DOE/EIA-0529(95)
Distribution Category UC-950

U.S. Coal Reserves: A Review and Update

August 1996

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Preface

Section 205(a)(2) of the Department of Energy Organization Act of 1977 (Public Law 95-91) requires the Administrator of the Energy Information Administration (EIA) to carry out a central, comprehensive, and unified energy data information program to collect, evaluate, assemble, analyze, and disseminate data and information relevant to energy resources, reserves, production, demand, technology, and related economic and statistical information.

This report, *U.S. Coal Reserves: A Review and Update*, is the third in series of "U.S. Coal Reserves" reports. As part of the EIA program to provide information on coal, it presents detailed estimates of domestic coal reserves, which are basic to the analysis and forecasting of future coal supply. It also describes the data, methods, and assumptions used to develop such estimates and explains terminology related to recent data programs. In addition, the report provides technical documentation for specific revisions and adjustments to the demonstrated reserve base (DRB) of coal in the United States and for coal quality and reserve allocations. It makes the resulting data available for general use by the public.

This report includes data on recoverable coal reserves located at active mines and on the estimated distribution of rank and sulfur content in those reserves. An analysis of the projected demand and depletion in recoverable reserves at active mines is used to evaluate the areas and magnitude of anticipated investment in new mining capacity.

The legislation that created EIA vested the organization with an element of statutory independence. EIA's responsibilities are to provide timely, high-quality information and to perform objective, credible analyses in support of deliberations by both public and private decisionmakers. EIA does not take positions on policy questions. Accordingly, this report does not purport to represent the policy positions of the U.S. Department of Energy or the Administration.

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Demonstrated Reserve Base

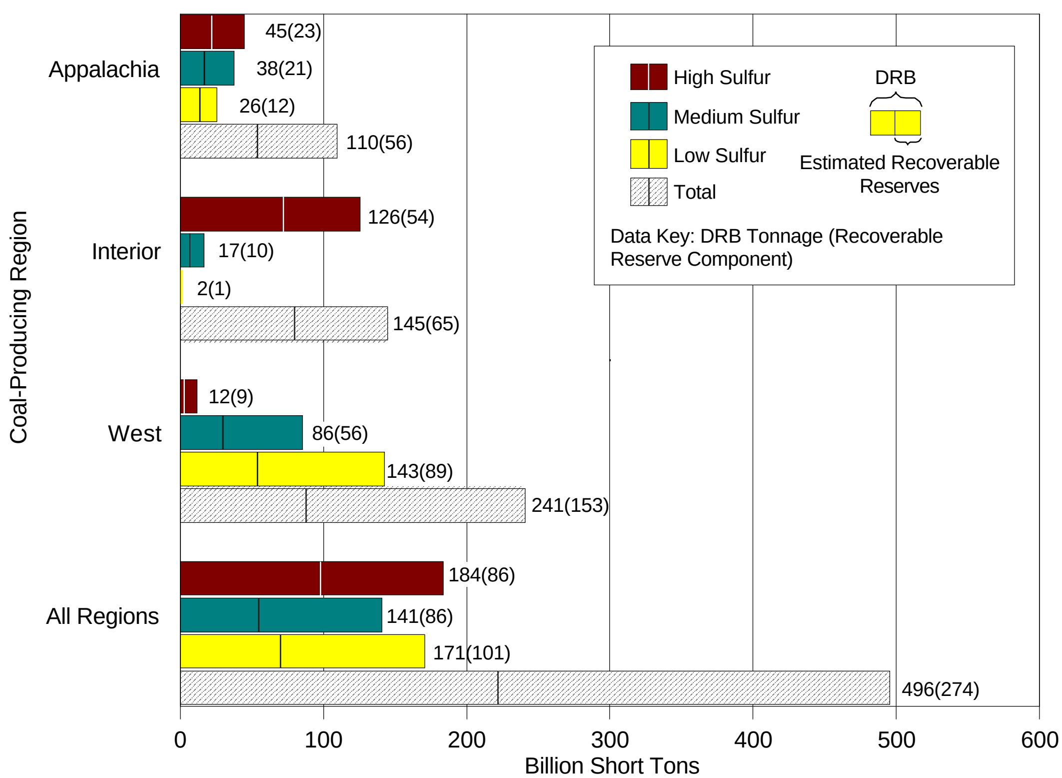
This report, *U.S. Coal Reserves: A Review and Update*, contains updates to the coal resource and reserve data maintained by the Energy Information Administration (EIA). The demonstrated reserve base (DRB) of coal is a selected subset of U.S. coal resource data, first published in 1974, to provide an internally compatible database of in-place coal in which mining is likely to occur. Key DRB data include the following:

- ✔ **The new estimates of DRB coal resources remaining as of January 1, 1995, is 496 billion short tons** (Figure HL1). This is an increase of nearly 22 billion short tons over the previous (1993) DRB estimate of 474 billion short tons. Although the DRB is more than 480 times U.S. coal production in 1995, almost half the DRB is either inaccessible or likely to be lost in the mining process

- ✔ The increase in the DRB is attributable to major revisions in a few States. In New Mexico, the updated DRB increased by more than 8 billion short tons; in Illinois, by 12 billion short tons; and in eastern Kentucky, by 4 billion short tons. Nationally, these increases were offset by nearly 3 billion short tons of depletion between 1993 and 1995.

- ✔ **Nearly half the DRB is found in the West** (see Figure HL2). Coal resources recoverable by

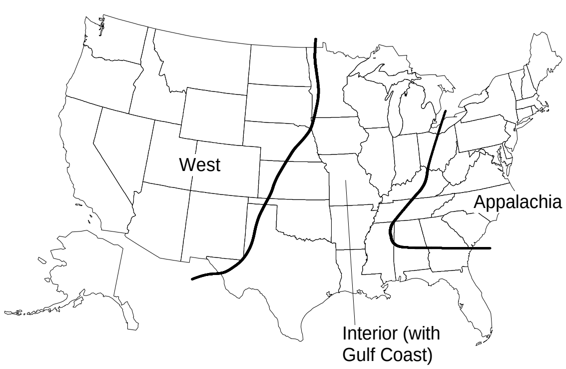
Figure HL1. Demonstrated Reserve Base of Coal and Estimated Recoverable Reserves in the United States by Sulfur Content and Coal-Producing Region as of January 1, 1995



Note: In each bar the entire length represents the demonstrated reserve base (DRB), and the segment of the bar on the right represents estimated recoverable reserves.
Source: Energy Information Administration estimates.

surface mining make up one-third of the DRB, more than half of which (58 percent) also occurs in the West. Two-thirds of the DRB is minable only by underground mining, and more than half of that amount (56 percent) is found in the Interior and Appalachian Coal-Producing Regions. Overall, recovery of about 55 percent of the coal in the DRB is projected for surface and underground mining combined.

Figure HL2. Coal-Producing Regions



Note: Delineations depict only boundaries between regions. Actual coal production originates from coal-bearing areas (not shown) within each region. For more information, see Table 17.
Source: Energy Information Administration.

✔ **The quantities of low-sulfur, medium-sulfur, and high-sulfur coals in the DRB are in approximately equal proportions** (Figure HL1). Nationwide, low-sulfur coal is estimated to amount to 171 billion short tons, or 34 percent of all coal included in the DRB. Medium-sulfur coal accounts for 28 percent of the DRB and high-sulfur coal for 37 percent.

✔ **Most low-sulfur coal (84 percent) and medium-sulfur coal (61 percent) included in the DRB is in the West**. Most of the high-sulfur coal in the DRB (69 percent) is in the Interior region.

Estimated Recoverable Reserves

This report also includes updates to EIA's estimated recoverable reserves of coal in the United States. Estimated recoverable reserves (formerly called "recoverable reserves" by EIA) are the quantities of coal that may be recoverable from the DRB, based on regional estimates of coal resource accessibility and mining recovery rates. The estimated recoverable reserves have been assigned the same Btu and sulfur content as the regional DRB from which they were extracted. The estimated recoverable reserves have the following characteristics:

✔ **The estimated recoverable reserves of the United States include 274 billion short tons** (Figure HL1). Summarized by low-, medium-, and high-sulfur levels, they diverge somewhat from the profile of their DRB source data because of regional differences in resource accessibility, geology, and recovery rates.

