--	--	--	0.1	--	--	--	--	--	
1.30 - 1.35	4758	25.1	1.62	10.66	4.18	25.2	10.66	4.18	100.0	20.15	5.46	
1.35 - 1.40	3400	17.9	1.61	13.50	4.68	43.1	11.84	4.39	74.8	23.35	5.89	37.6
1.40 - 1.45	3729	19.7	1.58	18.51	4.90	62.8	13.93	4.55	56.9	26.44	6.27	36.6
1.45 - 1.50	3208	16.9	1.56	23.23	5.17	79.7	15.90	4.68	37.2	30.65	7.00	24.8
1.50 - 1.55	1488	7.9	1.46	26.39	5.73	87.6	16.85	4.77	20.3	36.84	8.52	11.3
1.55 - 1.70	1374	7.2	1.52	34.80	5.70	94.8	18.21	4.85	12.4	43.46	10.33	2.6
Sink 1.70	989	5.2	1.01	55.46	16.71	100.0	20.15	5.46	5.2	55.46	16.71	
Totals	18,965	100.0										

* Moisture-free basis.

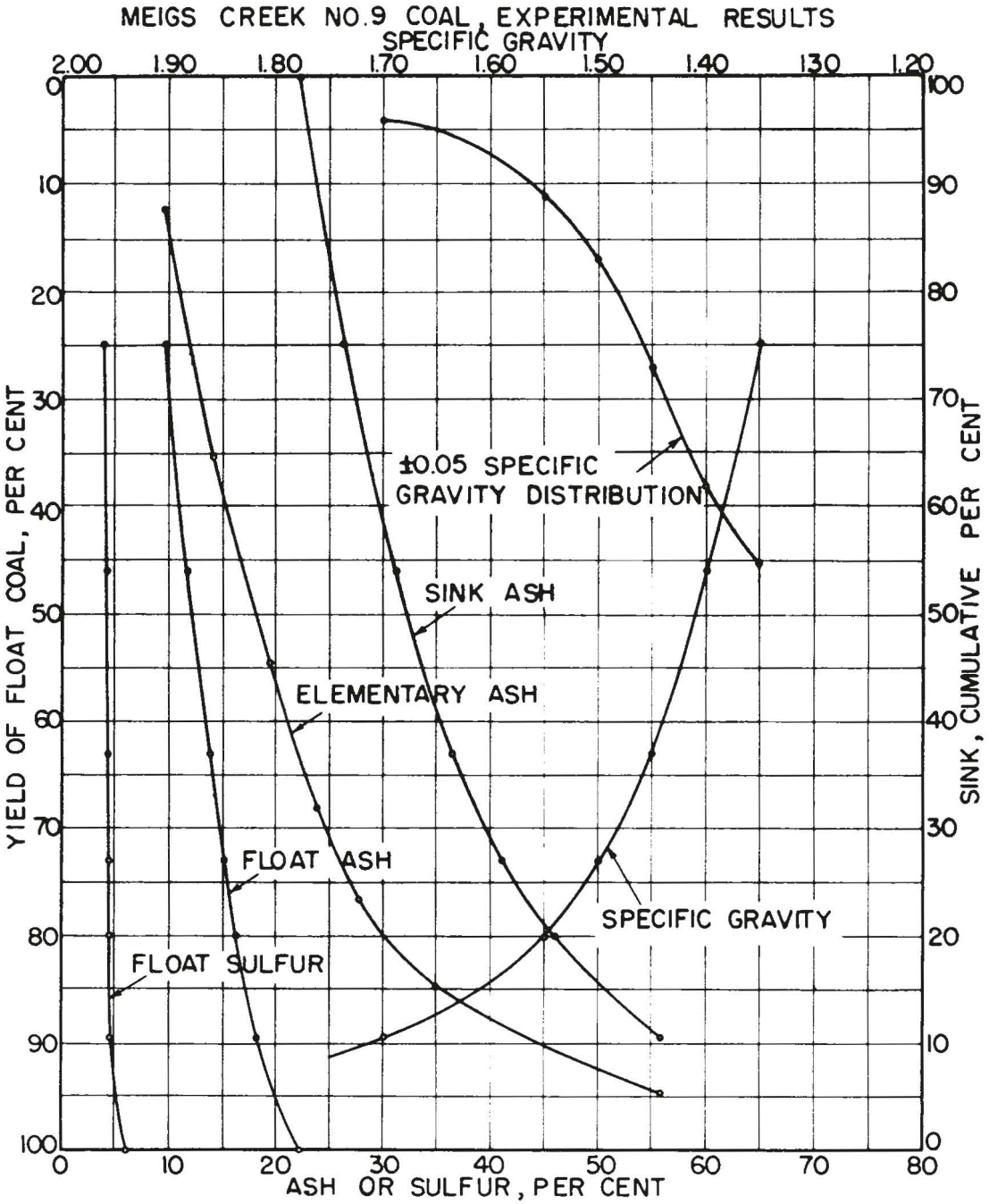
DATA SHEET 63. - Float-and-sink tests data sheet and washability curves; coal sample from upper bench of Koontz Coal Company strip mine near Harriettsville, SE ¼ SE ¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -1 to +3/4 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	66	0.2	--	--	--	0.2	--	--	--	--	--	
1.30 - 1.35	7384	25.7	1.29	9.66	3.94	25.9	9.66	3.94	100.0	20.62	5.46	46.3
1.35 - 1.40	5940	20.6	1.23	13.73	4.71	46.5	11.46	4.28	74.1	24.45	5.99	39.2
1.40 - 1.45	5364	18.6	1.37	18.75	4.95	65.1	13.55	4.47	53.5	28.58	6.49	30.6
1.45 - 1.50	3458	12.0	1.40	23.02	5.17	77.1	15.02	4.58	34.9	33.81	7.31	19.9
1.50 - 1.55	2279	7.9	1.27	27.61	5.18	85.0	16.19	4.64	22.9	39.47	8.42	10.9
1.55 - 1.70	2160	7.5	1.34	36.66	5.24	92.5	17.85	4.69	15.0	45.72	10.11	3.7
Sink 1.70	2146	7.5	1.06	54.74	15.06	100.0	20.62	5.46	7.5	54.74	15.06	
Totals	28,797	100.0										

* Moisture-free basis.

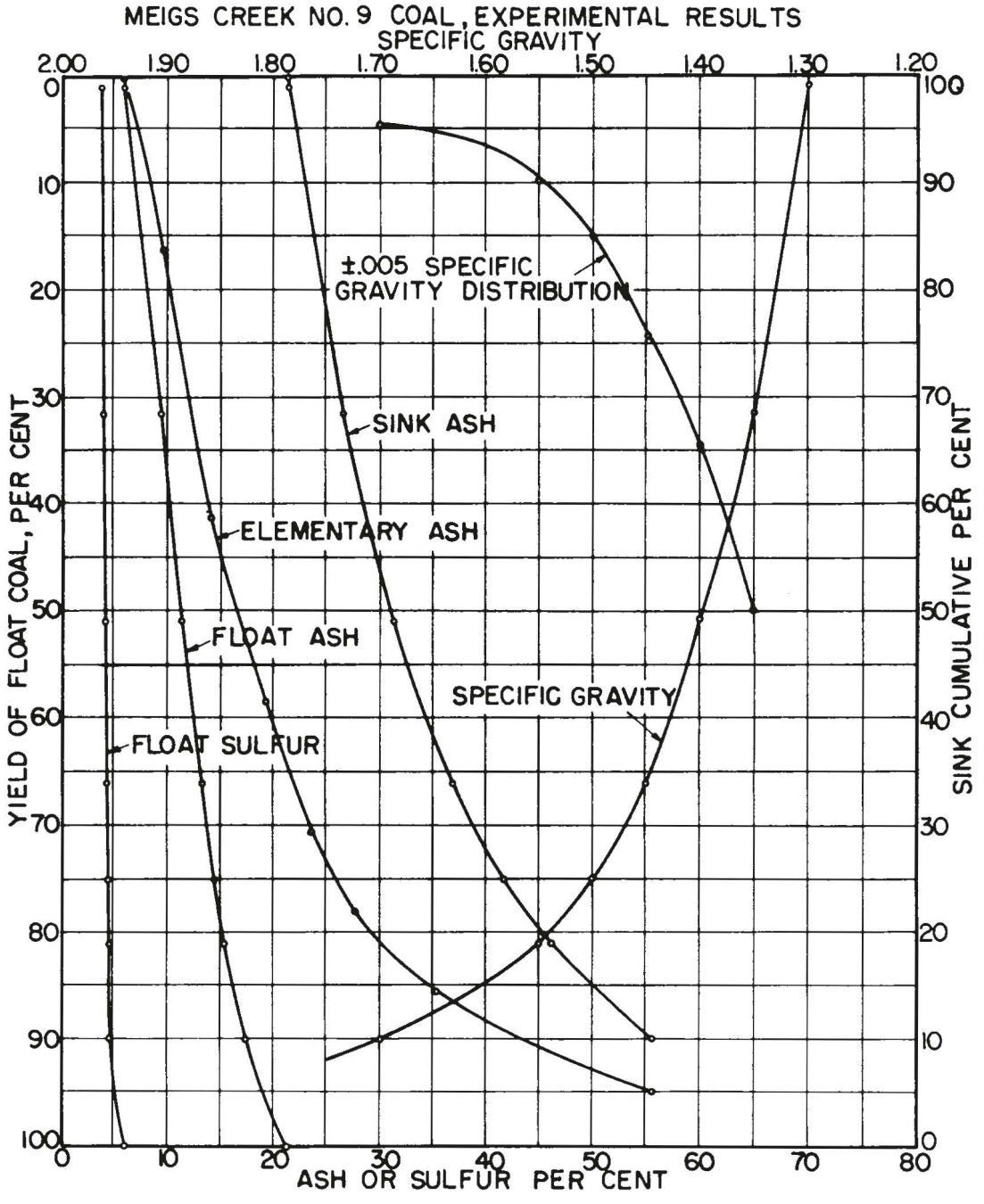
DATA SHEET 64. - Float-and-sink tests data sheet and washability curves; coal sample from upper bench of Koontz Coal Company strip mine near Harriettsville, SE ¼ SE ¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: - 3/4 to + 1/2 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	47	0.7	--	--	--	0.7	--	--	--	--	--	
1.30 - 1.35	1658	24.2	1.43	9.65	3.89	24.9	9.65	3.89	100.0	22.13	6.00	45.3
1.35 - 1.40	1446	21.1	1.32	14.07	4.60	46.0	11.68	4.21	75.1	26.27	6.70	38.2
1.40 - 1.45	1169	17.1	1.45	19.38	4.74	63.1	13.76	4.36	54.0	31.03	7.52	27.0
1.45 - 1.50	678	9.9	1.40	23.74	4.90	73.0	15.12	4.43	36.9	36.44	8.80	17.0
1.50 - 1.55	489	7.1	1.40	27.59	4.84	80.1	16.22	4.47	27.0	41.08	10.24	11.3
1.55 - 1.70	648	9.4	1.40	34.90	5.03	89.5	18.18	4.53	19.9	45.92	12.16	4.2
Sink 1.70	717	10.5	0.96	55.77	18.52	100.0	22.13	6.00	10.5	55.77	18.52	
Totals	6852	100.0										

* Moisture-free basis.

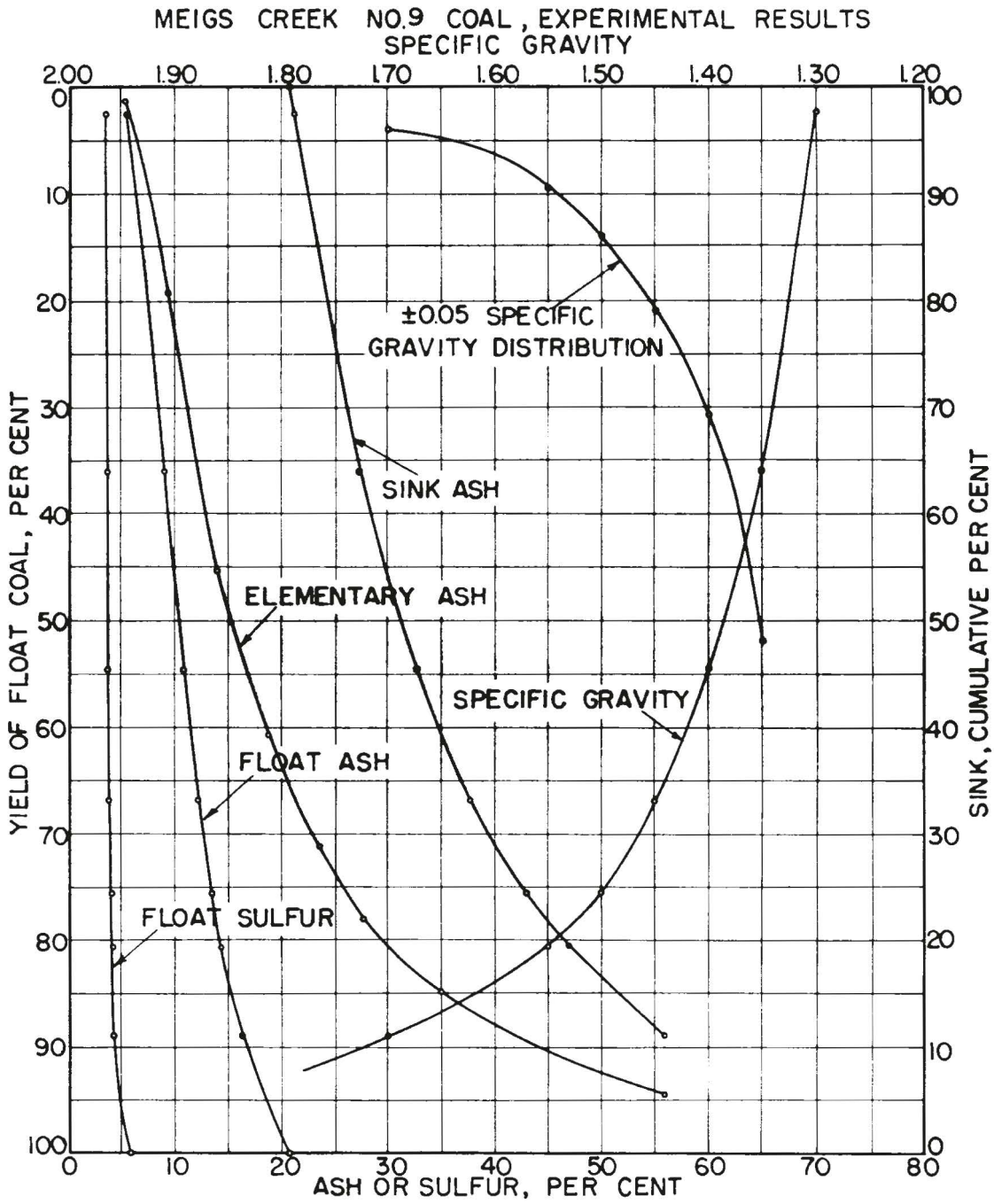
DATA SHEET 65. - Float-and-sink tests data sheet and washability curves; coal sample from upper bench of Koontz Coal Company strip mine near Harriettsville, SE ¼ SE ¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -1/2 to +3/8 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	172	0.9	1.32	6.04	3.65	0.9	6.04	3.65	100.0	21.09	5.88	
1.30 - 1.35	5668	30.6	1.33	9.54	3.81	31.5	9.44	3.81	99.1	21.22	5.90	49.9
1.35 - 1.40	3574	19.3	1.28	14.03	4.41	50.8	11.18	4.04	68.5	26.45	6.83	34.6
1.40 - 1.45	2845	15.3	1.24	19.28	4.81	66.1	13.05	4.21	49.2	31.32	7.78	24.3
1.45 - 1.50	1666	9.0	1.19	23.39	5.20	75.1	14.30	4.33	33.9	36.75	9.14	15.0
1.50 - 1.55	1109	6.0	1.19	27.58	5.20	81.1	15.28	4.40	24.9	41.57	10.55	9.6
1.55 - 1.70	1624	8.8	1.28	35.13	5.51	89.9	17.22	4.51	18.9	46.02	12.23	4.6
Sink 1.70	1875	10.1	0.89	55.50	18.09	100.0	21.09	5.88	10.1	55.50	18.09	
Totals	18,533	100.0										

* Moisture-free basis.