✔ **Estimated low-sulfur recoverable reserves make up the largest part of the total, at 37 percent**. Estimated medium- and high-sulfur recoverable reserves each make up about 31.5 percent. This distribution by sulfur content is somewhat reversed from that for the DRB, where high-sulfur coal accounts for the largest part of the total (37 percent).

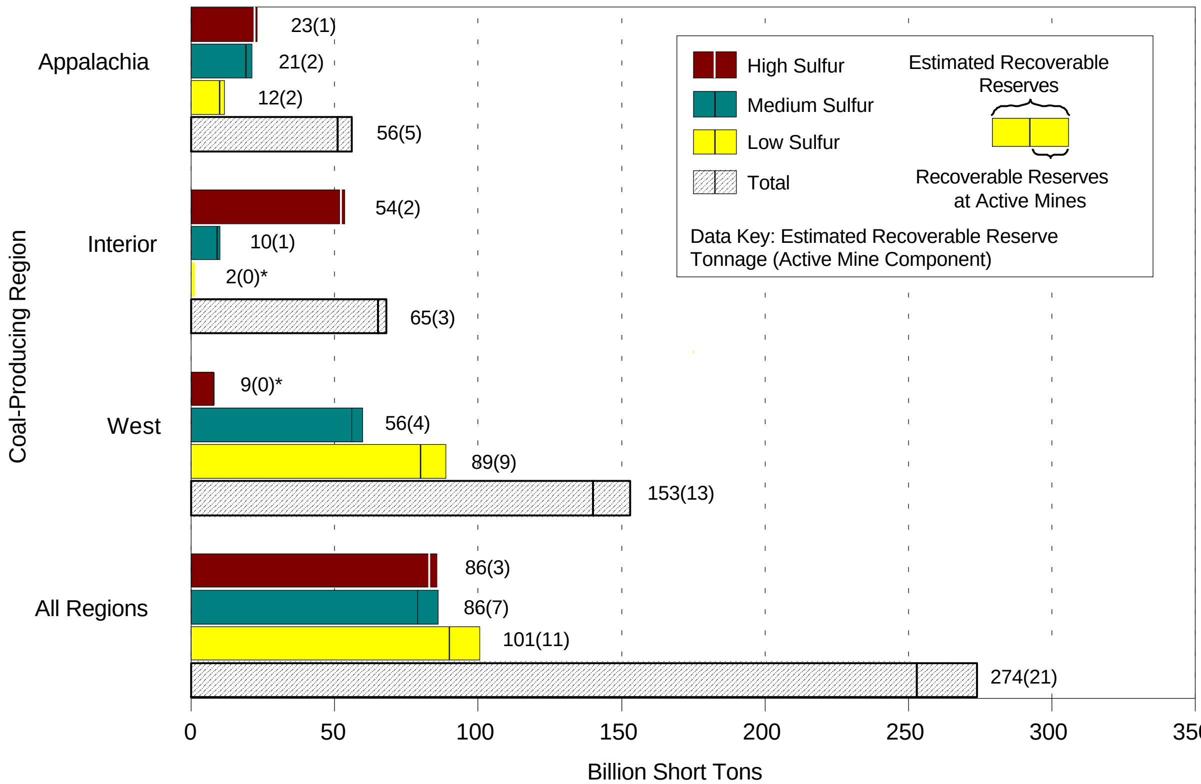
✔ **Higher recovery rates are projected for surface-minable reserves concentrated in the West than for underground reserves in the Interior and Appalachia, where more of the coal is high-sulfur.**

Recoverable Reserves at Active Mines

A new feature in this report is the allocation of recoverable coal reserves at active mines by sulfur content (Figure HL3). Recoverable reserves at active mines are reported in EIA's *Coal Industry Annual*, but sulfur content data are not provided. Estimates of the sulfur content of the recoverable reserves at active mines are developed using coal quality data collected for coal shipped to electric utilities, independent power producers, industrial consumers, and coke plants. This issue of *U.S. Coal Reserves* also contains estimates of the number of years that the recoverable reserves at mines active in 1994 (the most recent data available) could support the levels of coal production published in EIA's *Annual Energy Outlook 1996 (AEO96)* reference case forecast. *AEO96* provides an integrated forecast for all market-based sources of energy through 2015.

✔ **Recoverable coal reserves at active mines in some regions and for certain sulfur levels will soon be exhausted and new mine capacity will be needed.** Increased projected demand for low-sulfur coal indicates the need for substantial new

Figure HL3. Estimated Recoverable Reserves and Recoverable Reserves at Active Mines in the United States by Sulfur Content and Coal-Producing Region as of January 1, 1995



*Numbers less than 0.5 have been rounded to zero.

Notes: In each bar the entire length represents the estimated recoverable reserves and the smaller segment of the bar represents recoverable reserves at active mines. Totals for reserves at active mines exclude data for Arkansas, Kansas, Iowa, and Louisiana, which were withheld to avoid disclosure of individual company data. Recoverable reserves at active mines, as of December 31, 1994, are equated to January 1, 1995.

Source: Energy Information Administration estimates.

mine capacity in low-sulfur coal regions, primarily in central Appalachia. Investments in new low-sulfur capacity are most critical in southern West Virginia, where recoverable reserves of low-sulfur coal at active underground mines are equivalent to only 5 years' projected production. Over the forecast period, low-sulfur coal production at underground mines in this region is projected to average more than 100 million short tons per year.

✔ **Of the predominant low-sulfur coal regions, eastern Wyoming is best positioned to meet increasing demand for low-sulfur coal over the forecast**. Active surface mines in eastern Wyoming report an estimated 6 billion short tons of low-sulfur recoverable reserves, which represent nearly 75 percent of the low-sulfur reserves at active surface mines and almost 60 percent of low-sulfur reserves at all active mines. Over the forecast period, low-sulfur coal production from surface mines in this region is projected to average almost 270 million short tons per year.

✔ For medium- and high-sulfur coal, projections of an expanding coal market and increased use of flue gas desulfurization equipment create a relatively stable market. To meet demand, some new investments in medium-sulfur coal are indicated over the forecast, mostly in Appalachia.

1. The Role of Coal and Coal Reserves Data

Coal is the largest single source of domestically produced primary energy, accounting for 32 percent in 1995. Although coal fueled only 22 percent of U.S. energy consumption (petroleum accounted for the largest percentage), it was used to produce 55 percent of the electricity generated by electric utilities.[1]

Eighty-eight percent of the coal consumed domestically in 1995 went to electric utilities, about 8 percent was consumed to fuel industrial uses (primarily manufacturing), and nearly 4 percent to produce metallurgical coke. Of the fuels consumed in the United States, only coal has a positive trade balance, with net exports of 79.3 million short tons in 1995, valued at $3.3 billion.[2] Coal may continue to be important in the U.S. energy profile and in its balance of payments, but U.S. coal is challenged by other domestic fuels, by imported low-sulfur coals, and by conflicting uses for the land at potential mine sites. The contribution domestic coal reserves will make to the economy depends on the quality of the reserves and on cost variables, such as accessibility, minability, and transportation—variables that affect coal demand and competitiveness. Reliable knowledge of U.S. coal reserves is, therefore, important.

Despite steady improvements, coal is subject to outdated notions of its environmental impacts. Although the amount of coal combusted for electricity generation has increased consistently since World War II, the amount of sulfur dioxide (SO_2) emissions from combusting that coal has held steady or decreased each year since the implementation of the Clean Air Act in 1971. In 1994, the SO_2 emissions from fossil-fueled steam electric generation, almost all of which (96 percent) was attributable to coal, declined by 9.2 percent from the 1993 levels.[3] That decline was due primarily to the use of stack scrubbers and to switching to lower sulfur coals but, in the long run, even greater environmental benefits should accrue from progress in clean coal processing and combustion technologies. A case in point: In November 1995, the Wabash River Repowering Project came on-line. It repowered a 42-year-old steam electric generator, using coal gasification combined-cycle technology developed in a Federal-private partnership under the U.S. Department of Energy's (DOE)[4] Clean Coal Technology Program. The new facility burns high-sulfur Illinois Basin coal but reduces sulfur dioxide emissions by 98 percent, nitrogen oxide emissions by 90 percent, and carbon dioxide (CO_2) emissions by 20 percent, while improving power plant efficiency by 20 percent.[5,6]

The extraction and combustion of fossil fuels currently add significantly to the emissions of greenhouse gases—gases that can accumulate in the atmosphere and may tend to raise temperatures at the Earth's surface by trapping the heat from solar radiation. Those emissions can be mitigated, however, by changes in extraction practices and technologies, processing technologies, and end-use and combustion technologies. In 1993, of the four major greenhouse gases, CO_2 made up 85 percent of the estimated emissions, based on global warming potential. Coal consumption contributed 35 percent of that CO_2, as estimated from all energy and industry sources.[7]

Clearly, the country must rely on readily available coal for a major share of its energy, now and in the foreseeable future. Businesses, utilities, and governments need data on the amounts and characteristics of reserves in the

[1]Based on British thermal units (Btu) of energy produced and consumed and on kilowatthours of net generation of electricity by electric utilities. Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(96/04) (Washington, DC, April 1996), pp. 88, 169, 5, 7, 95.

[2]Energy Information Administration, *Quarterly Coal Report*, DOE/EIA-0121(95/4Q) (Washington, DC, May 1996), pp. 38-41.

[3]Energy Information Administration, *Electric Power Annual 1994*, Volume II, DOE/EIA-0348(94)/2 (Washington, DC, November 1995), pp. 4, 45, 46.

[4]A list of acronyms and abbreviations used in this report can be found following Chapter 4.

[5]*Clean Coal Today*, Issue No. 20, "O'Leary Heralds Wabash Startup" (Germantown MD: U.S. Department of Energy, Office of Fossil Energy, Winter 1995), pp. 1-2.

[6]U.S. Department of Energy, Assistant Secretary for Fossil Energy, *Clean Coal Technology Demonstration Program: Project Fact Sheets*, DOE/FE-0339 (Washington, DC, July 1995) pp. 22-23.

[7]Greenhouse gas values based on emissions of carbon or carbon equivalent. Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 1987-1994,* DOE/EIA-0573(87-94) (Washington, DC, October 1995), pp. x, xi, 11.

energy marketplace to plan investments in technologies for environmentally responsible uses of coal and other fossil fuels.

EIA Coal Reserves Data

This report is the third in a series published by the Energy Information Administration (EIA) to provide data on coal resources and reserves (see "Important Terminology" box) allocated by estimated ranges of heat value and sulfur content. EIA's estimated recoverable reserves are derived from the demonstrated reserve base (DRB) of coal in the United States by applying adjustments for the percentages of the DRB expected to be accessible, and for the percentages of the accessible DRB expected to be recoverable by surface and underground mining. EIA's recoverable reserves at active mines, about which EIA is authorized to collect simple tonnage and recovery rate estimates in its annual *Coal Production Report* survey, rely on mine operator estimates, and cannot be classified as to geologic assurance (see "Measured Resources" in "Important Terminology" box).

Originally developed for use in EIA coal supply models, the data in the first report[8] (1989) were published to broaden communication with the public on the available data and analyses of coal resources and their characteristics and to refine estimates of the resources that may be recoverable and suitable for future needs. The second report,[9] published in 1993, incorporated new coal resource and quality data in three States. Further, it expanded the 1989 database into various non-producing areas of the DRB. For the first time, coal quality and recoverability estimates were available for all the States with DRB data.

The DRB is the only publicly available, nationwide data file of the quantities of minable coal conforming to a unified set of criteria. The DRB provides the basic input for numerous coal and energy analysis and forecasting models—both government and private. These include EIA's Resource Allocation and Mine Costing (RAMC) model, which provides input to other EIA models and is used to answer congressional and executive department requests and ad hoc analyses, and the National Energy Modeling System (NEMS), EIA's integrated energy forecasting system. The NEMS forecasts are the basis for EIA's *Annual Energy Outlook*.[10] The DRB is also used in commercial models, such as ICF, Incorporated's Coal and Electric Utility Model.

The Demonstrated Reserve Base

The in-place coal resources in the United States, including the DRB and the identified and undiscovered resources, occur within the rocks in certain coal-bearing areas (Figure 1).

The DRB was originally devised to impart a uniform set of definitions and criteria and replace the compilations of variously defined coal reserve and resource data in Federal and State studies available in the 1950's and 1960's. Engineers and geologists at the U.S. Bureau of Mines (BOM) inaugurated the DRB in the early 1970's.[11] They selected geologic reliability criteria ("measured" and "indicated") that included only resources based on multiple field measurements or resource extensions corroborated by measurements, within a defined study area. Working with the thickness categories common to contemporary coal assessments, they selected as minability criteria those broad ranges of coalbed thickness and overburden thickness that encompassed most commercial mining. For a discussion of the significance of the data and criteria on updates of the DRB and related databases, see Appendix A.

The EIA assumed responsibility for the DRB and for coal reserves data in 1977, when DOE was established. Between 1983 and 1993, EIA published annual updates to the DRB in its annual *Coal Production* reports.[12] Because of differences between DRB data and the production data as reported by coalbeds the EIA updates could be maintained only at the State level, by coal rank and type of mining. Some State updates by EIA incorporated new resource data by coalbed, but it was not feasible to maintain the national DRB at the coalbed level. DRB updates during the 1980s also broadened criteria in locations where evidence showed that coal was being mined from beds thinner or deeper than the standards (Appendix A).

[8]Energy Information Administration, *Estimation of U.S. Coal Reserves by Coal Type: Heat and Sulfur Content*, DOE/EIA-0529 (Washington, DC, October 1989).

[9]Energy Information Administration, *U.S. Coal Reserves: An Update by Heat and Sulfur Content*, DOE/EIA-0529(92) (Washington, DC, February 1993).

[10]Energy Information Administration, *Annual Energy Outlook*, DOE/EIA-0383 (various years) (Washington, DC).

[11]U.S. Department of the Interior, Bureau of Mines, *Mineral Industry Surveys*, "Demonstrated Coal Reserve Base of the United States on January 1, 1974" (Washington, DC, June 1974).

[12]Energy Information Administration, *Coal Production*, DOE/EIA-0118 (Washington, DC, various years).

Important Terminology: Resources, Reserves, and the DRB[a]

"Resources" are naturally occurring concentrations or deposits of coal in the Earth's crust, in such forms and amounts that economic extraction is currently or potentially feasible.

"Measured resources" refers to coal for which estimates of the rank and quantity have been computed to a high degree of geologic assurance, from sample analyses and measurements from closely spaced and geologically well known sample sites. Under the U.S. Geological Survey (USGS) criteria, the points of observation are no greater than ½ mile apart (see Figure A1). Measured coal is projected to extend as a 1/4-mile-wide belt from the outcrop or points of observation or measurement.

"Indicated resources" refers to coal for which estimates of the rank, quality, and quantity have been computed to a moderate degree of geologic assurance, partly from sample analyses and measurements and partly from reasonable geologic projections. Under the USGS criteria, the points of observation are from ½ to 1½- miles apart (see Figure A1). Indicated coal is projected to extend as a ½-mile-wide belt that lies more than ¼mile from the outcrop or points of observation or measurement.

"Demonstrated resources" are the sum of measured resources and indicated resources.

"Demonstrated reserve base" (DRB) (or just "reserve base" in USGS usage) is, in its broadest sense, defined as those parts of identified resources that meet specified minimum physical and chemical criteria related to current mining and production practices, including those for quality, depth, thickness, rank, and distance from points of measurement. The "reserve base" is the in-place demonstrated resource from which reserves are estimated. The reserve base may encompass those parts of a resource that have a reasonable potential for becoming economically available within planning horizons that extend beyond those which assume proven technology and current economics.