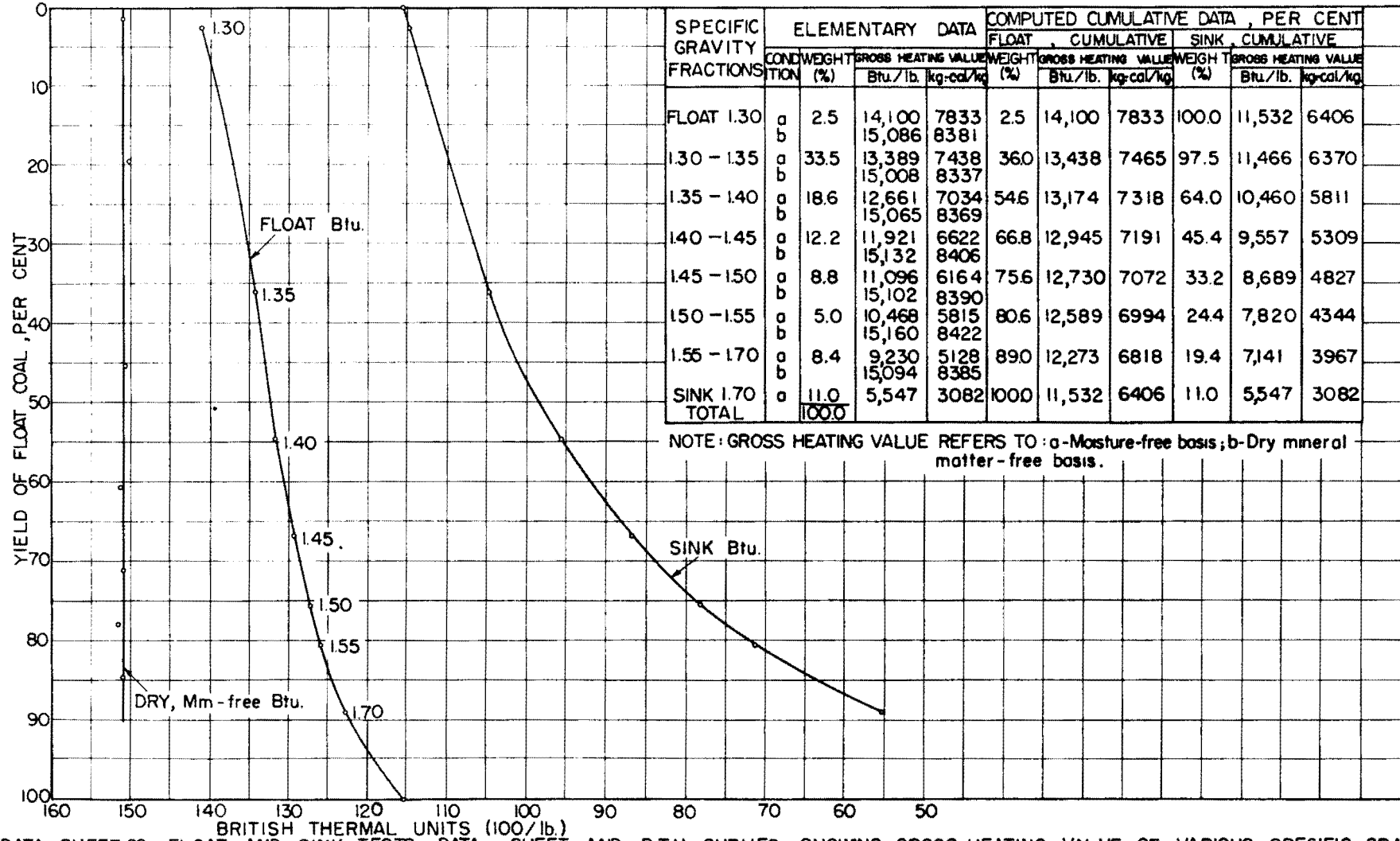
DATA SHEET 66. - Float-and-sink tests data sheet and washability curves coal sample from upper bench of Koontz Coal Company strip mine near Harriettsville, SE ¼ SE ¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -3/8 to +1/4 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	489	2.5	1.54	5.35	3.48	2.5	5.35	3.48	100.0	20.66	5.86	
1.30 - 1.35	6600	33.5	1.42	9.28	3.54	36.0	9.01	3.54	97.5	21.05	5.92	52.1
1.35 - 1.40	3667	18.6	1.34	13.95	4.09	54.6	10.69	3.72	64.0	27.21	7.17	30.8
1.40 - 1.45	2418	12.2	1.27	18.70	4.66	66.8	12.15	3.90	45.4	32.65	8.43	21.0
1.45 - 1.50	1732	8.8	1.60	23.53	5.09	75.6	13.48	4.03	33.2	37.78	9.80	13.8
1.50 - 1.55	988	5.0	1.58	27.60	5.18	80.6	14.35	4.11	24.2	42.91	11.50	9.6
1.55 - 1.70	1665	8.4	1.44	34.92	5.20	89.0	16.30	4.22	19.4	46.88	13.13	4.0
Sink 1.70	2160	11.0	1.07	55.99	19.18	100.0	20.66	5.86	11.0	55.99	19.18	
Totals	19,719	100.0										

* Moisture-free basis.

DATA SHEET 67. - Float-and-sink tests data sheet and washability curves; coal sample from upper bench of Koontz Coal Company strip mine near Harriettsville, SE¼ SE¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -1/4 to +1/8 inches.

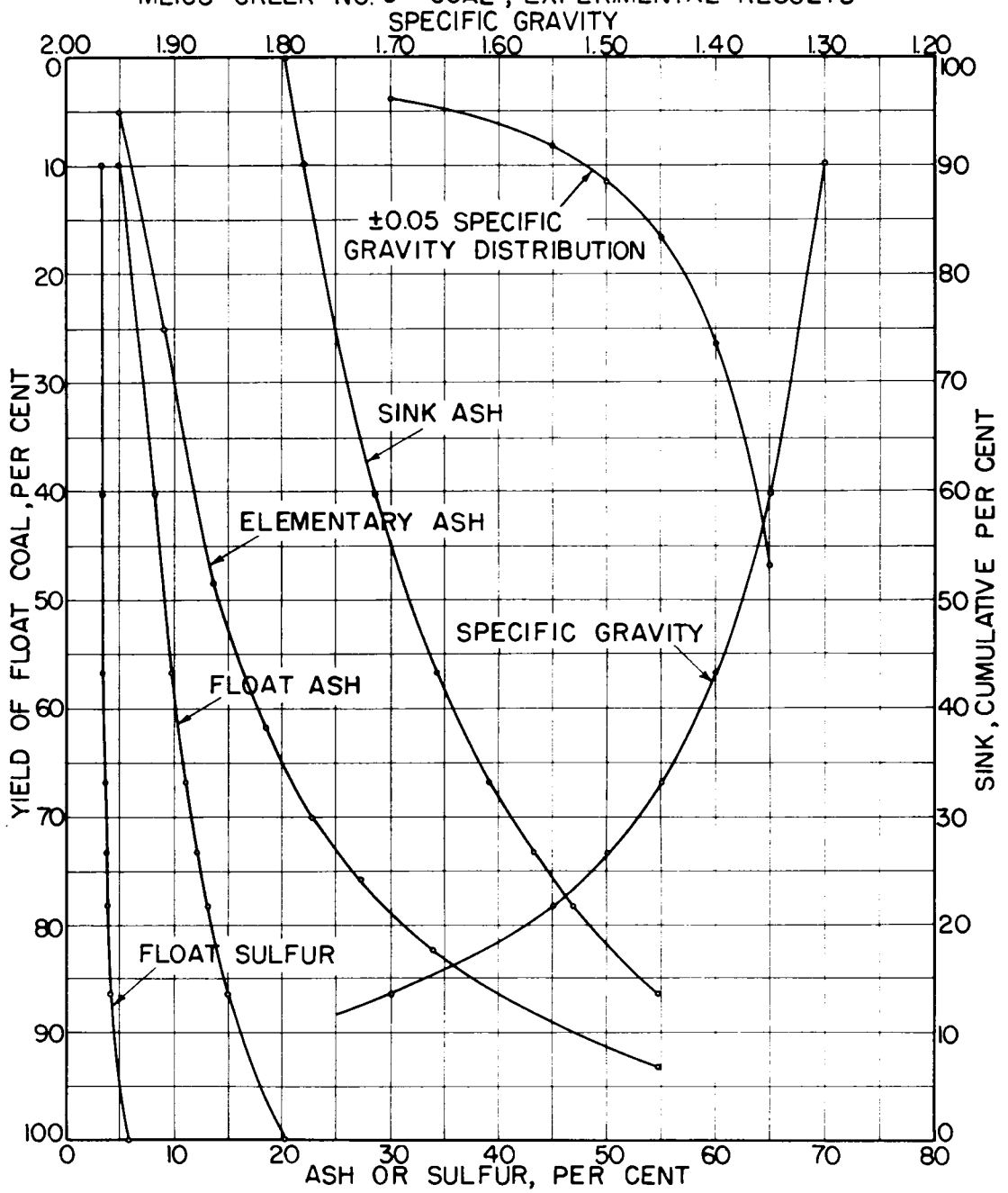


SPECIFIC GRAVITY FRACTIONS	ELEMENTARY DATA				COMPUTED CUMULATIVE DATA, PER CENT					
					FLOAT, CUMULATIVE			SINK, CUMULATIVE		
	CONDITION	WEIGHT (%)	GROSS HEATING VALUE		WEIGHT (%)	GROSS HEATING VALUE		WEIGHT (%)	GROSS HEATING VALUE	
			Btu./lb.	kg-cal/kg		Btu./lb.	kg-cal/kg		Btu./lb.	kg-cal/kg
FLOAT 1.30	a	2.5	14,100	7833	2.5	14,100	7833	100.0	11,532	6406
	b		15,086	8381						
1.30 – 1.35	a	33.5	13,389	7438	36.0	13,438	7465	97.5	11,466	6370
	b		15,008	8337						
1.35 – 1.40	a	18.6	12,661	7034	54.6	13,174	7318	64.0	10,460	5811
	b		15,065	8369						
1.40 – 1.45	a	12.2	11,921	6622	66.8	12,945	7191	45.4	9,557	5309
	b		15,132	8406						
1.45 – 1.50	a	8.8	11,096	6164	75.6	12,730	7072	33.2	8,689	4827
	b		15,102	8390						
1.50 – 1.55	a	5.0	10,468	5815	80.6	12,589	6994	24.4	7,820	4344
	b		15,160	8422						
1.55 – 1.70	a	8.4	9,230	5128	89.0	12,273	6818	19.4	7,141	3967
	b		15,094	8385						
SINK 1.70	a	11.0	5,547	3082	100.0	11,532	6406	11.0	5,547	3082
TOTAL		100.0								

NOTE: GROSS HEATING VALUE REFERS TO: a-Moisture-free basis; b-Dry mineral matter-free basis.

MEIGS CREEK NO. 9 COAL EXPERIMENTAL RESULTS

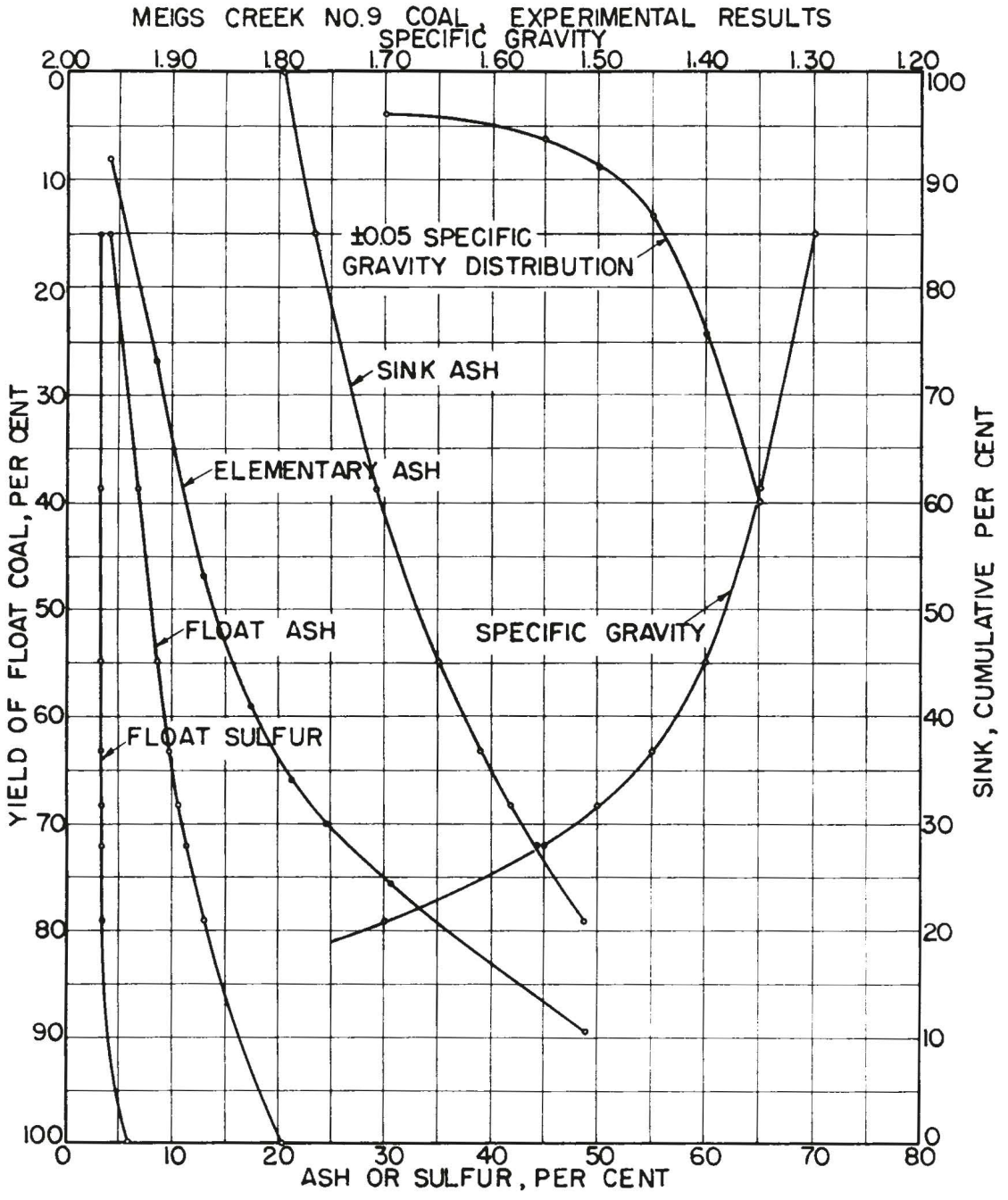
DATA SHEET 68.—FLOAT AND SINK TESTS DATA SHEET AND B.T.U. CURVES SHOWING GROSS HEATING VALUE OF VARIOUS SPECIFIC GRAVITY FRACTIONS; COAL SAMPLE FROM KOONTZ COAL COMPANY STRIP MINE NEAR HARRIETTSVILLE, SE ¼ SE ¼ SEC. 25, ELK TWP., NOBLE CO., OHIO. UPPER BENCH (REF. NO. 23/250), SCREEN SIZE: -¼" to +⅛".



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	390	9.8	1.39	4.89	3.23	9.8	4.89	3.23	100.0	20.31	5.78	
1.30 - 1.35	1213	30.5	1.33	9.09	3.35	40.3	8.07	3.32	90.2	21.99	6.02	46.9
1.35 - 1.40	654	16.4	1.28	13.61	3.70	56.7	9.67	3.43	59.7	28.57	7.39	26.6
1.40 - 1.45	405	10.2	1.22	18.37	4.17	66.9	11.00	3.54	43.3	34.24	8.79	16.7
1.45 - 1.50	259	6.5	1.19	22.70	4.57	73.4	12.03	3.63	33.1	39.13	10.22	11.5
1.50 - 1.55	200	5.0	1.12	27.05	4.74	78.4	12.99	3.71	26.6	43.16	11.60	8.3
1.55 - 1.70	324	8.1	1.51	33.89	5.04	86.5	14.95	3.83	21.6	46.88	13.15	3.8
Sink 1.70	539	13.5	1.55	54.69	18.26	100.0	20.31	5.78	13.5	54.69	18.26	
Totals	3984	100.0										

* Moisture-free basis.