"Inferred resources" refers to coal of a low degree of geologic assurance in unexplored extensions of demonstrated resources for which estimates of the quality and size are based on geologic evidence and projection. Quantitative estimates are based on broad knowledge of the geologic character of the bed or region where few measurements or sampling points are available and on assumed continuation from demonstrated coal for which there is geologic evidence. The points of measurement are from 1½ to 6 miles apart (Figure A1). Inferred coal is projected to extend as a 2¼-mile-wide belt that lies more than ¾ mile from the outcrop or points of observation or measurement. Inferred resources are not part of the DRB.

"Recoverable" refers to coal that is, or can be, extracted from a coalbed during mining.

"Reserves" relates to that portion of demonstrated resources that can be recovered economically with the application of extraction technology available currently or in the foreseeable future. Reserves include only recoverable coal; thus, terms such as "minable reserves," "recoverable reserves," and "economic reserves" are redundant. Even though "recoverable reserves" is redundant, implying recoverability in both words, EIA prefers this term specifically to distinguish recoverable coal from in-ground resources, such as the demonstrated reserve base, that are only partially recoverable.

"Minable" refers to coal that can be mined under present-day mining technology and (in certain contexts) economics.

[a]For a full discussion of coal resources and reserve terminology as used by EIA, USGS, and BOM, see Appendix A, "Specialized Resource and Reserve Terminology."

Sources: U.S. Department of the Interior, *Coal Resource Classification System of the U.S. Bureau of Mines and the U.S. Geological*

In 1990, EIA initiated the Coal Reserves Data Base (CRDB) program, to help meet the growing need for new sources of data for U.S. coal reserves estimates. Unpublished mapping data and coal quality data from various sources and years are commonly housed at State geological surveys in a wide range of formats. In order to promote the processing, analysis, and promulgation of such data, EIA has encouraged active participation of State surveys in the CRDB program.

The resulting revised coal resource estimates include the DRB, along with accessibility adjustments, estimated recoverable reserves (recoverable coal), and allocations by Btu, sulfur, and ash content using coal quality data coordinated with mapped resources. EIA's *U.S. Coal Reserves* report in 1993 included new CRDB/State-agency data in major portions of Ohio and Wyoming, resulting in significant revisions. It also contained EIA revisions in the Pennsylvania anthracite coal fields and Btu/sulfur range

Figure 1. Coal-Bearing Areas of the United States

Sources: United States Geological Survey, *Coalfields of the United States, 1960-1961*; Texas Bureau of Economic Geology, *Lignite Resources in Texas, 1980*; Louisiana Geological Survey, *Near Surface Lignite in Louisiana, 1981*; Colorado Geological Survey, *Coal Resources and Development Map, 1981*; and Mississippi Bureau of Geology, 1983.

allocations for the DRB in parts of 10 other States. The present report includes new State agency data developed via CRDB projects in New Mexico, Illinois, and eastern Kentucky.

Coal Resource Data Framework

The DRB is part of a larger system of coal resource data and EIA's estimates of coal reserves are part of a hierarchy of U.S. Government coal resource assessment data (Figure 2). The U.S. Geological Survey (USGS) performs the mapping and field studies required to calculate identified coal resources, and it estimates undiscovered resources from extensions of available data based on known geologic information. State geological surveys also may map coal resources, and many do so in cooperation with the USGS and have adopted USGS criteria as their standards.

EIA's underlying responsibility is to develop reliable data on coal reserves, but the coal reserves data EIA is authorized to collect from the coal industry are too limited

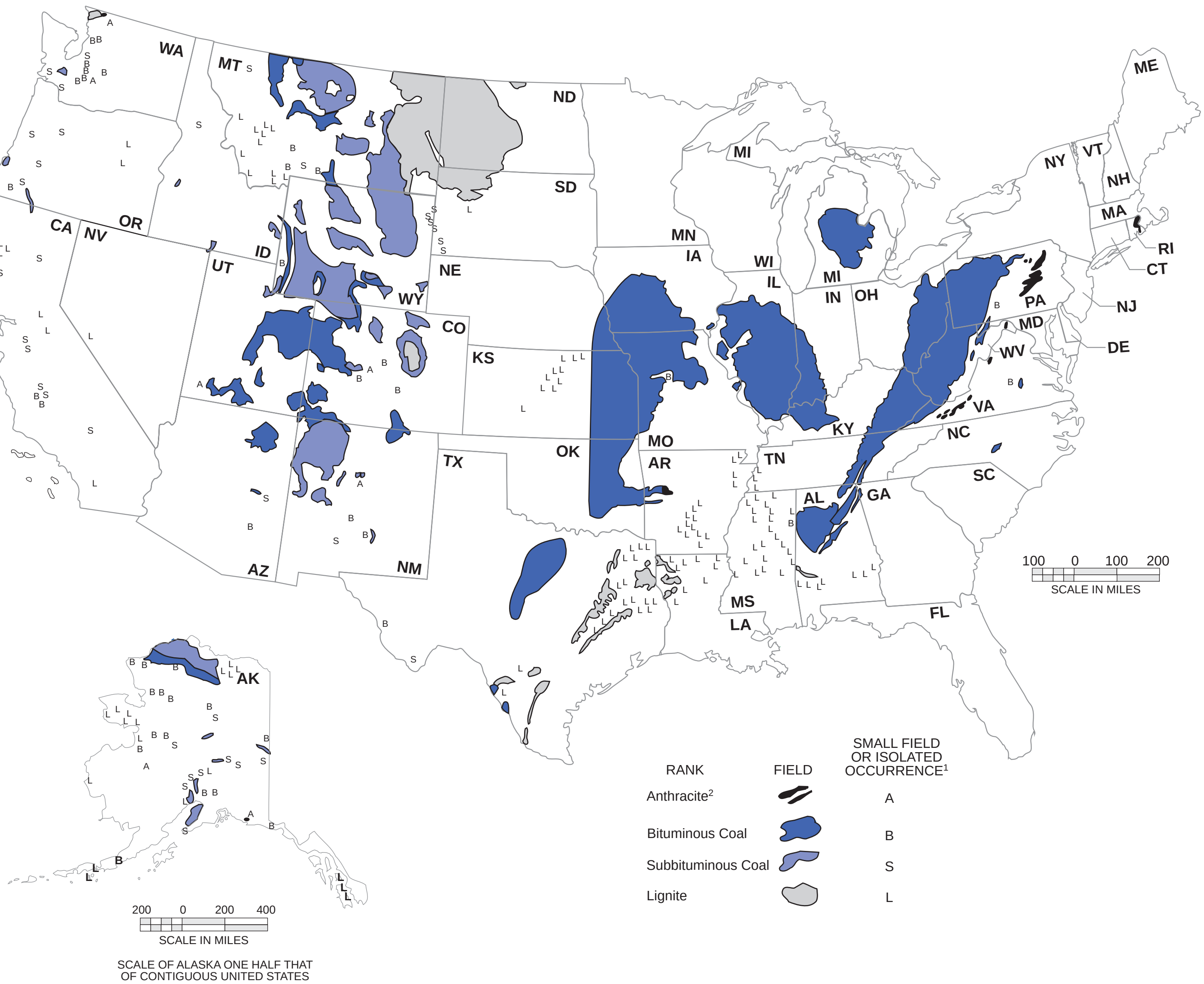
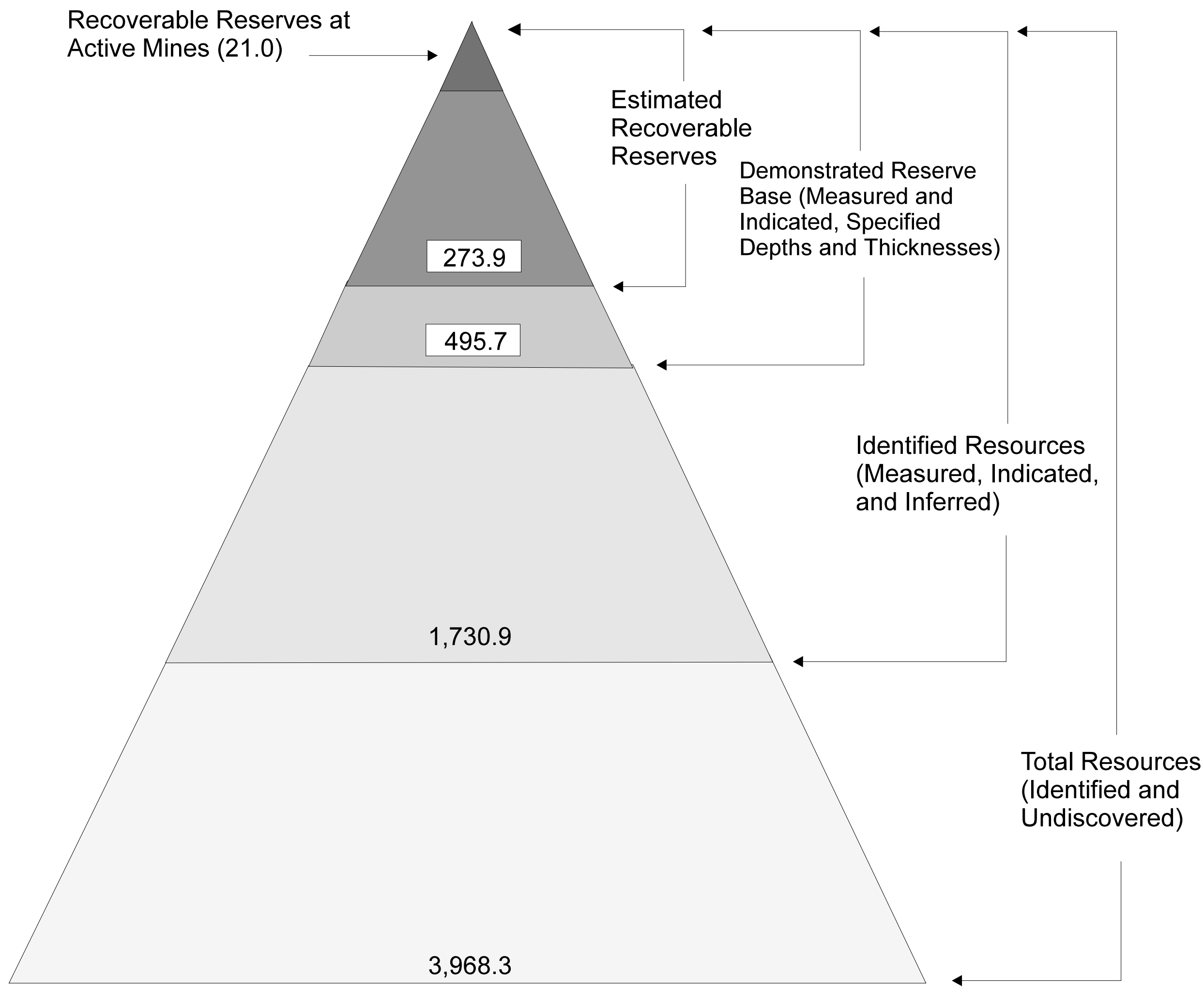

RANK
FIELD
SMALL FIELD OR ISOLATED OCCURRENCE[1]
Anthracite[2]
A
Bituminous Coal
B
Subbituminous Coal
S
Lignite
L
100 0 100 200
SCALE IN MILES
200 0 200 400
SCALE IN MILES
SCALE OF ALASKA ONE HALF THAT OF CONTIGUOUS UNITED STATES

Figure 2. Delineation of U.S. Coal Resources and Reserves
(Billion Short Tons as of January 1, 1995)



Notes: Resources and reserves data are in billion short tons. Darker shading in the diagram corresponds to greater relative data reliability. The estimated recoverable reserves depicted near the top of the diagram assume that the 21 billion short tons of recoverable reserves at active mines reported by mine operators to the Energy Information Administration (EIA) are part of the same body of resource data. This diagram portrays the theoretical relationships of data magnitude and reliability among coal resource data. All numbers are subject to revision with changes in knowledge of coal resource data.

Sources: The DRB estimate was compiled by the EIA as of January 1, 1995. Estimated recoverable reserves were compiled in EIA's Coal Reserves Data Base (CRDB) program. Identified resources and total resources are estimates as of January 1, 1974, compiled and published by the U.S. Geological Survey in *Coal Resources of the United States, January 1, 1974.*

for mid- or long-term analyses. To supply a broader national database of coal reserves, EIA analyzes coal resource data—primarily the DRB, but also the other measured, indicated, and inferred resource categories from which the DRB might be derived. These resource categories include: the DRB and estimated recoverable reserves, which EIA reckons from available data on coal resources in the ground; the identified resources, which are estimated by USGS and State geological surveys and include inferred coal resources and all measured and indicated resources currently too thin or too deep to include in the DRB; and the undiscovered resources estimated by the USGS, which, along with identified resources, constitute the comprehensive "total resources" classification (Figure 2).

Although the data represented in Figure 2 are all interrelated conceptually, in practice they cannot be maintained uniformly. The recoverable reserves at active mines are updated annually. However, they represent only a fraction of the reserves controlled by mining companies. EIA treats the recoverable reserves at active mines as though they constitute a portion of its estimated recoverable reserves. In reality, some of the data at mines may incorporate reserves from beyond the coverage of the DRB and EIA's estimated recoverable reserves data. The mine data EIA receives are not detailed enough to allow comparative analysis.

In many States, the active mines data may be more timely than the broader resource studies from which estimated recoverable reserves are derived. Similarly, the DRB data are derived from more recent sources in many areas than were available when the USGS compiled identified resources and total resources as of 1974. Thus, in Figure 2, the data for active mines are generally more current than the DRB and its associated recoverable reserve estimates, which are in turn more up to date than much of the total resource data. Under current planning, there is little likelihood that total resources of coal will be updated by the USGS in the near future.

Recent Developments

In some situations, the most recent source data for the DRB are old, and there may even be evidence that coal is being mined that is not in the DRB. In other words, the DRB in such areas is out of date. By definition, the DRB almost never represents all the coal in the ground. It represents coal that has been mapped, that meets DRB reliability and minability criteria, and for which the data are publicly available. The resource data assessment and the DRB are clearly out of date if the resources being mined supersede in quantity, location, or physical parameters, the resources that have been demonstrated. In that event, analyses of current or projected production based on the DRB alone would be data-restricted. That is, the reserves may be in the ground but there is a shortfall of reliable data. To resolve situations like that, EIA used some data on inferred coal resources to develop coal forecasts published in the *Annual Energy Outlook* for 1995 and 1996.[13]

Inferred coal resources are not listed in this report because they are less reliable than the DRB and because the coverage of inferred data is not consistent from one State to another. Recent CRDB studies include updated DRB and inferred resource data and extend allocations and analyses to the inferred if supported by the geologic evidence. Inferred data can be updated at little or no additional cost in CRDB studies and, even though inferred data are not published by EIA, they supply useful information about mining potential in important areas.

In the only currently active CRDB project, new data are being incorporated in Part 2 of the Illinois study, due January 1997. A project is being planned that would revise coal resource estimates and update the CRDB in several coalfields in Colorado, commencing in late 1996.

EIA has been able to obtain useful new accessibility and recoverability data for some coal reserve estimates from the USGS Coal Availability Studies (CAS) and the BOM Coal Recoverability Studies (CRS) conducted before the Bureau of Mines was shut down. The USGS recognizes the value of the CRS, which complement its availability studies with economic mining feasibility data, and it included a vestigial CRS effort in recent USGS budget proposals. It is not clear at this time at what level a CRS at USGS will be funded. Both programs have been sources of updated objective data for EIA's coal reserves adjustments; their loss or reduction would impact EIA's CRDB program. As explained in Chapter 3, EIA has also adopted some of the CAS criteria for "restricted resources" in its own accessibility adjustments. This allows the DRB criteria to remain more consistent because local coal minability restrictions can be updated via the local accessibility factors.