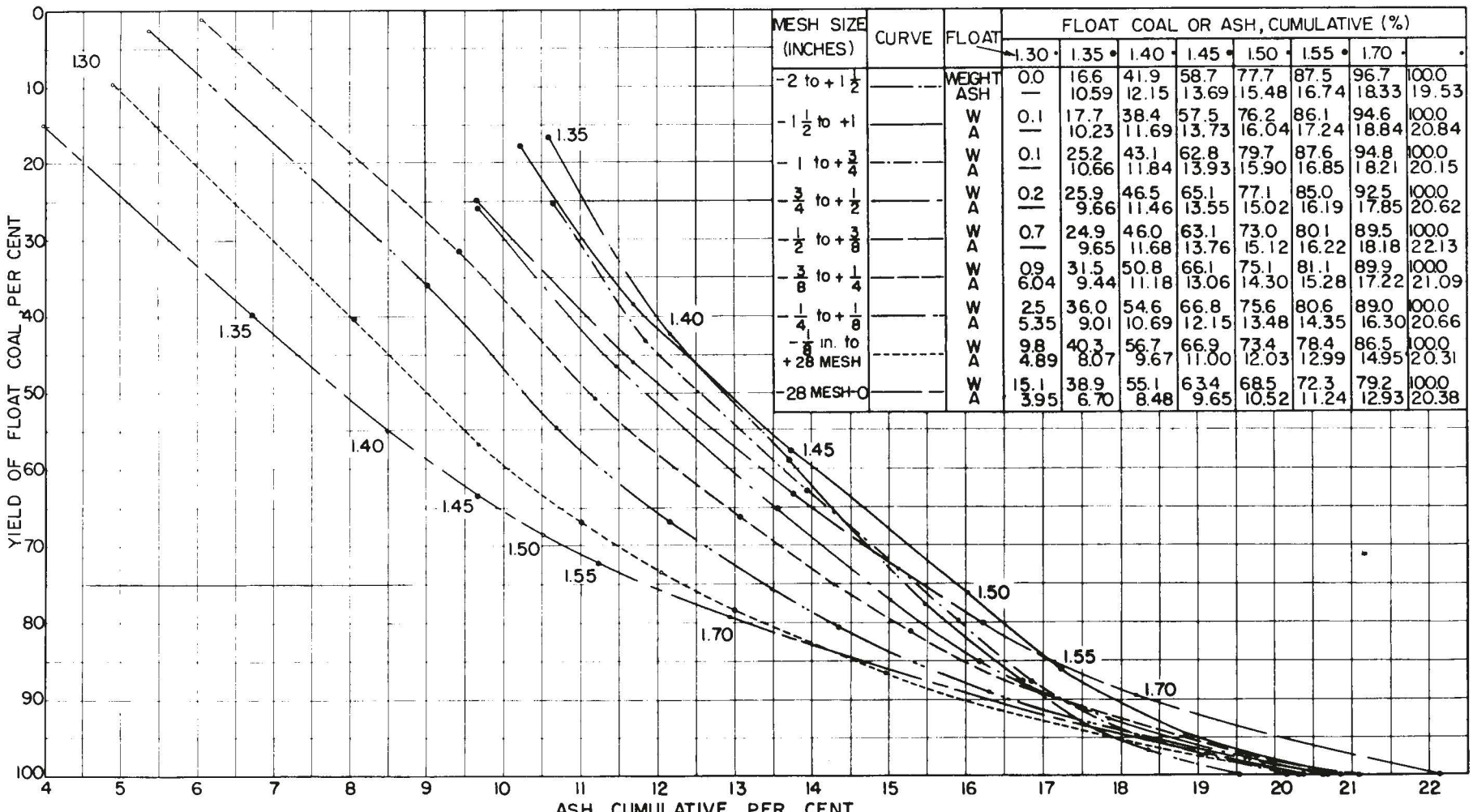
DATA SHEET 69. - Float-and-sink tests data sheet and washability curves; coal sample from upper bench of Koontz Coal Company strip mine near Harriettsville, $SE\frac{1}{4}$ $SE\frac{1}{4}$ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -1/8 inches to +28 mesh.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	401	15.1	1.55	3.95	3.05	15.1	3.95	3.05	100.0	20.38	5.86	
1.30 - 1.35	632	23.8	1.48	8.45	3.17	38.9	6.70	3.12	84.9	23.30	6.36	40.0
1.35 - 1.40	430	16.2	1.51	12.76	3.26	55.1	8.48	3.16	61.1	20.09	7.60	24.5
1.40 - 1.45	220	8.3	1.57	17.42	3.42	63.4	9.65	3.20	44.9	34.98	9.17	13.4
1.45 - 1.50	134	5.1	1.75	21.24	3.51	68.5	10.52	3.22	36.6	38.97	10.47	8.9
1.50 - 1.55	101	3.8	1.85	24.34	3.62	72.3	11.24	3.24	31.5	41.82	11.60	6.3
1.55 - 1.70	184	6.9	3.08	30.60	3.62	79.2	12.93	3.27	27.7	44.24	12.70	4.0
Sink 1.70	551	20.8	4.11	48.77	15.71	100.0	20.38	5.86	20.8	48.77	15.71	
Totals	2653	100.0										

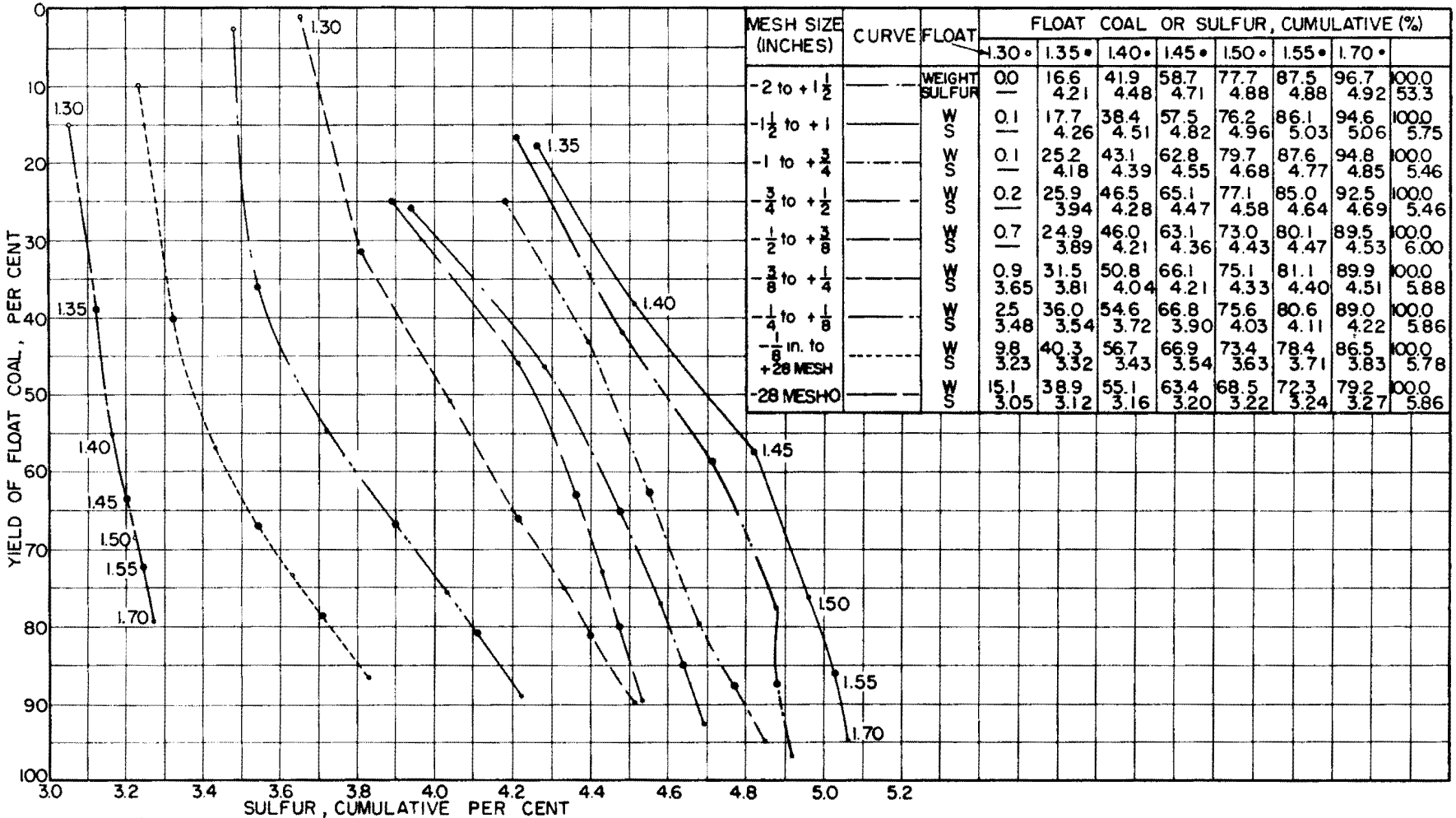
* Moisture-free basis.

DATA SHEET 70. - Float-and-sink tests data sheet and washability curves; coal sample from upper bench of Koontz Coal Company strip mine near Harriettsville, SE¼ SE¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -28 mesh to 0.



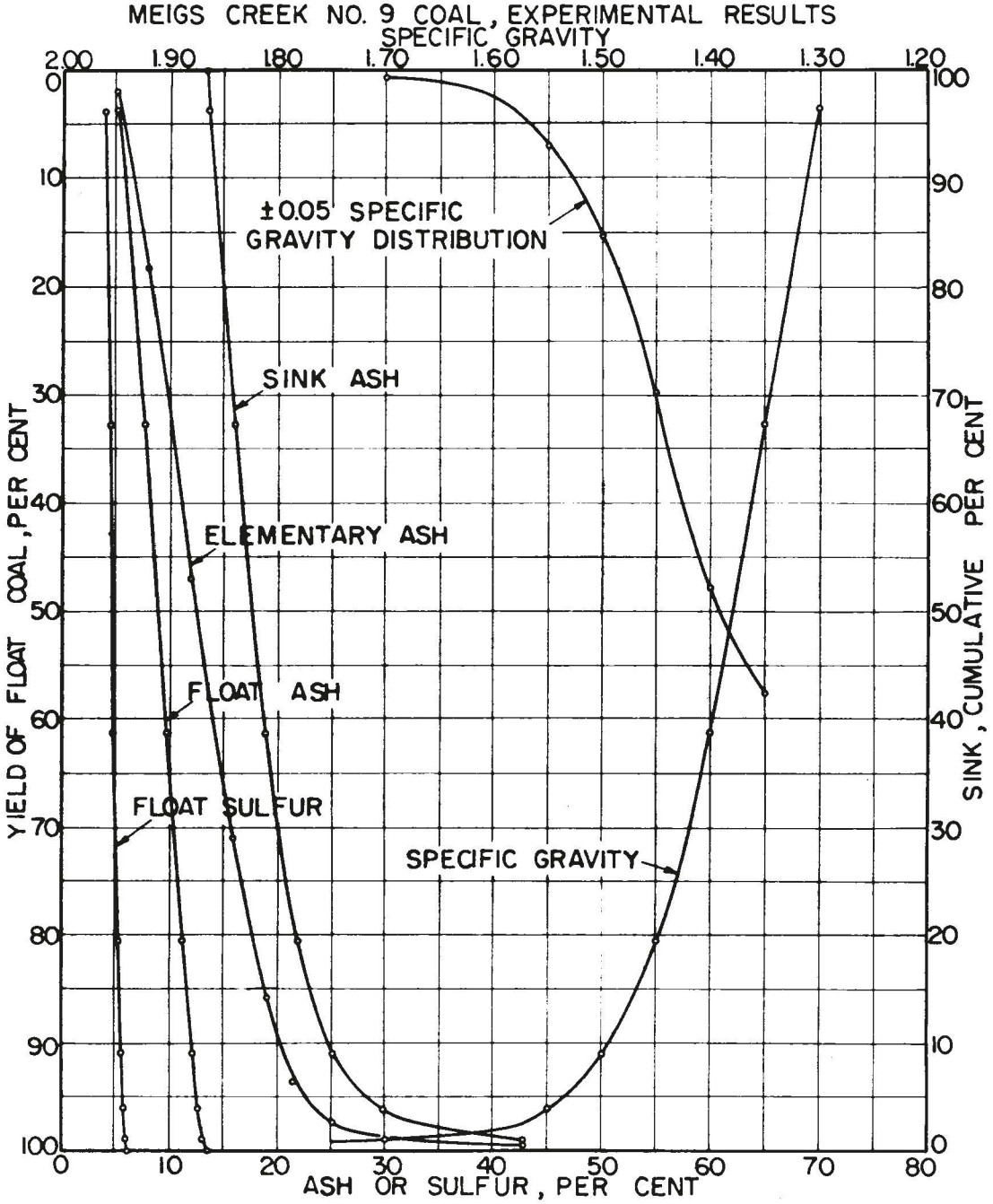
MESH SIZE (INCHES)	CURVE	FLOAT	FLOAT COAL OR ASH, CUMULATIVE (%)							
			1.30	1.35	1.40	1.45	1.50	1.55	1.70	
-2 to +1 1/2	——·——	WEIGHT	0.0	16.6	41.9	58.7	77.7	87.5	96.7	100.0
		ASH	—	10.59	12.15	13.69	15.48	16.74	18.33	19.53
-1 1/2 to +1	———	W	0.1	17.7	38.4	57.5	76.2	86.1	94.6	100.0
		A	—	10.23	11.69	13.73	16.04	17.24	18.84	20.84
-1 to +3/4	——·——	W	0.1	25.2	43.1	62.8	79.7	87.6	94.8	100.0
		A	—	10.66	11.84	13.93	15.90	16.85	18.21	20.15
-3/4 to +1/2	———	W	0.2	25.9	46.5	65.1	77.1	85.0	92.5	100.0
		A	—	9.66	11.46	13.55	15.02	16.19	17.85	20.62
-1/2 to +3/8	——·——	W	0.7	24.9	46.0	63.1	73.0	80.1	89.5	100.0
		A	—	9.65	11.68	13.76	15.12	16.22	18.18	22.13
-3/8 to +1/4	———	W	0.9	31.5	50.8	66.1	75.1	81.1	89.9	100.0
		A	6.04	9.44	11.18	13.06	14.30	15.28	17.22	21.09
-1/4 to +1/8	——·——	W	2.5	36.0	54.6	66.8	75.6	80.6	89.0	100.0
		A	5.35	9.01	10.69	12.15	13.48	14.35	16.30	20.66
-1/8 in. to +28 MESH	———	W	9.8	40.3	56.7	66.9	73.4	78.4	86.5	100.0
		A	4.89	8.07	9.67	11.00	12.03	12.99	14.95	20.31
-28 MESH-0	——·——	W	15.1	38.9	55.1	63.4	68.5	72.3	79.2	100.0
		A	3.95	6.70	8.48	9.65	10.52	11.24	12.93	20.38

DATA SHEET 71.- FLOAT AND SINK TESTS DATA SHEET, AND FLOAT ASH CURVES SHOWING YIELD OF FLOAT COAL VS. CUMULATIVE ASH CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COAL SAMPLE (NO.23/250) FROM UPPER BENCH OF KOONTZ COAL COMPANY STRIP MINE NEAR HARRETTSVILLE, SE 1/4 SE 1/4 SEC. 25, ELK TWP., NOBLE CO., OHIO.