The USGS is proceeding with its National Coal Resource Assessment (NCRA)—a project running from 1995 to 1999 to update basic U.S. coal resources data. The NCRA incorporates new data in systematic study of designated major coal deposits to produce a representative estimate of resources for coalbeds that will produce the majority of U.S. coal for the next 30 years. It does not attempt to compile data for new total U.S. coal resource estimates, which have long been beyond the scope of any fundable Federal project. When completed, the NCRA data may serve an important role in updating—or even replacing—EIA's DRB.

About This Report

In this report, EIA adds new coal resource and coal quality data in three States and updates the DRB and reserves

[13]Approximately 180 billion short tons of inferred resources were added to the coal data base from existing DRB data sources in areas where the DRB was out of date and no significant new resource data were available. Energy Information Administration, *Annual Energy Outlook 1995, with Projections to 2010* and *Annual Energy Outlook 1996, with Projections to 2015,* DOE/EIA-0383(95) and DOE/EIA-0383(96) (Washington, DC, January 1995 and January 1996).

data to January 1, 1995. Chapter 2 reports on the derivation of new coal resource and reserve estimates in New Mexico, Illinois, and eastern Kentucky through cooperative agreements between EIA and the geological surveys of those States. In Chapter 3, the 1995 DRB and estimated recoverable reserves are summarized and discussed. Chapter 4 describes EIA's database of recoverable coal reserves at active mines and analyzes the implications of the data with reference to anticipated future investment in new mines.

In addition, reference information is included in two appendices. Appendix A discusses coal resource and reserve terminology at EIA and related terms at USGS, and explains their usage. Appendix A also contains documentation for EIA’s criteria, updates, and changes in the DRB and estimated recoverable coal reserves. Appendix B contains tables of the DRB, estimated recoverable reserves, and the recoverable reserves at active mines, detailed by coal supply area, type of mining, and sulfur ranges.

What's New in This Report

- Terminology – We modified some coal terminology related to resources and reserves for better clarity and for consistency.
- Coal Resource and Reserve Data – New data from CRDB studies in eastern Kentucky, New Mexico, and Illinois are presented and their derivation described.
- The Demonstrated Reserve Base and Estimated Recoverable Reserves – Data are updated to January 1, 1995.
- Recoverable Reserves at Active Mines – We report the coal reserve data derived from EIA's annual survey of coal producers, aggregated by coal supply areas, by surface- and underground-minable reserves, and by estimated coal rank and sulfur ranges. The data are also presented and discussed in terms of the years of projected production that they can support.
- Accessible Reserve Base – State-level tables of these data are no longer published. As an intermediate step in estimated recoverable reserve compilations, the accessible reserve base was of limited interest. The net accessibility factors and coal recovery rates for each State are still reported.

2. New EIA Coal Resource and Reserve Data Derivations

This chapter includes descriptions of revisions in the coal resource and reserve data in the coal supply areas of New Mexico, Illinois, and eastern Kentucky.[14] The data were updated through cooperative agreements between EIA and the geological surveys of those States. The results of these comparative agreements are updates to the data base of coal resources, including demonstrated reserve base (DRB) and inferred coal resources, estimates of the portions of the DRB that would be accessible for mining (the accessible reserve base) and estimates of the coal quantities recoverable from the accessible reserve base (EIA's estimated recoverable reserves). In addition, these coal resource and reserves data are allocated to heat and sulfur content.

Each State was selected for updating based on a combination of criteria, including: the importance of the State as a coal producer; the relative quantities and qualities of coals in the State; the existence of significant new data to revise coal resource estimates and to analyze the coal quality of those resources, the accessibility, and the minability or recovery factors; the capability of the State's geological survey to perform the mapping, compilations, and analyses needed; and the availability of key personnel in the geological survey to work on the project within EIA's budget and performance period requirements.

New Mexico was selected because of the importance of the San Juan Basin as a source of relatively low-sulfur coal and because of the existence of an excellent coal resource mapping program with new resource and coal quality data that could be recompiled to EIA criteria by an accomplished staff. Illinois was selected because of the importance of its vast resources of coal, most of which contain high amounts of sulfur, and the need to monitor the impacts of changes in high-sulfur coal markets on consumption and distribution patterns and on State and regional economies. Eastern Kentucky was chosen because it is one of the remaining sizable sources of low-sulfur compliance coal in the eastern United States and because the State holds a large database of coal resource and coal quality data that could be coordinated in new coal resource and reserve databases with the assistance of some of the same State personnel who had assisted in the data collection and mapping.

A limited project to update high-priority resources in several Colorado coalfields is in planning. Colorado is being considered because of the increasing importance of the State as a shipper of high-quality bituminous coal to new domestic markets and because the State's geological survey has actively acquired and processed new resource data and coal quality analyses that should permit a more accurate profile of Colorado's future coal supplies.

New resource and reserve assessments are needed in numerous other States, but the data and / or the personnel are not available. For example, in both Pennsylvania and West Virginia coal resource reevaluations are in progress that may take 4 or more years to complete. In the meantime, it would be futile to try to update the coal resource data using sources that would soon be obsolete. Other States need revisions but do not have enough mapping completed or qualified personnel on staff to support the revisions. In some cases of that type there may be no sources of coal resource data available that are better than the sources EIA currently uses.

New Mexico

Overview

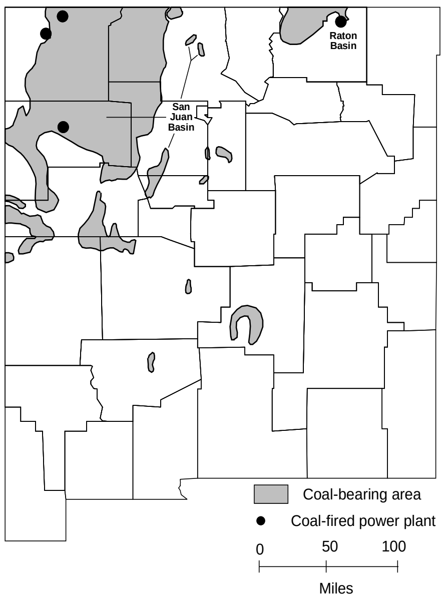
The New Mexico update incorporates new resource mapping in the San Juan Basin recompiled under an EIA cooperative agreement with the New Mexico Bureau of Mines and Mineral Resources (NMBMMR), which was completed in July 1994.[15] EIA developed DRB estimates

[14]Terminology related to coal resources and reserves is defined in the glossary following Chapter 4. A discussion of Federal programs to develop coal resource and reserve data, and of their use of related terms, is included in Appendix A.

[15]New Mexico Bureau of Mines and Mineral Resources, *Demonstrated Reserve Base for Coal in New Mexico*, by Gretchen K. Hoffman, Final Report to the Energy Information Administration for Cooperative Agreement DE-FC0193EI23974 (Socorro, NM, 1994).

in the Raton Basin from a separate report. The data of the San Juan and Raton Basins constitute 99.7 percent of the DRB in New Mexico. The remaining 0.3 percent is based on older data in small isolated fields throughout the State.

Figure 3. Coal-Bearing Areas of New Mexico



Source: United States Geological Survey, *Coalfields of the United States*, 1960.

San Juan Basin

The San Juan Basin occupies more than 26,000 square miles—more than 80 percent in northwestern New Mexico and the remainder in neighboring Colorado. Numerous coal-bearing areas have been mapped within the basin.

The new DRB developed by the NMBMMR for coal of the San Juan Basin, New Mexico, was 11.29 billion short tons remaining as of January 1, 1993 (Table 1). This compares with 4.40 billion short tons in the EIA's DRB as of the same data for all of New Mexico and 2.78 billion short tons for the San Juan Basin. The increase of 8.51 billion short tons in the San Juan Basin DRB is based on data in the NMBMMR computerized data file. Many of these data points were on file in 1983 when EIA evaluated 11 billion short tons of resources. Except for 228 million short tons of undisputed bituminous resources, however, the data could not be used in 1983 because of uncertainties about the ranks of the coal.[16] Coal analysis data in the State files indicated that much of the coal in the San Juan Basin that had previously been classified as subbituminous might in fact be bituminous. The rank issues have now been settled and additional measurement points added to the NMBMMR files.

The NMBMMR estimate includes revised resource calculations in the San Juan Basin for San Juan, McKinley, Sandoval, Rio Arriba, Bernalillo, and Cibola counties. The DRB estimates include adjustments both for depletion due to past mining and for accessibility and recoverability (Table 2).

Data on sulfur, heat, and ash content from available analyses appropriate for characterizing the State's remaining coal resources were coordinated with the updated DRB. Coal quality data were examined in conjunction with coal resource mapping. Samples from exploration drill holes and coal coring as well as from locations in or near mines within traditional coal resource districts were consulted in allocating resource quantities to ranges of sulfur and Btu content. The new allocations placed 3.27 billion short tons, or 29 percent, of the San Juan Basin DRB in the 0.41–0.60 sulfur content range (pounds of sulfur per million Btu), as compared to 1.50 billion short tons, which represented 34 percent of the New Mexico total, in EIA's previous DRB.

As part of the study, certain factors affecting coal accessibility and recent data on mining recovery rates were also analyzed. Based on the updated, January 1, 1993 DRB, the accessible reserve base for the San Juan Basin was 10.33 billion short tons and estimated recoverable reserves were 7.70 billion short tons.

Data for this study consisted of point source data in the NMBMMR computerized database. These data are from published sources, NMBMMR data files (i.e., NMBMMR Oil and Gas Library geophysical logs), data acquired from companies, Bureau of Land Management "inactive files," data from Federal coal leases that are no longer active, tract delineation studies, and NMBMMR coal studies. Collection and entry of these data into the National Coal Resources Data System (NCRDS) is part of a cooperative grant with the U.S. Geological Survey (USGS). Point source data plotted on 7.5-minute quadrangle maps and hand-planimetered resource area measurements of these data were reevaluated. Exposures of coal-bearing formations and / or members from the latest geologic mapping were transferred onto these data-point maps to delineate resource areas accurately.

[16]DRB tonnages are influenced by rank because standard coal density values and bed thickness cutoffs conform to coal rank.

Table 1. Estimates of the Demonstrated Reserve Base of Coal in the San Juan Basin, New Mexico
(Million Short Tons Remaining as of January 1, 1993)

County	Geologic Formation	Heat Content (million Btu per short ton)	Sulfur Content (pounds of sulfur per million Btu) 0.41-0.60	0.61-0.83	0.84-1.24	1.25-1.67	Total All Sulfur Categories	Ash Content (percent by weight)[a] 5.01-10	10.01-15	> 15
Coal Rank: Bituminous										
Minable from Surface										
San Juan	Fruitland	15-19.99	–	24.81	31.30	–	56.11	–	–	550.16
		20-22.99	–	46.40	447.65	–	494.05	112.94	–	–
	Menefee	20-22.99	–	112.94	–	–	112.94	–	–	–
McKinley	Menefee	20-22.99	31.88	–	–	–	31.88	–	31.88	–
	Crevasse[b]	20-22.99	112.56	100.57	–	–	213.13	213.13	–	–
Sandoval	Menefee	20-22.99	6.40	20.85	40.84	–	68.09	–	68.09	–
Rio Arriba	Menefee	23-24.99	–	–	–	7.63	7.63	–	7.63	–
All Counties	Subtotal	15-19.99	–	24.81	31.30	–	56.11	–	–	–
	Subtotal	20-22.99	150.84	280.76	488.49	–	920.09	–	–	–
	Subtotal	23-24.99	–	–	–	7.63	7.63	–	–	–
Bituminous Surface Totals			**150.84**	**305.57**	**519.79**	**7.63**	**983.83**	**326.07**	**107.60**	**550.16**
Minable Underground										
San Juan	Fruitland	15-19.99	–	138.27	269.05	–	407.32	–	–	862.80
		20-22.99	–	204.26	251.22	–	455.48	–	–	–
	Menefee	20-22.99	–	135.80	–	–	135.80	135.80	–	–
McKinley	Menefee	20-22.99	10.51	–	–	–	10.51	–	10.51	–
	Crevasse[b]	20-22.99	239.26	129.75	–	–	369.01	369.01	–	–
Sandoval	Menefee	20-22.99	–	44.78	19.29	–	64.07	–	64.07	–
Rio Arriba	Menefee	23-24.99	–	–	–	31.58	31.58	–	31.58	–
All Counties	Subtotal	15-19.99	–	138.27	269.05	–	407.32	–	–	–
	Subtotal	20-22.99	249.77	514.59	270.51	–	1,034.87	–	–	–
	Subtotal	23-24.99	–	–	–	31.58	31.58	–	–	–
Bituminous Underground Totals			**249.77**	**652.86**	**539.56**	**31.58**	**1,473.77**	**504.81**	**106.16**	**862.80**
Bituminous Total			**400.61**	**958.43**	**1,059.35**	**39.21**	**2,457.60**	**830.88**	**213.76**	**1,412.96**
Coal Rank: Subbituminous										
Minable from Surface										
San Juan	Fruitland	15-19.99	1,059.12	605.61	874.73	–	2,539.46	–	–	2,557.64
		20-22.99	–	18.18	–	–	18.18	–	–	–
	Menefee	15-19.99	–	–	72.07	–	72.07	–	72.07	–
		20-22.99	–	–	10.24	–	10.24	10.24	–	–
McKinley	Fruitland	15-19.99	–	483.89	–	–	483.89	–	–	483.89
	Menefee	15-19.99	–	–	444.35	114.75	559.10	5.82	804.31	–
		20-22.99	26.62	–	224.41	–	251.03	–	–	–
	Crevasse[b]	15-19.99	–	–	–	662.51	662.51	–	662.51	–
		20-22.99	262.70	72.73	31.37	–	366.80	343.47	–	23.34
	Gallup SS	20-22.99	–	1.15	35.36	29.16	65.67	–	65.67	–

See footnotes at end of table.

Table 1. Estimates of the Demonstrated Reserve Base of Coal in the San Juan Basin, New Mexico (Continued)
(Million Short Tons Remaining as of January 1, 1993)

County	Geologic Formation	Heat Content (million Btu per short ton)	Sulfur Content (pounds of sulfur per million Btu) 0.41-0.60	0.61-0.83	0.84-1.24	1.25-1.67	Total All Sulfur Categories	Ash Content (percent by weight)[a] 5.01-10	10.01-15	> 15
Sandoval	Fruitland	15-19.99	–	117.35	–	–	117.35	–	–	117.35
	Menefee	20-22.99	41.62	39.88	100.63	–	182.13	170.04	12.09	–
	Crevasse[b]	15-19.99	–	–	12.41	–	12.41	12.41	–	–
Cibola	Crevasse[b]	20-22.99	13.92	–	–	–	13.92	–	13.92	–
	Gallup SS	20-22.99	–	–	0.56	–	0.56	–	0.56	–
Bernalillo	Crevasse[b]	15-19.99	–	–	12.29	–	12.29	12.29	–	–
All Counties	Subtotal	15-19.99	1,059.12	1,206.85	1,415.85	777.26	4,459.08	–	–	–
	Subtotal	20-22.99	344.86	131.94	402.57	29.16	908.53	–	–	–
Subbituminous Surface Totals			**1,403.98**	**1,338.79**	**1,818.42**	**806.42**	**5,367.61**	**554.27**	**1,631.13**	**3,182.22**
Minable Underground										
San Juan	Fruitland	15-19.99	1,225.57	199.02	33.69	–	1,458.28	–	–	1,501.34
		20-22.99	–	43.05	–	–	43.05	–	–	–
	Menefee	15-19.99	–	–	54.25	–	54.25	–	57.60	–
		20-22.99	3.35	–	31.41	–	34.76	31.41	–	–
McKinley	Fruitland	15-19.99	–	127.09	–	–	127.09	–	–	127.09
	Menefee	15-19.99	–	–	300.52	308.46	608.98	50.74	853.19	–
		20-22.99	148.34	–	146.60	–	294.94	–	–	–
	Crevasse[b]	15-19.99	–	–	–	457.58	457.58	100.70	457.58	30.61
		20-22.99	25.33	24.17	81.80	–	131.30	–	–	–
	Gallup SS	20.22.99	–	–	9.95	1.20	11.15	–	11.15	–
Sandoval	Fruitland	15-19.99	–	52.21	–	–	52.21	–	–	52.21
	Menefee	20-22.99	56.01	20.03	110.03	–	186.07	172.78	13.29	–
	Crevasse[b]	15-19.99	–	–	–	–	–	–	–	–
Cibola	Crevasse[b]	20-22.99	5.80	–	–	–	5.80	–	5.80	–
	Gallup SS	20-22.99	–	–	1.33	–	1.33	–	1.33	–
All Counties	Subtotal	15-19.99	1,225.57	378.32	388.46	766.04	2,758.39	–	–	–
	Subtotal	20-22.99	238.83	87.25	381.12	1.20	708.40	–	–	–
Subbituminous Underground Total			**1,464.40**	**465.57**	**769.58**	**767.24**	**3,466.79**	**355.63**	**1,399.94**	**1,711.25**
Subbituminous Total			**2,868.38**	**1,804.36**	**2,588.00**	**1,573.66**	**8,834.40**	**909.90**	**3,031.07**	**4,893.47**