MESH SIZE (INCHES)	CURVE	FLOAT	FLOAT COAL OR SULFUR, CUMULATIVE (%)							
			1.30 ◦	1.35 •	1.40 •	1.45 •	1.50 ◦	1.55 •	1.70 •	
-2 to +1½	—·—	WEIGHT	0.0	16.6	41.9	58.7	77.7	87.5	96.7	100.0
		SULFUR	—	4.21	4.48	4.71	4.88	4.88	4.92	5.33
-1½ to +1	———	W	0.1	17.7	38.4	57.5	76.2	86.1	94.6	100.0
		S	—	4.26	4.51	4.82	4.96	5.03	5.06	5.75
-1 to +¾	—·—·—	W	0.1	25.2	43.1	62.8	79.7	87.6	94.8	100.0
		S	—	4.18	4.39	4.55	4.68	4.77	4.85	5.46
-¾ to +½	—— —	W	0.2	25.9	46.5	65.1	77.1	85.0	92.5	100.0
		S	—	3.94	4.28	4.47	4.58	4.64	4.69	5.46
-½ to +⅜	———	W	0.7	24.9	46.0	63.1	73.0	80.1	89.5	100.0
		S	—	3.89	4.21	4.36	4.43	4.47	4.53	6.00
-⅜ to +¼	———	W	0.9	31.5	50.8	66.1	75.1	81.1	89.9	100.0
		S	3.65	3.81	4.04	4.21	4.33	4.40	4.51	5.88
-¼ to +⅛	———	W	2.5	36.0	54.6	66.8	75.6	80.6	89.0	100.0
		S	3.48	3.54	3.72	3.90	4.03	4.11	4.22	5.86
-⅛ in. to +28 MESH	- - - -	W	9.8	40.3	56.7	66.9	73.4	78.4	86.5	100.0
		S	3.23	3.32	3.43	3.54	3.63	3.71	3.83	5.78
-28 MESH	———	W	15.1	38.9	55.1	63.4	68.5	72.3	79.2	100.0
		S	3.05	3.12	3.16	3.20	3.22	3.24	3.27	5.86

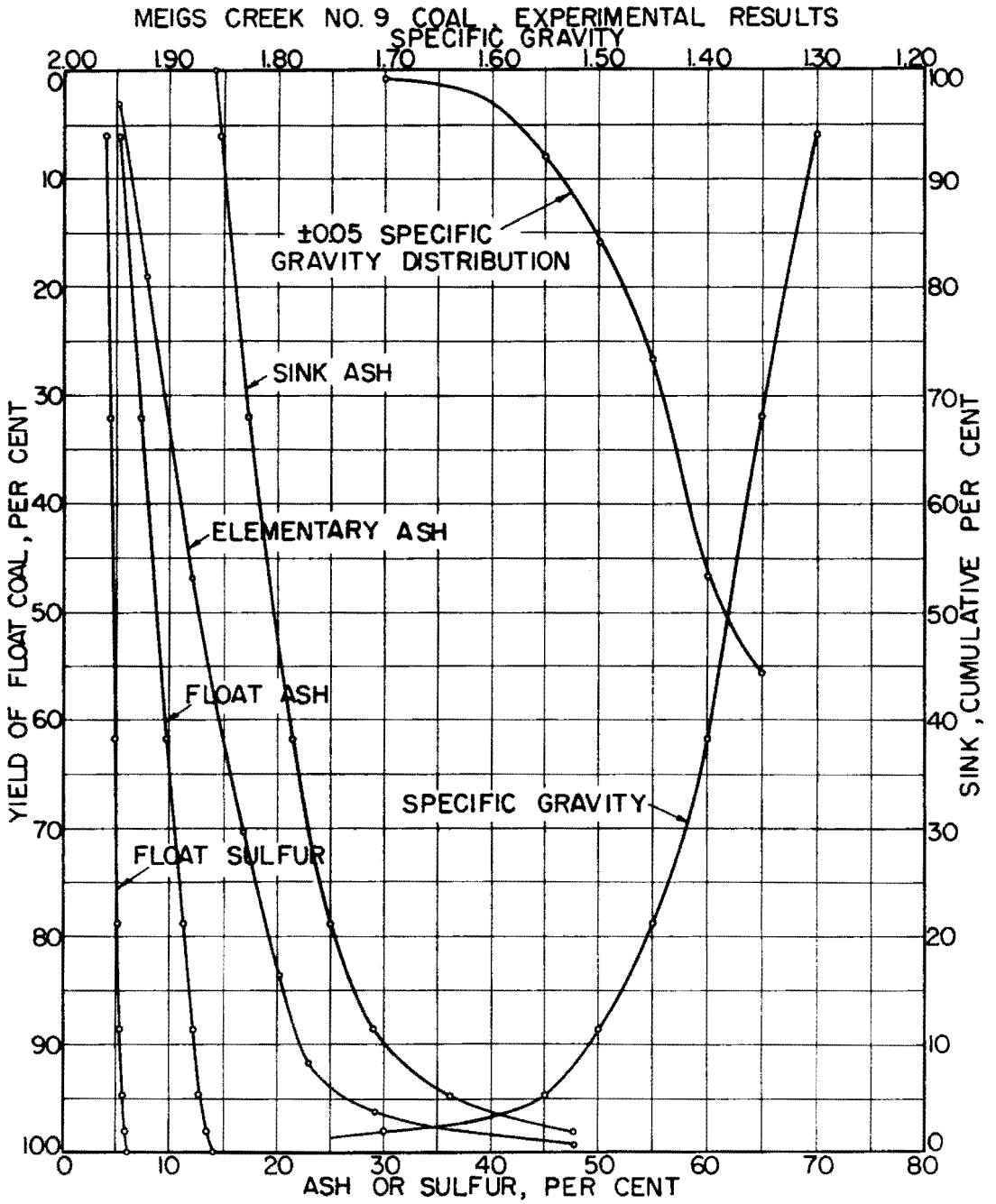
DATA SHEET 72:— FLOAT AND SINK TESTS DATA SHEET AND FLOAT SULFUR CURVES SHOWING YIELD OF FLOAT COAL VS. CUMULATIVE SULFUR CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP BY STEP CRUSHING AND FLOATING OF THE SAME COAL SAMPLE (NO. 23/250) FROM UPPER BENCH OF KOONTZ COAL COMPANY STRIP MINE NEAR HARRIETTSVILLE, SE¼ SE¼ SEC. 25, ELK TWP., NOBLE CO., OHIO.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	2,117	3.7	1.77	5.15	4.06	3.7	5.15	4.06	100.0	13.25	6.12	
1.30 - 1.35	16,613	29.0	1.58	8.04	4.53	32.7	7.71	4.48	96.3	13.56	6.20	57.5
1.35 - 1.40	16,301	28.5	1.66	11.95	5.42	61.2	9.69	4.92	67.3	15.94	6.92	47.9
1.40 - 1.45	11,113	19.4	1.46	15.86	6.54	80.6	11.17	5.31	38.8	18.87	8.01	29.8
1.45 - 1.50	5,962	10.4	1.43	19.03	7.60	91.0	12.07	5.57	19.4	21.89	9.49	15.4
1.50 - 1.55	2,852	5.0	1.38	21.40	9.11	96.0	12.56	5.75	9.0	25.18	11.68	7.0
1.55 - 1.70	1,666	2.9	1.29	25.10	12.43	98.9	12.92	5.95	4.0	29.81	15.00	0.7
Sink 1.70	610	1.1	0.83	42.70	21.45	100.0	13.25	6.12	1.1	42.70	21.45	
Totals	57,234	100.0										

* Moisture-free basis.

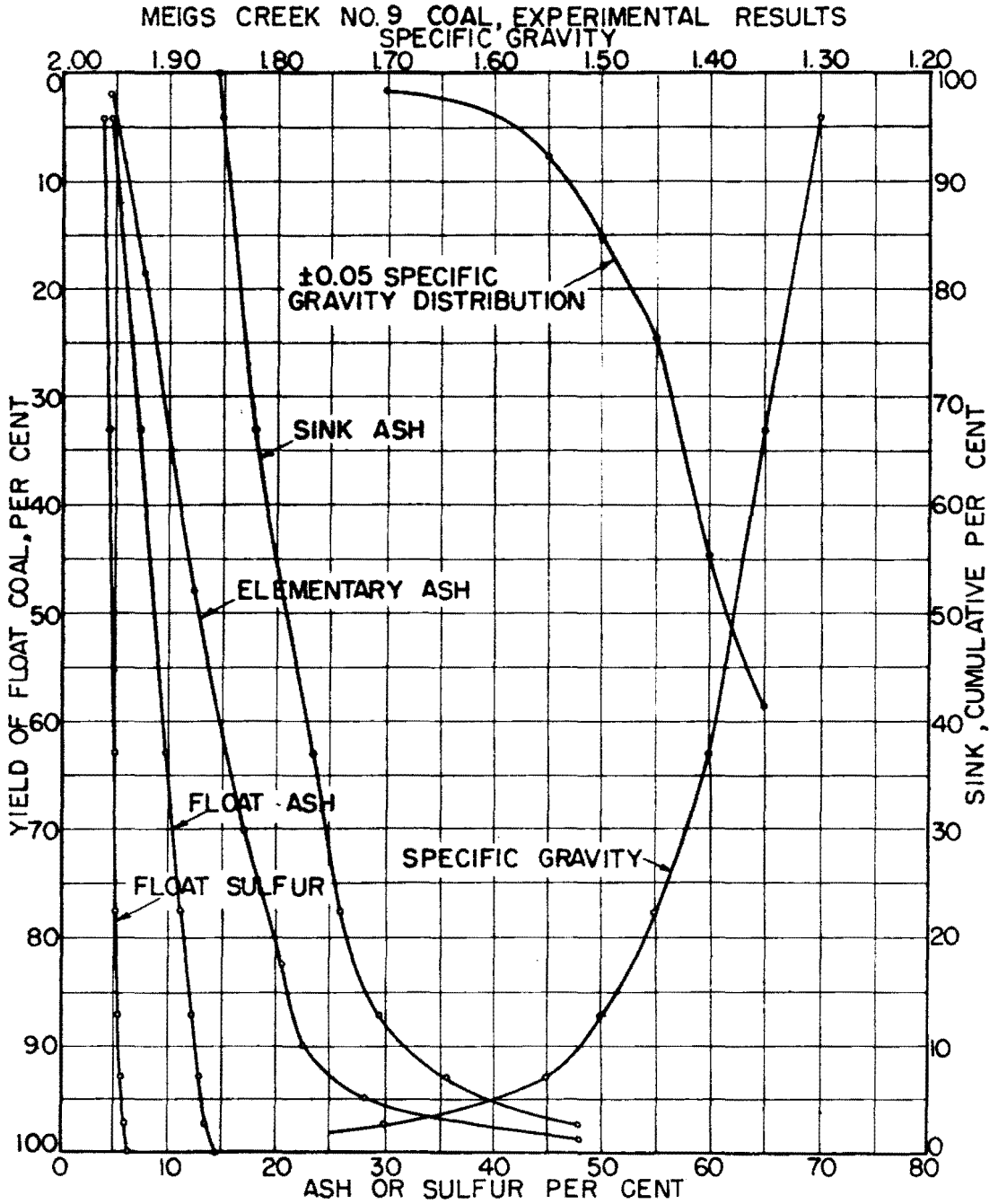
DATA SHEET 73. - Float-and-sink tests data sheet and washability curves; coal sample from lower bench of Konntz Coal Company strip mine near Harriettsville, SE¼ SE¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -2 to +1½ inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	2,925	6.0	1.47	5.27	4.01	6.0	5.27	4.01	100.0	14.16	6.09	
1.30 - 1.35	12,594	26.0	1.37	7.83	4.42	32.0	7.35	4.34	94.0	14.73	6.22	55.7
1.35 - 1.40	14,366	29.7	1.35	12.17	5.27	61.7	9.67	4.79	68.0	17.36	6.92	46.8
1.40 - 1.45	8,262	17.1	1.72	16.88	6.42	78.8	11.23	5.14	38.3	21.39	8.18	26.9
1.45 - 1.50	4,759	9.8	1.72	20.32	7.21	88.6	12.24	5.37	21.2	25.05	9.62	15.9
1.50 - 1.55	2,974	6.1	1.55	22.94	9.20	94.7	12.93	5.62	11.4	29.08	11.69	8.1
1.55 - 1.70	1,614	3.3	1.54	29.15	9.85	98.0	13.48	5.76	5.3	36.14	14.49	0.8
Sink 1.70	964	2.0	0.98	47.69	21.99	100.0	14.16	6.09	2.0	47.69	21.99	
Totals	48,458	100.0										

* Moisture-free basis.

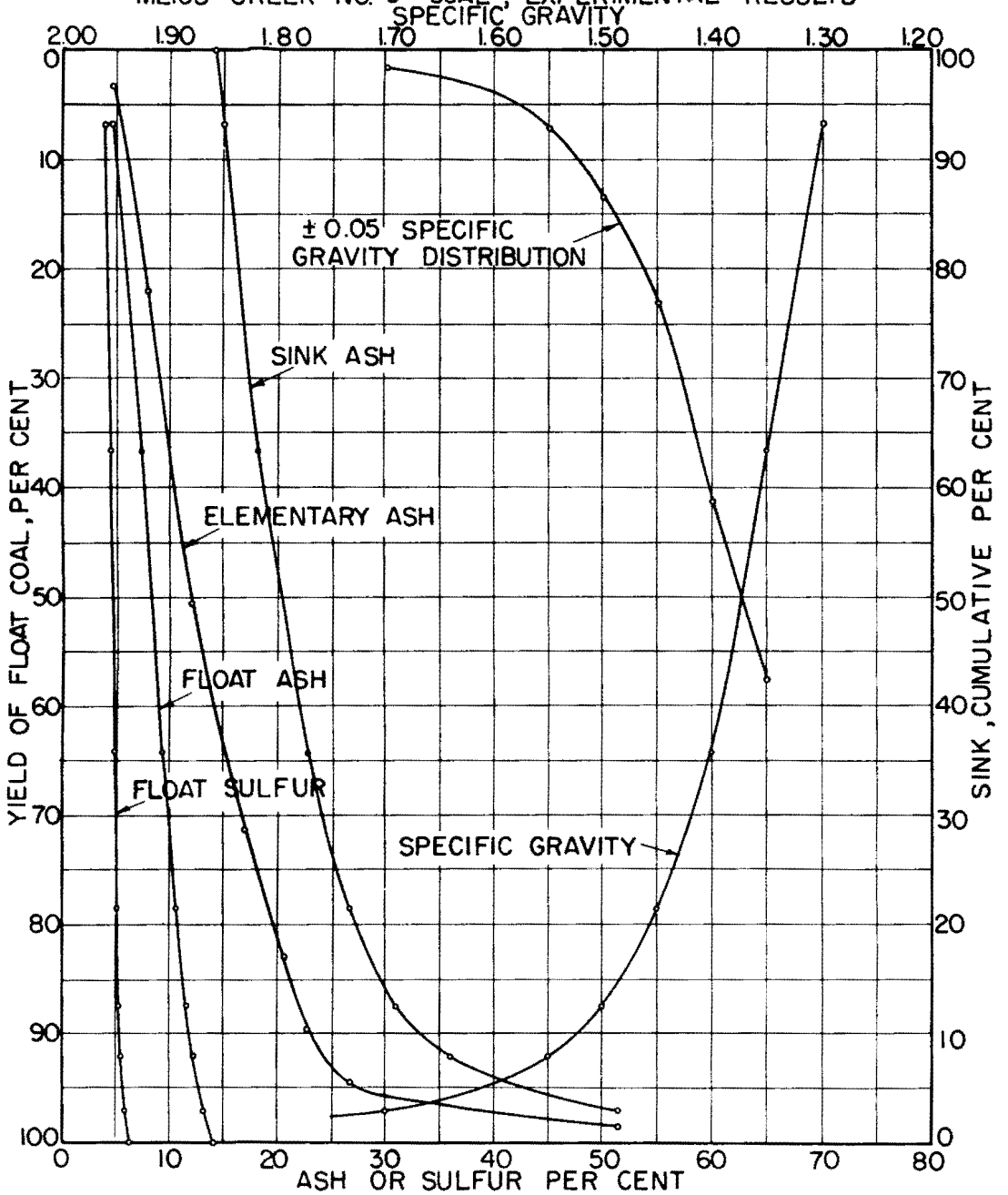
DATA SHEET 74. - Float-and-sink tests data sheet and washability curves; coal sample from lower bench of Koontz Coal Company strip mine near Harriettsville, SE¼ SE¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -1½ to +1 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	1,895	4.2	1.64	4.50	3.90	4.2	4.50	3.90	100.0	14.40	6.39	
1.30 - 1.35	13,164	28.8	1.61	7.78	4.46	33.0	7.36	4.39	95.8	14.83	6.50	58.6
1.35 - 1.40	13,635	29.8	1.53	12.23	5.49	62.8	9.67	4.91	67.0	17.87	7.38	44.6
1.40 - 1.45	6,784	14.8	1.66	17.03	6.19	77.6	11.08	5.16	37.2	23.39	8.89	24.5
1.45 - 1.50	4,410	9.7	1.60	20.88	7.36	87.3	12.16	5.40	22.4	25.90	10.65	15.3
1.50 - 1.55	2,567	5.6	1.51	22.09	9.62	92.9	12.76	5.65	12.7	29.80	13.20	7.7
1.55 - 1.70	1,998	4.4	1.40	28.27	10.35	97.3	13.46	5.87	7.1	35.86	16.07	1.5
Sink 1.70	1,250	2.7	1.01	48.03	25.28	100.0	14.40	6.39	2.7	48.03	25.28	
Totals	45,703	100.0										

* Moisture-free basis.

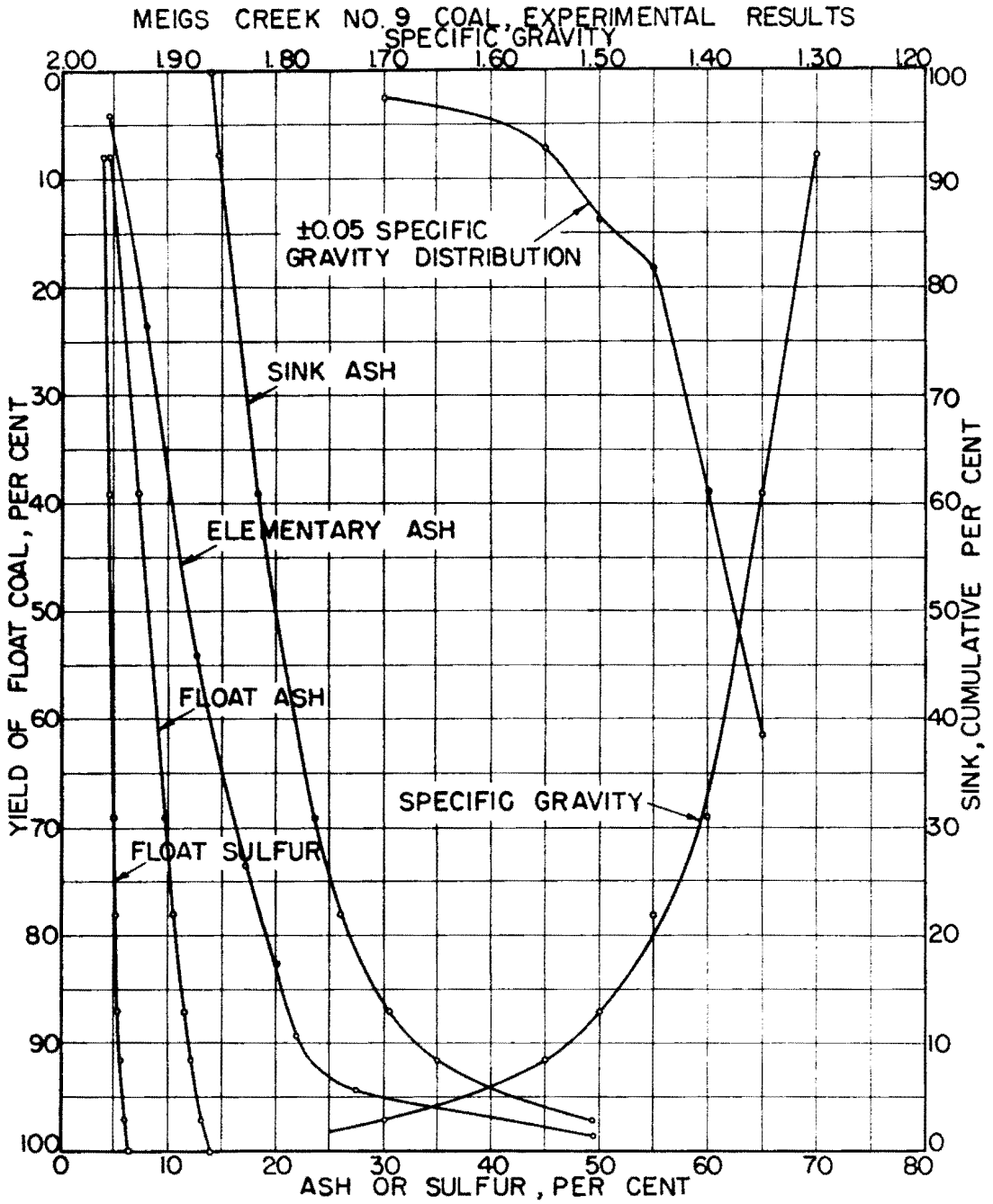
DATA SHEET 75. - Float-and-sink tests data sheet and washability curves: coal sample from lower bench of Koontz Coal Company strip mine near Harriettsville, SE¼ SE¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -1 to +3/4 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	4,310	6.7	1.87	4.66	3.95	6.7	4.66	3.95	100.0	14.12	6.42	
1.30 - 1.35	19,747	30.5	1.70	7.88	4.57	37.2	7.30	4.46	93.3	14.80	6.60	57.5
1.35 - 1.40	17,451	27.0	1.64	12.01	5.55	64.2	9.28	4.92	62.8	18.16	7.58	41.3
1.40 - 1.45	9,232	14.3	1.70	16.95	6.24	78.5	10.68	5.16	35.8	22.80	9.11	23.2
1.45 - 1.50	5,784	8.9	1.74	20.77	7.05	87.4	11.70	5.35	21.5	26.68	11.02	13.6
1.50 - 1.55	3,027	4.7	1.70	22.62	9.43	92.1	12.26	5.56	12.6	30.91	13.84	7.2
1.55 - 1.70	3,264	5.0	1.57	26.69	11.23	97.1	13.01	5.85	7.9	35.80	16.45	1.5
Sink 1.70	1,868	2.9	1.08	51.45	25.39	100.0	14.12	6.42	2.9	51.45	25.39	
Totals	64,683	100.0										

* Moisture-free basis.

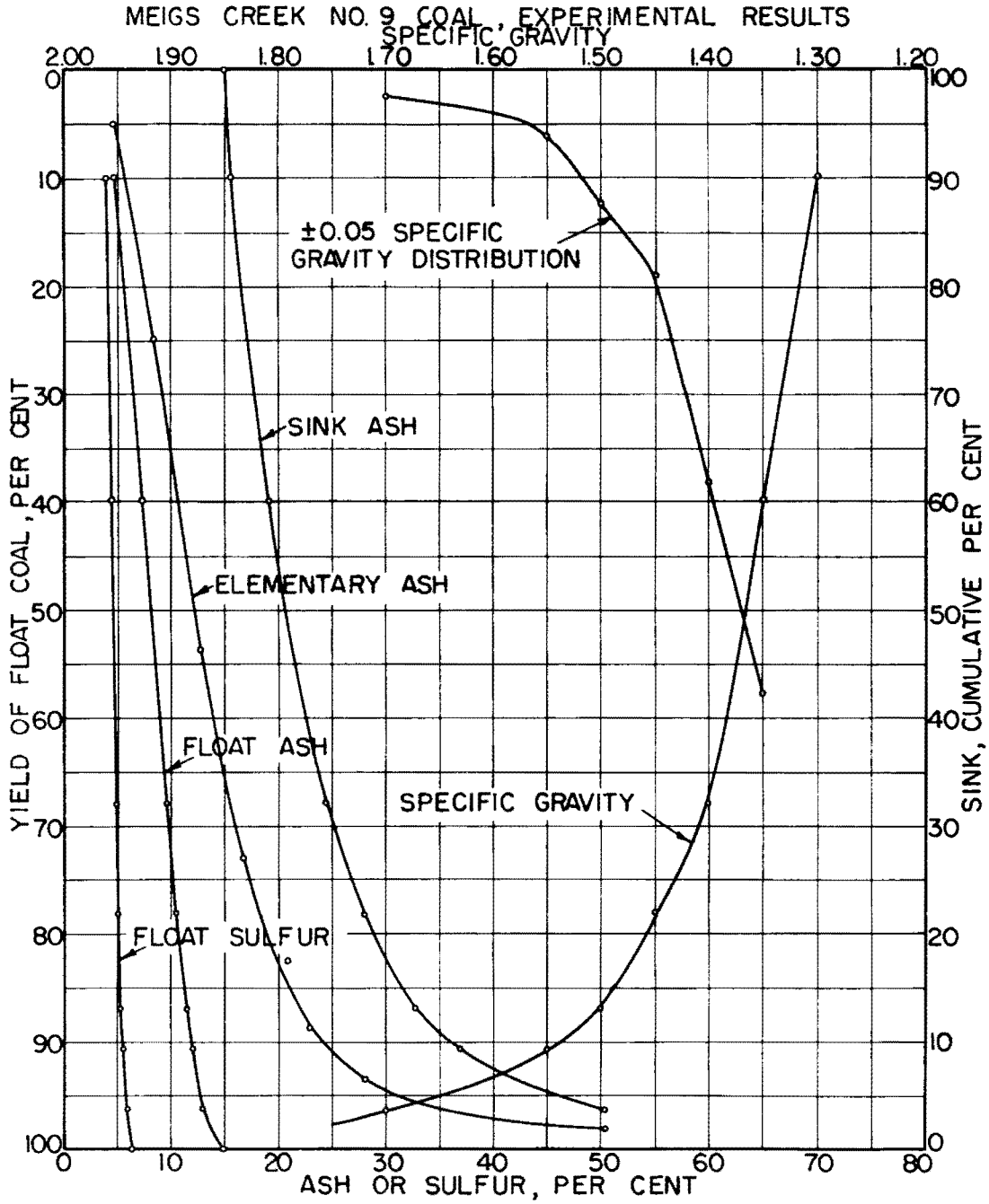
DATA SHEET 76. - Float-and-sink tests data sheet and washability curves; coal sample from lower bench of Koontz Coal Company strip mine near Harriettsville, SE¼ SE¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -3/4 to +1/2 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	2,550	7.7	1.99	4.47	4.02	7.7	4.47	4.02	100.0	13.93	6.33	
1.30 - 1.35	10,441	31.4	1.74	8.08	4.62	39.1	7.37	4.50	92.3	14.72	6.52	61.4
1.35 - 1.40	9,993	30.0	1.68	12.59	5.53	69.1	9.64	4.95	60.9	18.14	7.50	38.8
1.40 - 1.45	2,930	8.8	1.53	17.09	6.30	77.9	10.48	5.10	30.9	23.52	9.42	18.0
1.45 - 1.50	3,077	9.2	1.46	20.05	7.10	87.1	11.49	5.31	22.1	26.09	10.67	13.7
1.50 - 1.55	1,501	4.5	1.63	21.87	9.34	91.6	12.00	5.51	12.9	30.40	13.22	6.9
1.55 - 1.70	1,818	5.5	1.49	27.37	10.80	97.1	12.87	5.81	8.4	34.98	15.27	2.4
Sink 1.70	950	2.9	0.94	49.31	23.85	100.0	13.93	6.33	2.9	49.31	23.85	
Totals	33,260	100.0										

* Moisture-free basis.

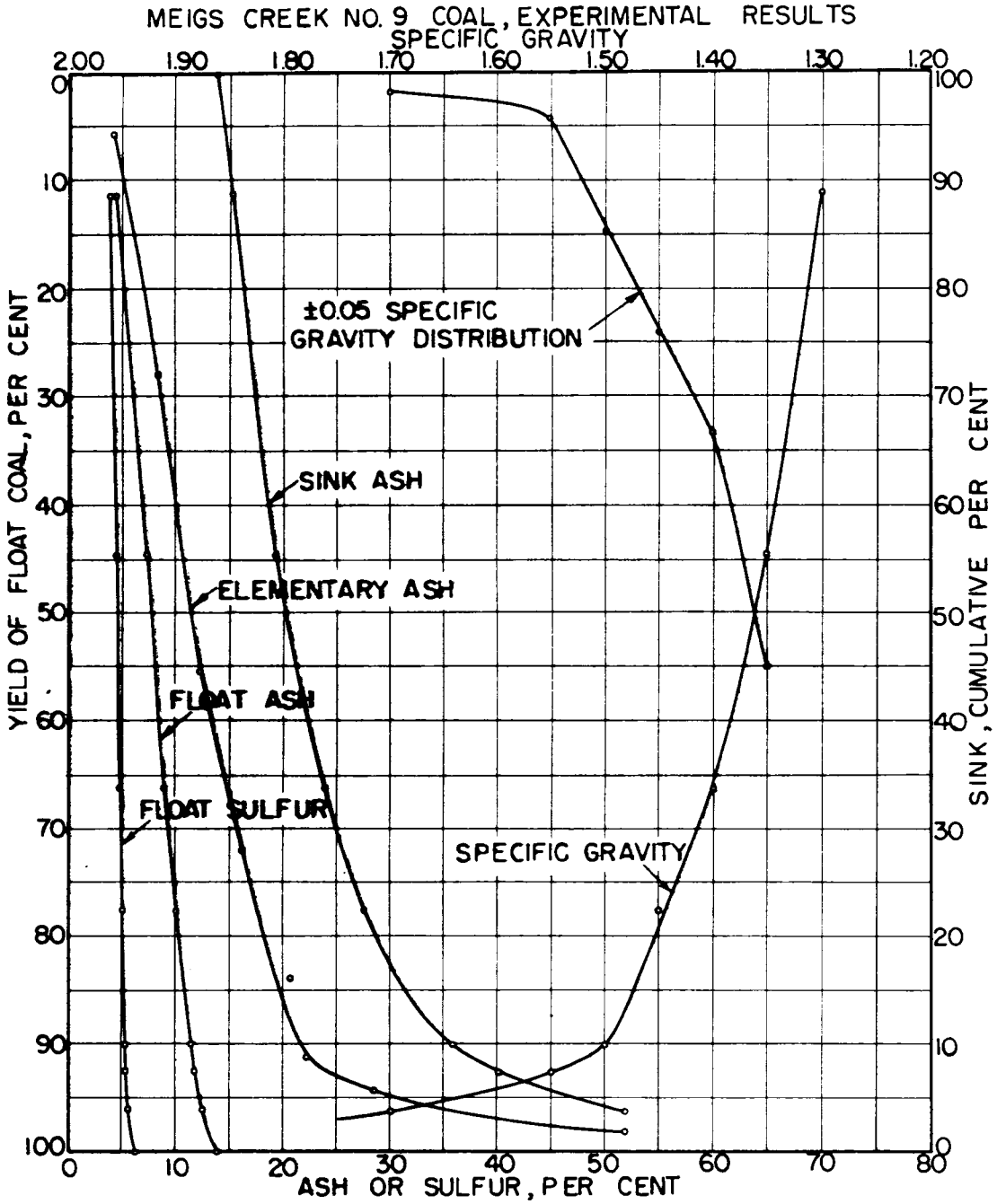
DATA SHEET 77. - Float-and-sink tests data sheet and washability curves; coal sample from lower bench of Koontz Coal Company strip mine near Harriettsville, SE¼ SE¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -1/2 to +3/8 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	6,457	10.0	1.77	4.52	3.89	10.0	4.52	3.89	100.0	14.35	6.43	
1.30 - 1.35	19,306	29.9	1.72	8.25	4.59	39.9	7.32	4.41	90.0	15.44	6.71	57.8
1.35 - 1.40	17,968	27.9	1.66	12.82	5.67	67.8	9.58	4.93	60.1	19.02	7.77	38.3
1.40 - 1.45	6,726	10.4	1.51	16.85	6.48	78.2	10.55	5.14	32.2	24.39	9.59	19.2
1.45 - 1.50	5,653	8.8	1.52	20.82	7.05	87.0	11.59	5.33	21.8	27.98	11.06	12.5
1.50 - 1.55	2,413	3.7	1.61	22.61	9.65	90.7	12.04	5.51	13.0	32.82	13.79	6.2
1.55 - 1.70	3,600	5.6	1.55	28.04	10.52	96.3	12.97	5.80	9.3	36.88	15.40	2.4
Sink 1.70	2,373	3.7	1.23	50.44	22.90	100.0	14.35	6.43	3.7	50.44	22.90	
Totals	64,496	100.0										

* Moisture-free basis.

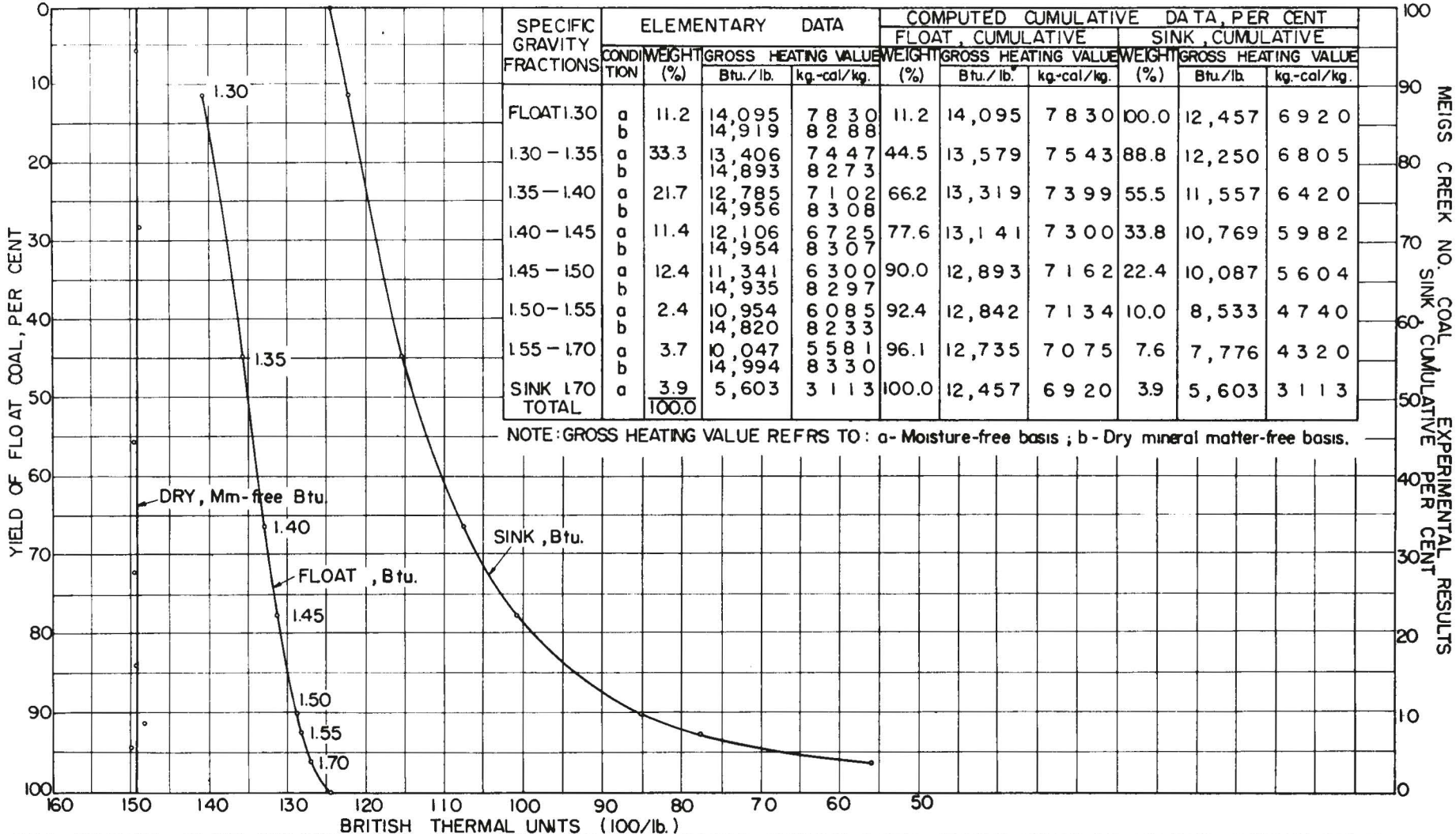
DATA SHEET 78. - Float-and-sink tests data sheet and washability curves; coal sample from lower bench of Koontz Coal Company strip mine near Harriettsville, $SE\frac{1}{4}$ $SE\frac{1}{4}$ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -3/8 to +1/4 inches.



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	1776	11.2	1.87	4.34	3.88	11.2	4.34	3.88	100.0	13.99	6.36	
1.30 - 1.35	5293	33.3	1.86	8.33	4.65	44.5	7.33	4.46	88.8	15.21	6.67	55.0
1.35 - 1.40	3444	21.7	1.84	12.34	5.53	66.2	8.97	4.81	55.5	19.33	7.88	33.1
1.40 - 1.45	1816	11.4	1.80	16.34	6.50	77.6	10.05	5.06	33.8	23.82	9.40	23.8
1.45 - 1.50	1970	12.4	1.54	20.81	7.40	90.0	11.53	5.38	22.4	27.64	10.86	14.8
1.50 - 1.55	382	2.4	1.59	22.36	9.11	92.4	11.82	5.48	10.0	36.13	15.18	4.0
1.55 - 1.70	582	3.7	1.47	28.50	10.22	96.1	12.46	5.66	7.6	40.37	17.06	1.6
Sink 1.70	614	3.9	1.23	51.84	23.65	100.0	13.99	6.36	3.9	51.84	23.65	
Totals	15,877	100.0										

* Moisture-free basis.

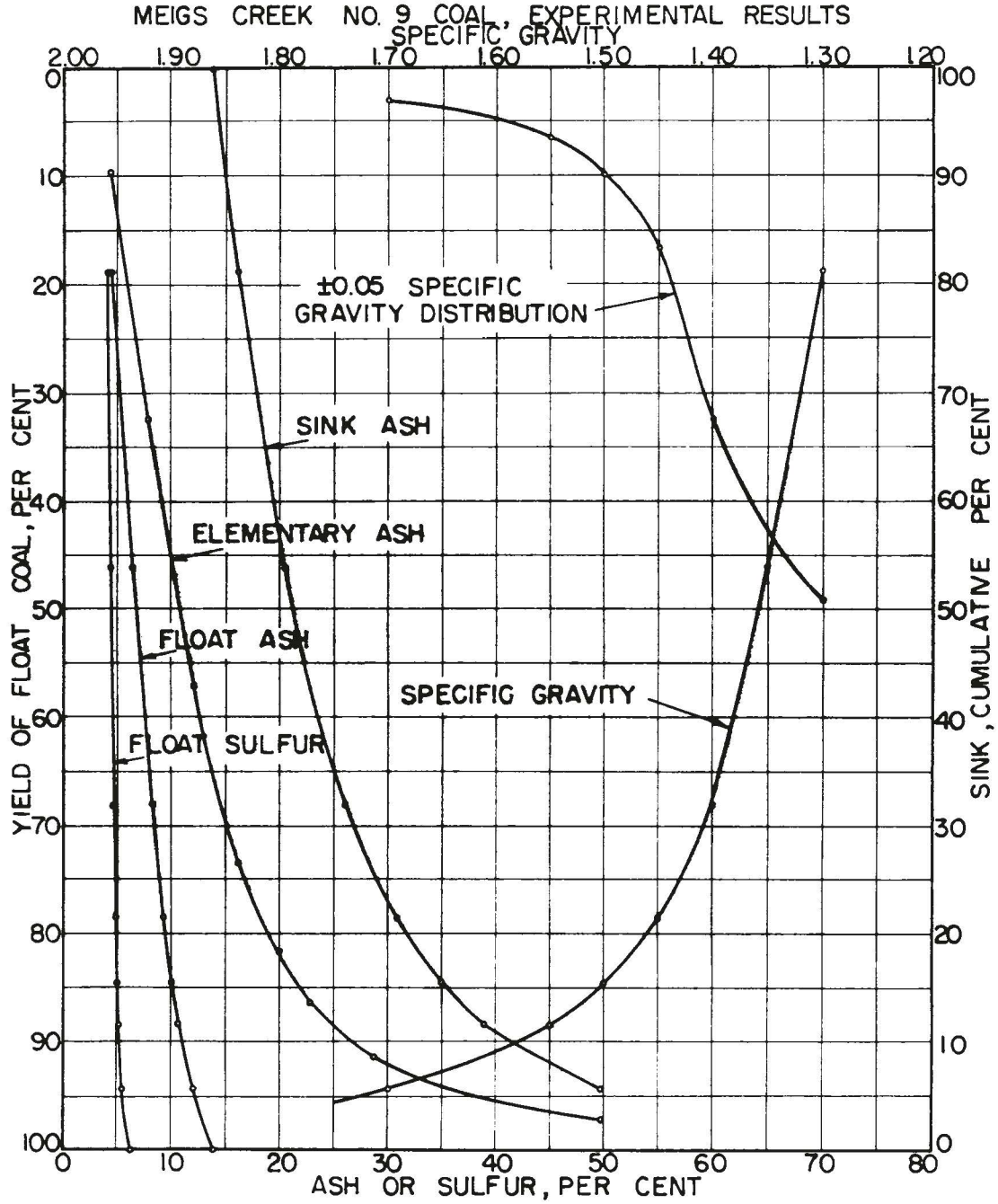
DATA SHEET 79. - Float-and-sink tests data sheet and washability curves; coal sample from lower bench of Koontz Coal Company strip mine near Harriettsville, SE¼ SE¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -1/4 to +1/8 inches.



SPECIFIC GRAVITY FRACTIONS	ELEMENTARY DATA				COMPUTED CUMULATIVE DATA, PER CENT					
					FLOAT, CUMULATIVE			SINK, CUMULATIVE		
	CONDITION	WEIGHT (%)	GROSS HEATING VALUE		WEIGHT (%)	GROSS HEATING VALUE		WEIGHT (%)	GROSS HEATING VALUE	
			Btu./lb.	kg.-cal/kg.		Btu./lb.	kg.-cal/kg.		Btu./lb.	kg.-cal/kg.
FLOAT 1.30	a	11.2	14,095	7830	11.2	14,095	7830	100.0	12,457	6920
	b		14,919	8288						
1.30 – 1.35	a	33.3	13,406	7447	44.5	13,579	7543	88.8	12,250	6805
	b		14,893	8273						
1.35 – 1.40	a	21.7	12,785	7102	66.2	13,319	7399	55.5	11,557	6420
	b		14,956	8308						
1.40 – 1.45	a	11.4	12,106	6725	77.6	13,141	7300	33.8	10,769	5982
	b		14,954	8307						
1.45 – 1.50	a	12.4	11,341	6300	90.0	12,893	7162	22.4	10,087	5604
	b		14,935	8297						
1.50 – 1.55	a	2.4	10,954	6085	92.4	12,842	7134	10.0	8,533	4740
	b		14,820	8233						
1.55 – 1.70	a	3.7	10,047	5581	96.1	12,735	7075	7.6	7,776	4320
	b		14,994	8330						
SINK 1.70	a	3.9	5,603	3113	100.0	12,457	6920	3.9	5,603	3113
TOTAL		100.0								

NOTE: GROSS HEATING VALUE REFRS TO: a- Moisture-free basis ; b - Dry mineral matter-free basis.

DATA SHEET 80.- FLOAT AND SINK TESTS DATA SHEET AND B.T.U. CURVES SHOWING GROSS HEATING VALUE OF VARIOUS SPECIFIC GRAVITY FRACTIONS, COAL SAMPLE FROM LOWER BENCH (REF. NO. 24/251), OF KOONTZ COAL COMPANY STRIP MINE NEAR HARRIETTSVILLE, SE¼ SE¼ SEC. 25, ELK TWP., NOBLE CO., OHIO. SCREEN SIZE: -¼" to +⅛".

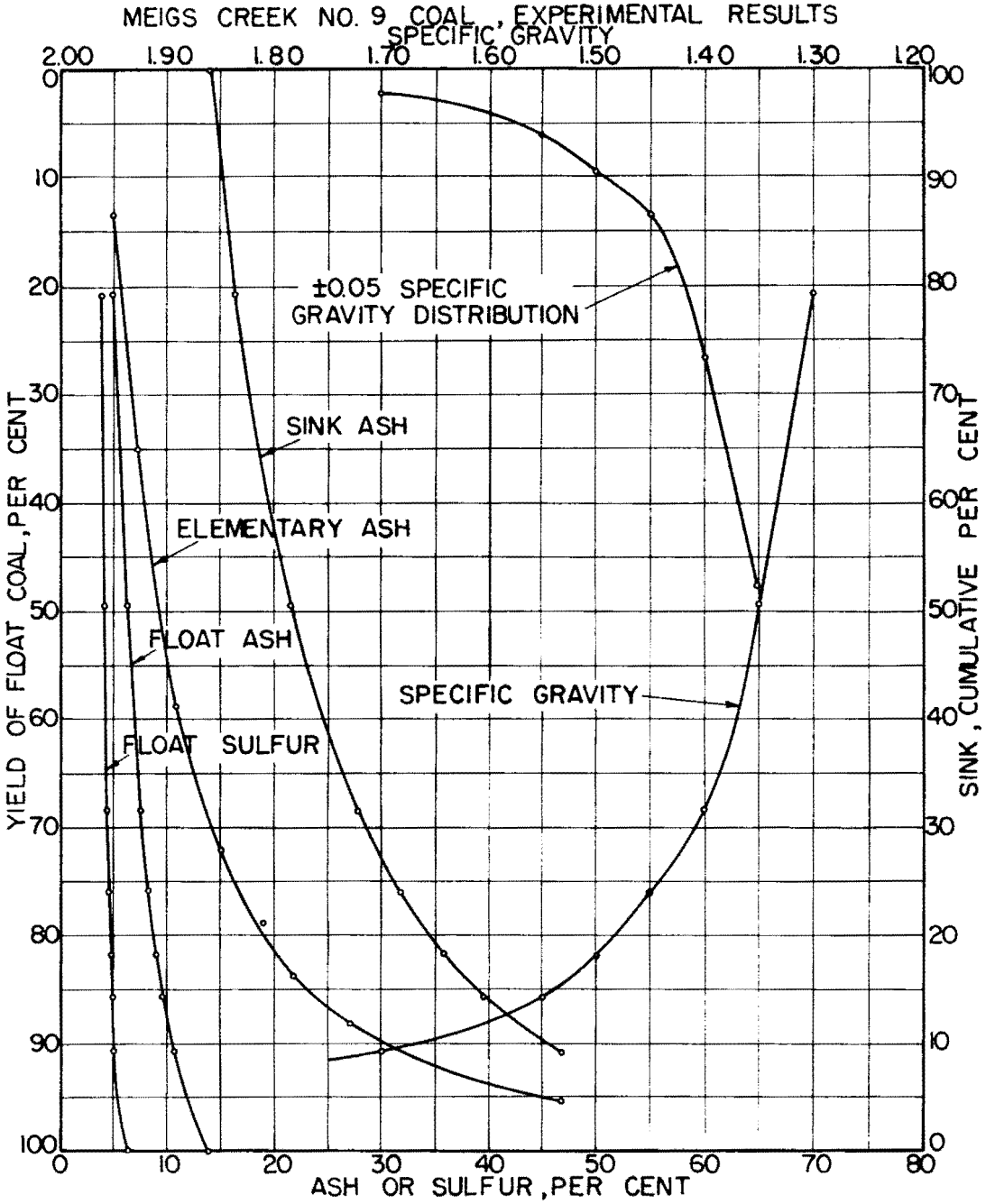


Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	2363	18.8	1.60	4.11	3.88	18.8	4.11	3.88	100.0	13.86	6.31	
1.30 - 1.35	3429	27.3	1.57	7.69	4.60	46.1	6.23	4.31	81.2	16.12	6.87	49.1
1.35 - 1.40	2733	21.8	1.60	12.02	5.32	67.9	8.09	4.63	53.9	20.39	8.02	32.4
1.40 - 1.45	1334	10.6	1.47	16.33	6.10	78.5	9.20	4.83	32.1	26.07	9.86	16.6
1.45 - 1.50	755	6.0	1.51	20.21	6.88	84.5	9.98	4.98	21.5	30.87	11.71	9.9
1.50 - 1.55	494	3.9	1.53	22.85	8.34	88.4	10.55	5.12	15.5	35.01	13.56	6.3
1.55 - 1.70	743	5.9	1.45	28.79	9.96	94.3	11.69	5.43	11.6	39.08	15.38	2.8
Sink 1.70	712	5.7	1.36	49.76	21.01	100.0	13.86	6.31	5.7	49.76	21.01	
Totals	12,563	100.0										

* Moisture-free basis.

DATA SHEET 81. - Float-and-sink tests data sheet and washability curves; coal sample from lower bench of Koontz Coal Company strip mine near Harriettsville, SE¼ SE¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -1/8 inches to +28 mesh.

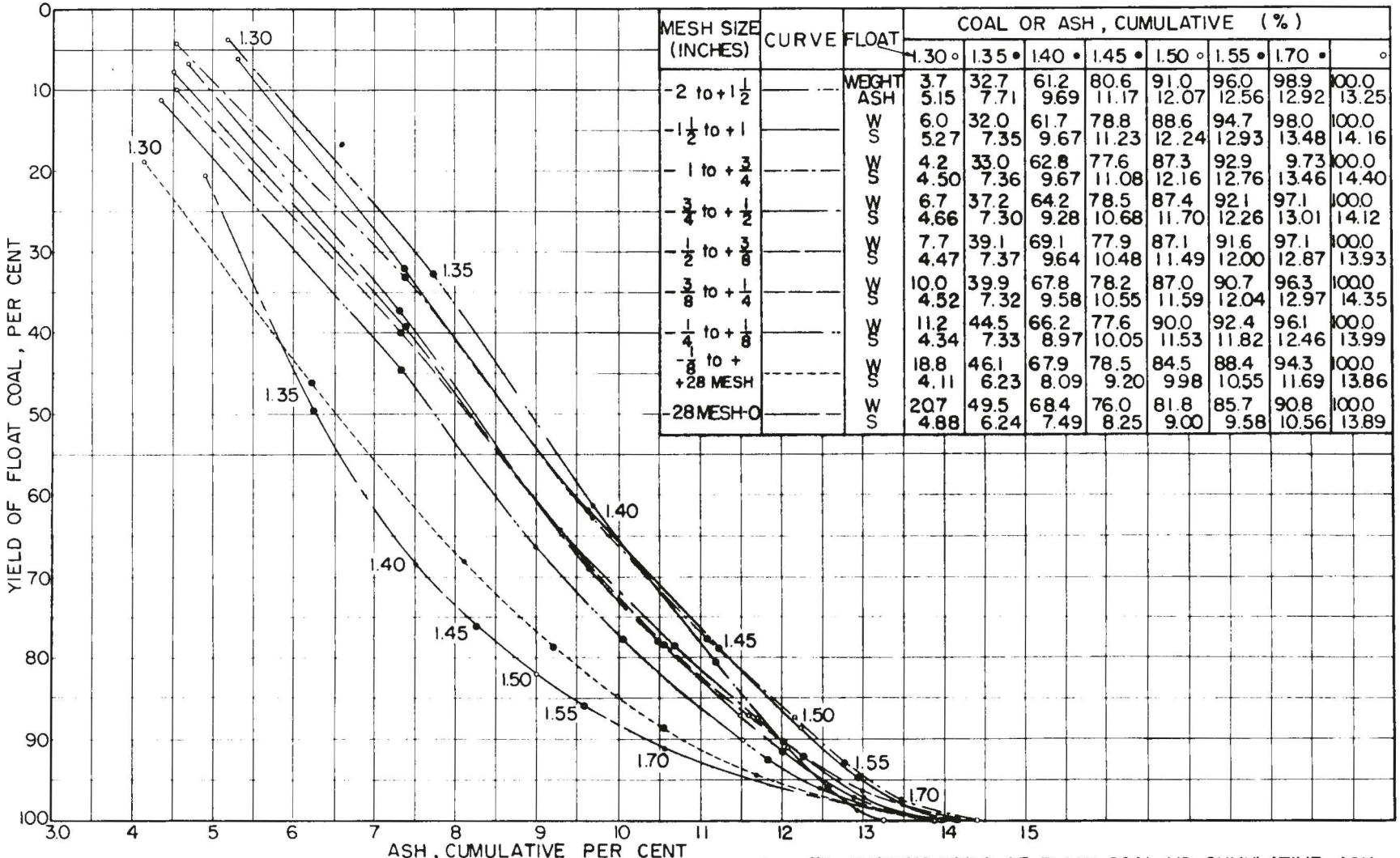
MEIGS CREEK NO. 9 COAL, EXPERIMENTAL RESULTS



Specific Gravity Fractions	Elementary Data					Computed Cumulative Data, Per Cent						Near Gravity ±0.05%
	Weight Grams	Per Cent				Float, Cumulative			Sink, Cumulative			
		Weight	Moisture	Ash*	Sulfur*	Weight	Ash*	Sulfur*	Weight	Ash*	Sulfur*	
Float 1.30	917	20.7	1.91	4.88	3.88	20.7	4.88	3.88	100.0	13.89	6.44	
1.30 - 1.35	1271	28.8	1.80	7.21	4.34	49.5	6.24	4.15	79.3	16.24	7.11	47.7
1.35 - 1.40	835	18.9	1.88	10.79	5.15	68.4	7.49	4.42	50.5	21.39	8.68	26.5
1.40 - 1.45	334	7.6	1.86	15.09	6.01	76.0	8.25	4.58	31.6	27.74	10.81	13.4
1.45 - 1.50	256	5.8	1.69	18.84	6.58	81.8	9.00	4.72	24.0	31.75	12.33	9.7
1.50 - 1.55	173	3.9	1.74	21.70	7.43	85.7	9.58	4.85	18.2	35.87	14.17	6.2
1.55 - 1.70	226	5.1	2.01	27.03	8.77	90.8	10.56	5.07	14.3	39.44	15.97	2.3
Sink 1.70	408	9.2	2.00	46.74	19.93	100.0	13.89	6.44	9.2	46.74	19.93	
Totals	4420	100.0										

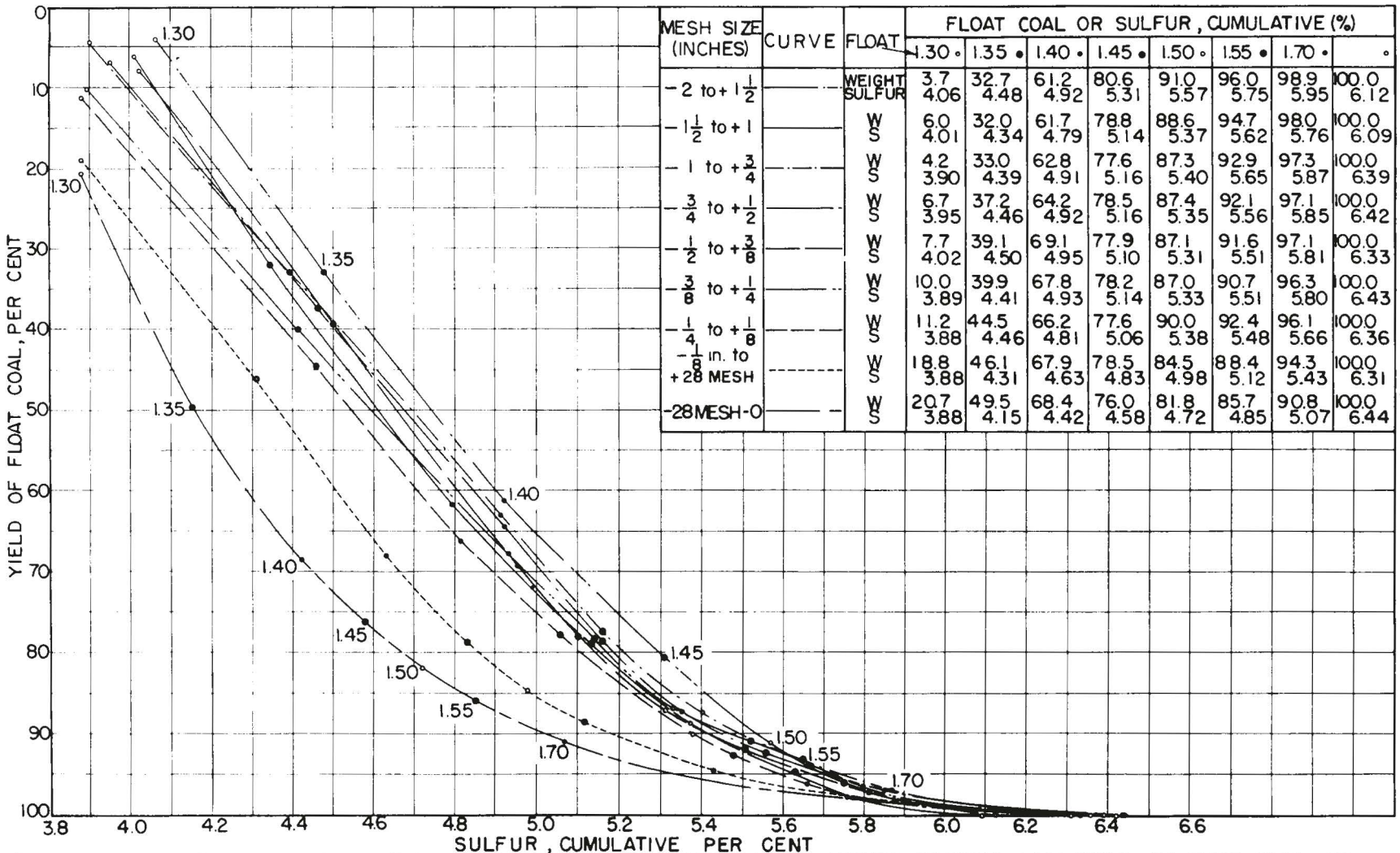
* Moisture-free basis.

DATA SHEET 82. - Float-and-sink tests data sheet and washability curves; coal sample from lower bench of Koontz Coal Company strip mine near Harriettsville, SE¼ SE¼ Sec. 25, Elk Township, Noble County, Ohio. Screen size: -28 mesh to 0.



MESH SIZE (INCHES)	CURVE	FLOAT	COAL OR ASH, CUMULATIVE (%)							
			1.30 ○	1.35 ●	1.40 ●	1.45 ●	1.50 ○	1.55 ●	1.70 ●	○
-2 to +1½	—·—	WEIGHT	3.7	32.7	61.2	80.6	91.0	96.0	98.9	100.0
		ASH	5.15	7.71	9.69	11.17	12.07	12.56	12.92	13.25
-1½ to +1	——	W	6.0	32.0	61.7	78.8	88.6	94.7	98.0	100.0
		S	5.27	7.35	9.67	11.23	12.24	12.93	13.48	14.16
-1 to +¾	—·—	W	4.2	33.0	62.8	77.6	87.3	92.9	9.73	100.0
		S	4.50	7.36	9.67	11.08	12.16	12.76	13.46	14.40
-¾ to +½	——	W	6.7	37.2	64.2	78.5	87.4	92.1	97.1	100.0
		S	4.66	7.30	9.28	10.68	11.70	12.26	13.01	14.12
-½ to +⅜	——	W	7.7	39.1	69.1	77.9	87.1	91.6	97.1	100.0
		S	4.47	7.37	9.64	10.48	11.49	12.00	12.87	13.93
-⅜ to +¼	——	W	10.0	39.9	67.8	78.2	87.0	90.7	96.3	100.0
		S	4.52	7.32	9.58	10.55	11.59	12.04	12.97	14.35
-¼ to +⅛	—··	W	11.2	44.5	66.2	77.6	90.0	92.4	96.1	100.0
		S	4.34	7.33	8.97	10.05	11.53	11.82	12.46	13.99
-⅛ to +28 MESH	- - -	W	18.8	46.1	67.9	78.5	84.5	88.4	94.3	100.0
		S	4.11	6.23	8.09	9.20	9.98	10.55	11.69	13.86
-28 MESH-0	——	W	20.7	49.5	68.4	76.0	81.8	85.7	90.8	100.0
		S	4.88	6.24	7.49	8.25	9.00	9.58	10.56	13.89

DATA SHEET 83.— FLOAT AND SINK TESTS DATA SHEET AND FLOAT ASH CURVES SHOWING YIELD OF FLOAT COAL VS. CUMULATIVE ASH CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COAL SAMPLE (NO. 24/251) FROM LOWER BENCH OF KOONTZ COAL COMPANY STRIP MINE NEAR HARRIETTSVILLE, SE¼ SE¼ SEC. 25 ELK TWP., NOBLE CO., OHIO.



MESH SIZE (INCHES)	CURVE	FLOAT	FLOAT COAL OR SULFUR, CUMULATIVE (%)							
			1.30 ◦	1.35 •	1.40 •	1.45 •	1.50 ◦	1.55 •	1.70 •	◦
−2 to+ 1½	———	WEIGHT	3.7	32.7	61.2	80.6	91.0	96.0	98.9	100.0
		SULFUR	4.06	4.48	4.92	5.31	5.57	5.75	5.95	6.12
−1½ to+ 1	———	W	6.0	32.0	61.7	78.8	88.6	94.7	98.0	100.0
		S	4.01	4.34	4.79	5.14	5.37	5.62	5.76	6.09
− 1 to +¾	———	W	4.2	33.0	62.8	77.6	87.3	92.9	97.3	100.0
		S	3.90	4.39	4.91	5.16	5.40	5.65	5.87	6.39
−¾ to +½	———	W	6.7	37.2	64.2	78.5	87.4	92.1	97.1	100.0
		S	3.95	4.46	4.92	5.16	5.35	5.56	5.85	6.42
−½ to +⅜	———	W	7.7	39.1	69.1	77.9	87.1	91.6	97.1	100.0
		S	4.02	4.50	4.95	5.10	5.31	5.51	5.81	6.33
−⅜ to +¼	———	W	10.0	39.9	67.8	78.2	87.0	90.7	96.3	100.0
		S	3.89	4.41	4.93	5.14	5.33	5.51	5.80	6.43
−¼ to +⅛	———	W	11.2	44.5	66.2	77.6	90.0	92.4	96.1	100.0
		S	3.88	4.46	4.81	5.06	5.38	5.48	5.66	6.36
−⅛ in. to +28 MESH	- - -	W	18.8	46.1	67.9	78.5	84.5	88.4	94.3	100.0
		S	3.88	4.31	4.63	4.83	4.98	5.12	5.43	6.31
-28MESH-0	———	W	20.7	49.5	68.4	76.0	81.8	85.7	90.8	100.0
		S	3.88	4.15	4.42	4.58	4.72	4.85	5.07	6.44

DATA SHEET 84— FLOAT AND SINK TESTS DATA SHEET AND FLOAT SULFUR CURVES SHOWING THE YIELD OF FLOAT COAL VS. CUMULATIVE SULFUR CONTENT FOR VARIOUS SCREEN SIZES AS OBTAINED BY A STEP-BY-STEP CRUSHING AND FLOATING OF THE SAME COAL SAMPLE (NO. 24/251) FROM LOWER BENCH OF KOONTZ COAL COMPANY STRIP MINE NEAR HARRIETTSVILLE, SE¼ SE¼ SEC 25, ELK TWP., NOBLE CO., OHIO.

1. Anon., Largest Bituminous Coal Cleaning Plant Begins Operations, Mining Congress J., 37, 20-23 (Aug. 1951).

2. Anon., Hanna Opens 3-Process Plant, Mechanization, 15, 105-107 (Sept. 1951).

3. Anon., Georgetown Preparation Plant, Coal Age, 56, 78-83 (Sept. 1951).

4. Anon., Coal Chemicals, Fortune, Sept. 1952, p. 122.

5. Bailey, A. L., and Landry, B. A., Sampling of Coal for Float-and-Sink Tests, Min. Eng., 1 (3) (March 1949); Mining Trans. pp. 79-84, A.I.M.E. Tech. Paper 2539 F.

6. Bird, B. M., Interpretation of Float-and-Sink Data, Proc. Third International Conference on Bituminous Coal, 2, 721-735 (Nov. 1931).

7. Bird, B. M., Gandrud, B. W., and Nelson, E., Washability Studies of the Mary Lee Bed at Lewisburg, Alabama, U. S. Bur. Mines, R. I. 3012, 1930.

8. Bituminous Coal Institute, Bituminous Coal Annual, Washington 5, D. C., 1950.

9. Bownocker, J. A., and Dean, Ethel S., Analyses of the Coals of Ohio; Part II, Ohio Coal Supply and its Exhaustion by Frank A. Ray, Geological Survey of Ohio, Bull. 34, Columbus, 1929.

10. Breithaupt, C. E., Low-Temperature Carbonization of Oil Shale and Coal, Thesis for M. Sc. degree, The Ohio State University, 1951.

11. British Coke Research Association, Tech. Paper No. 3, Jan. 1952.

12. Chapman, W. R., The Examination of Coals with a View to Mechanical Cleaning, Colliery Guardian (Overseas Supplement) London, Winter 1951, pp. 6-11.

13. Chapman, W. R., and Mott, R. A., The Cleaning of Coal, Chapman & Hall Ltd., London, 1928.

14. Coe, G. D., An Explanation of Washability Curves for the Interpretation of Float-and-Sink Data on Coal, U. S. Bur. Mines, I. C. 7045, 1938.

15. Cooper, H. M., Tarpley, E. C., and Abernethy, F. R., Effects of Moisture on Float-and-Sink Testing of Lignite, U. S. Bur. Mines, R. I. 4184, 1947.

16. Fieldner, A. C., and Selvig, W. A., Notes on the Sampling and Analysis of Coal, U. S. Bur. Mines Tech. Paper 586, 1941.

17. Fraser, T., Crentz, W. L., and Bailey, A. L., High-Sulfur Pittsburgh Coal, U. S. Bur. Mines Bull. 483, 1950.

18. Fraser, T., Crentz, W. L., and Barrett, O. T., Preparation Characteristics of Some Coals Available for the Synthetic Liquid Fuels Industry, U. S. Bur. Mines Bull. 495, 1950.

19. Gandrud, B. W., and Coe, G. D., Washability Studies of the America and the Pratt Coal Beds at Gorgas, Ala., U. S. Bur. Mines R. I. 3458, 1939.

BIBLIOGRAPHY (CON'T)

20. Krumin P. O. , Review of Estonian Oil Shale Industry, with a Brief Account of Oil Shale Development in the United States, O. S. U. Eng. Exp. Sta. Circ. 50, Nov. 1949.

21. Krumin, P. O., Some Studies of Ohio Coals and Oil Shales, in O. S. U. Eng. Exp. Sta. Bull. 143, May, 1951.

22. Ohio Coal Association, Description of Ohio Coal Beds, Cleveland 13, Ohio, 1950.

23. Johnson, A. J., and Auth, G. H., Fuels and Combustion Handbook, McGraw-Hill Book Co., Inc., 1951.

24. Savage, W. H. D., Brink, P. A. M., v.d. Merwe, J. M., and Malherbe, P. Le R., A Study of the Float and Sink Analysis of Coal with Special Reference to the Effect of Variations in the Moisture Content of the Coal, Fuel Research Inst., South Africa, Bull. 36, July, 1951.

25. Yancey, H. F., and Fraser, T., Coal-Washing Investigations, Methods, and Tests, U. S. Bur. Mines Bull. 300, 1929.

26. Yancey, H. F. and Geer, M. R., The Cleaning of Coal, in Chemistry of Coal Utilization, H. H. Lowry, Ed., John Wiley & Sons, Inc., New York, Vol. I, pp. 572-599.

27. Zimmerman, R. E., Plant Control and Efficiencies, in Coal Preparation, D. R. Mitchell, Ed., American Institute of Mining and Metallurgical Engineers, New York, 1950, pp.773-796.

ACKNOWLEDGMENTS

The author of Part II wishes to express his grateful acknowledgment for the assistance and consideration received during the preparation of this material to the following:

Professor Harry E. Nold, Department of Mining, The Ohio State University, and Professor John H. Melvin, Chief of the Division of Geological Survey, for initiation of the Project, designated "Investigation of the Meigs Creek No. 9 Coal," and many valuable suggestions; C. E. MacQuigg, late Dean of the College of Engineering and Director of the Engineering Experiment Station; J. R. Shank, Assistant Director of the Engineering Experiment Station, and Professor T. H. Kerr, Director of the Fuels Research Laboratory, for granting funds to carry on the work, and for their active interest in and continued assistance during the investigation; Dr. Arno Fieldner, Chief Fuel Technologist, U. S. Bureau of Mines, Washington, D. C., and Bureau of Mines staff members Roy F. Abernethy, Chief, Coal Analysis Section, and William L. Crentz, Coal Technologist, Coal Preparation Section, for the many valuable suggestions regarding the methods used for float-and-sink tests; to the management and staff of the: (1) Hanna Coal Company, (2) Janes Coal Sales, Inc., (3) Central Ohio Coal Company, (4) Koontz Coal Company, and (5) the persons listed in Table I for complete co-operation in gathering coal samples for investigation; Karl Svanks and Emil Mednis, Research Assistants, Engineering Experiment Station, who showed a great interest in laboratory investigations and performed many of the necessary analyses, with very reliable results; graduate students R. N. Eilerman, J. J. Shlosser, M. B. Dutt, R. MacGregor, C. M. Patel and H. S. Al-Ahmad for aid and assistance in performing part of the routine work; the Station's draftsman, Tom Strub, in preparing the illustrations, and the Station's editorial staff in preparing the manuscript for the printer; thanks are also given to Representative David Lewis of Perry County for calling to the attention of government and university officials the urgent need for coal research in the state of Ohio and to the Ohio State University for recognizing this responsibility for special funds which have made this research possible.

MEIGS CREEK COAL MAPS AND SECTIONS

Showing Extent of Coal in the

CUMBERLAND AND CALDWELL QUADRANGLES

The two maps and plate of sections contained in this envelope were prepared in 1947 by G. W. White during his tenure as State Geologist and were printed as an expedient in making available data on the extent of the Meigs Creek coal deposits.

Because the 1952 report on the Meigs Creek coal Resources will largely supersede the original purpose of these maps, the remaining copies are being distributed with Report of Investigations #17 to a selected list of individuals and companies to whom it is felt they will be of the most value.

OHIO
CALDWELL QUADRANGLE

Base from U.S. Geological Survey, 1909

MAP OF MEIGS CREEK COAL IN CALDWELL QUADRANGLE, OHIO

(PARTS OF NOBLE, WASHINGTON AND MORGAN COUNTIES.)

Compiled by

GEO. W. WHITE

From work of G.W. White, assisted by R.E. Lee, 1944 and N.K. Flint, 1945; W. Stout, assisted by R.H. Peters, 1926 and T.R. Meyers, 1927; D.D. Condit, 1910; and C.N. Brown, 1883.

1 ½ 0 1 2 3 4 Miles

Contour interval 20 feet.

STATE OF OHIO DEPARTMENT OF PUBLIC WORKS
GEOLOGICAL SURVEY OF OHIO
COLUMBUS 1947

EXPLANATION

(blue)	Area underlain by Meigs Creek Coal.
912	Elevation of base of coal.
X	Location of measured section shown on accompanying sheet, sections measured by
123	G. W. White
S712	W. Stout
B40	C.N. Brown

OHIO
CUMBERLAND QUADRANGLE

MAP OF MEIGS CREEK COAL IN CUMBERLAND QUADRANGLE, OHIO

(PARTS OF GUERNSEY, NOBLE, MUSKINGUM AND MORGAN COUNTIES.)

Compiled by

GEO. W. WHITE

From work of G.W. White, assisted by R.E. Lee, 1944 and N.K. Flint, 1945; W. Stout, 1917 and 1926; R.E. Lamborn, 1916, D.D. Condit, 1910; and C.N. Brown, 1883.

1 ½ 0 1 2 3 4 Miles

Contour interval 20 feet.

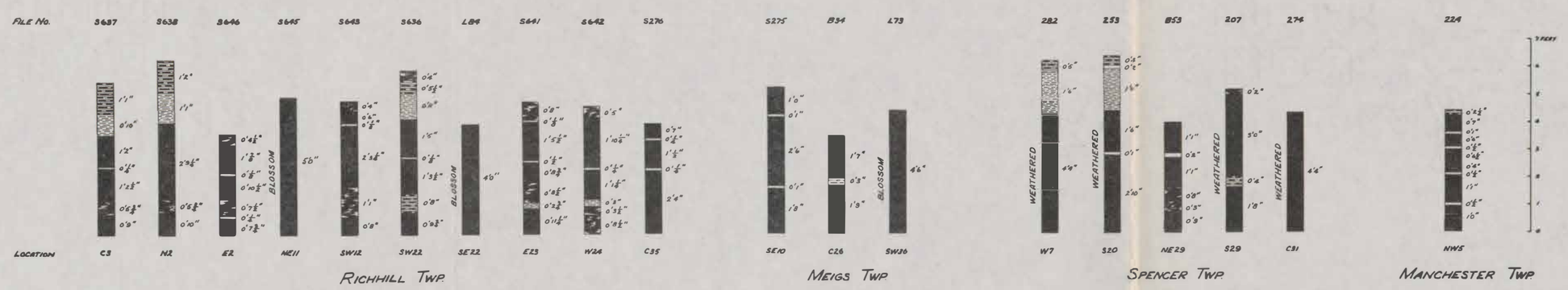
STATE OF OHIO DEPARTMENT OF PUBLIC WORKS
GEOLOGICAL SURVEY OF OHIO
COLUMBUS 1947

Base from U.S. Geological Survey, 1909

EXPLANATION

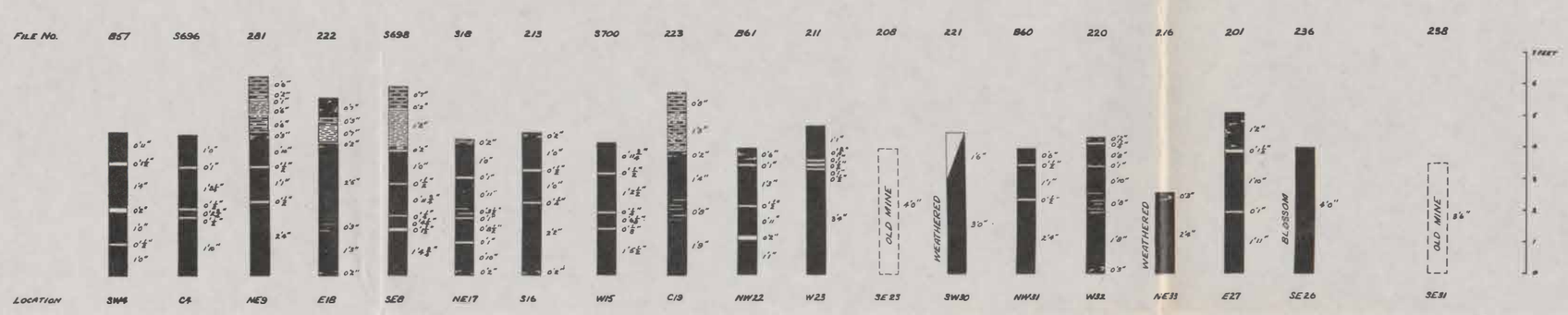
	Area underlain by Meigs Creek Coal.
912	Elevation of base of coal.
X	Location of measured section shown on accompanying sheet, sections measured by
123	G. W. White
S712	W. Stout
L84	R.E. Lamborn
B40	C.N. Brown

CUMBERLAND QUADRANGLE



RICHHILL TWP. | MEIGS TWP. | SPENCER TWP. | MANCHESTER TWP.

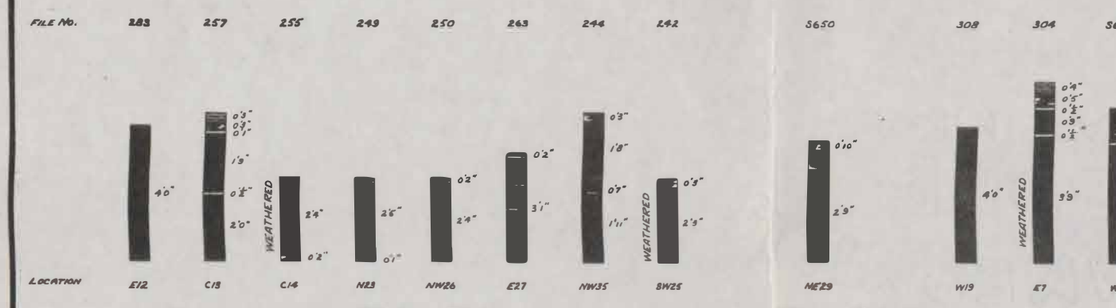
MUSKINGUM COUNTY | GUERNSEY COUNTY | MORGAN CO.



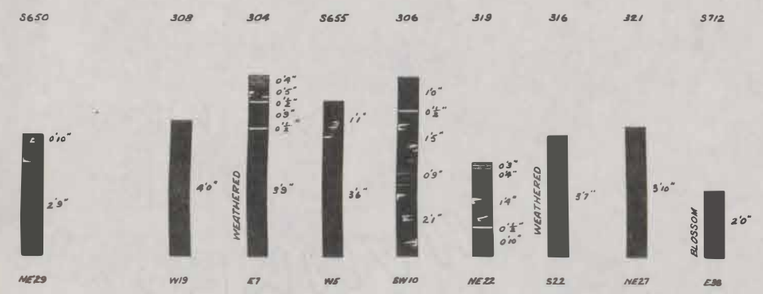
BROOKFIELD TWP. | NOBLE TWP.

NOBLE COUNTY

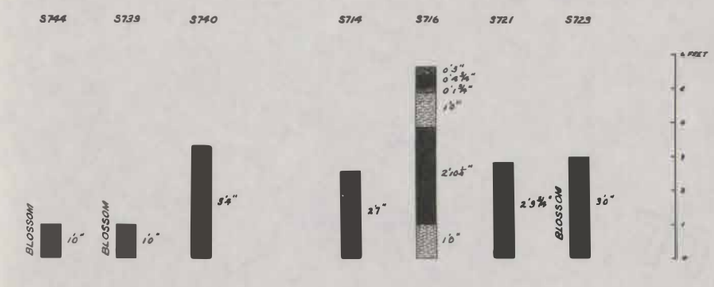
CALDWELL QUADRANGLE



SHARON TWP.

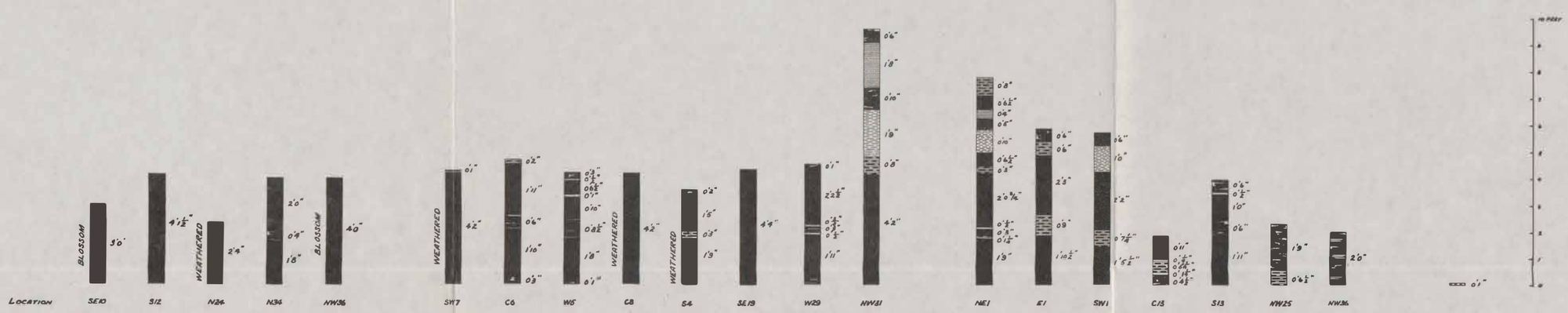


OLIVE TWP. | JACKSON TWP.

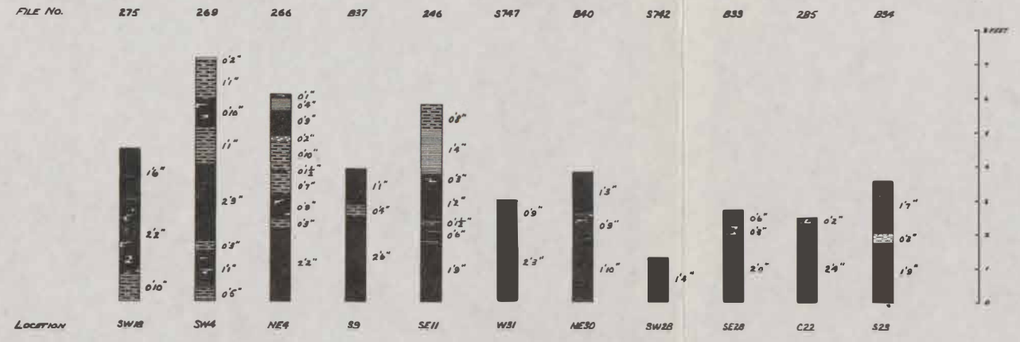


WATERFORD TWP. | ADAMS TWP.

NOBLE COUNTY | WASHINGTON COUNTY



BRISTOL TWP. | MANCHESTER TWP. | MEIGSVILLE TWP. | WINDSOR TWP.



CENTER TWP.

MORGAN COUNTY

STATE OF OHIO
DEPARTMENT OF PUBLIC WORKS
GEOLOGICAL SURVEY OF OHIO
1947

EXPLANATION

- Coal
- Shaly or Bony Coal
- Carbonaceous Shale
- Shale

Locations shown by file numbers on quadrangle maps.

123 Section measured by G.W. White

S720 Section measured by W. Stout

B40 Section measured by C.N. Brown

L84 Section measured by R.E. Lamborn

SECTIONS OF MEIGS CREEK COAL IN CUMBERLAND AND CALDWELL QUADRANGLES OHIO

(Parts of Muskingum, Guernsey, Morgan, Noble and Washington Counties)

TO ACCOMPANY MAPS SHOWING MEIGS CREEK COAL IN CUMBERLAND AND CALDWELL QUADRANGLES OHIO

LBP