[a]Percentage of ash is not differentiated by heat content categories.
[b]Crevasse Canyon Formation.
Notes: Subtotals are shown by San Juan Basin coal resources falling within county boundaries, by geologic rock formation containing the coal in each county, and by ranges of heat and sulfur content in each county/formation. Data may not equal sum of components due to independent rounding.
Source: New Mexico Bureau of Mines and Mineral Resources, *Demonstrated Reserve Base for Coal in New Mexico.*

Coal rank, sulfur, Btu, and ash categories were determined using all available analyses in the NMBMMR quality database for the San Juan Basin. Coal analyses were on the as-received basis, excluding samples with more than 33 percent ash yield. Some resource and quality data are clustered in exploration or mine areas, but data are sparse in many areas, particularly areas of greater coal depth. The majority of analyses in the NMBMMR database are from cores or mine samples, totaling 1,313 individual analyses. These were weighted by percent of total seam thickness and statistically averaged by township to determine quality categories for the DRB. A

Table 2. Accessibility Factors and Estimated Recoverable Reserves of Coal in the San Juan Basin, New Mexico
(Million Short Tons Remaining as of January 1, 1993)

County	Geologic Formation	Heat Content (million Btu per short ton)	Total DRB[a]	Acces-sibility Factors	Acces-sible DRB[b]	Estimated Recoverable Reserves (pounds of sulfur per million Btu) 0.41-0.60	0.61-0.83	0.84-1.24	1.25-1.67	Total All Sulfur Categories
Coal Rank: Bituminous										
Minable from Surface										
San Juan	Fruitland	15-19.99	56.11	0.89	49.94	0.00	19.43	24.51	0.00	43.95
		20-22.99	494.05	0.89	439.70	0.00	36.34	350.60	0.00	386.94
	Menefee	20-22.99	112.94	0.74	83.08	0.00	73.11	0.00	0.00	73.11
McKinley	Menefee	20-22.99	31.88	0.92	29.31	25.80	0.00	0.00	0.00	25.80
	Crevasse	20-22.99	213.13	0.93	197.96	92.00	82.20	0.00	0.00	174.20
Sandoval	Menefee	20-22.99	68.09	0.91	61.96	5.12	16.69	32.70	0.00	54.52
Rio Arriba	Menefee	23-24.99	7.63	0.89	6.77	0.00	0.00	0.00	5.95	5.95
All	Subtotal	15-19.99	56.11	0.89	49.94	0.00	19.43	24.51	0.00	43.95
Counties	Subtotal	20-22.99	920.09	0.88	812.01	122.92	208.34	383.30	0.00	714.57
	Subtotal	23-24.99	7.63	0.89	6.77	0.00	0.00	0.00	5.95	5.95
Bituminous Surface Totals			**983.83**	**0.88**	**868.71**	**122.92**	**227.78**	**407.81**	**5.95**	**764.47**
Minable Underground										
San Juan	Fruitland	15-19.99	407.32	0.80	325.00	0.00	61.78	120.22	0.00	182.00
		20-22.99	455.48	0.80	363.43	0.00	91.27	112.25	0.00	203.52
	Menefee	20-22.99	135.80	0.67	91.58	0.00	51.29	0.00	0.00	51.29
McKinley	Menefee	20-22.99	10.51	0.93	9.82	5.50	0.00	0.00	0.00	5.50
	Crevasse	20-22.99	369.01	0.99	365.14	132.58	71.90	0.00	0.00	204.48
Sandoval	Menefee	20-22.99	64.07	0.94	59.99	0.00	23.48	10.11	0.00	33.59
Rio Arriba	Menefee	23-24.99	31.58	0.86	27.22	0.00	0.00	0.00	15.24	15.24
All	Subtotal	15-19.99	407.32	0.80	325.00	0.00	61.78	120.22	0.00	182.00
Counties	Subtotal	20-22.99	1,034.87	0.86	889.95	138.08	237.93	122.37	0.00	498.37
	Subtotal	23-24.99	31.58	0.86	27.22	0.00	0.00	0.00	15.24	15.24
Bituminous Underground Total . . .			**1,473.77**	**0.84**	**1,242.18**	**138.08**	**299.71**	**242.58**	**15.24**	**695.62**
Bituminous Total			**2,457.60**	**0.86**	**2,110.89**	**261.00**	**527.49**	**650.40**	**21.20**	**1,460.08**
Coal Rank: Subbituminous										
Minable from Surface										
San Juan	Fruitland	15-19.99	2,539.46	0.97	2,454.90	900.99	515.19	744.13	0.00	2,160.31
		20-22.99	18.18	0.97	17.57	0.00	15.47	0.00	0.00	15.47
	Menefee	15-19.99	72.07	0.89	64.34	0.00	0.00	56.62	0.00	56.62
		20-22.99	10.24	0.89	9.14	0.00	0.00	8.05	0.00	8.05
McKinley	Fruitland	15-19.99	483.89	0.97	467.82	0.00	411.69	0.00	0.00	411.69
	Menefee	15-19.99	559.10	0.92	514.09	0.00	0.00	359.55	92.85	452.40
		20-22.99	251.03	0.92	230.82	21.54	0.00	181.58	0.00	203.12
	Crevasse	15-19.99	662.51	0.96	634.29	0.00	0.00	0.00	558.17	558.17
		20-22.99	366.80	0.96	351.17	221.33	61.28	26.43	0.00	309.03
	Gallup SS	20-22.99	65.67	0.99	65.08	0.00	1.00	30.84	25.43	57.27
Sandoval	Fruitland	15-19.99	117.35	0.97	113.45	0.00	99.84	0.00	0.00	99.84
	Menefee	20-22.99	182.13	0.90	163.90	32.96	31.58	79.69	0.00	144.23
	Crevasse	15-19.99	12.41	0.95	11.84	0.00	0.00	10.42	0.00	10.42

See footnotes at end of table.

Table 2. Accessibility Factors and Estimated Recoverable Reserves of Coal in the San Juan Basin, New Mexico (Continued)
(Million Short Tons Remaining as of January 1, 1993)

County	Geologic Formation	Heat Content (million Btu per short ton)	Total DRB[a]	Accessibility Factors	Accessible DRB[b]	Estimated Recoverable Reserves (pounds of sulfur per million Btu) 0.41-0.60	0.61-0.83	0.84-1.24	1.25-1.67	Total All Sulfur Categories
Cibola	Crevasse	20-22.99	13.92	0.95	13.25	11.66	0.00	0.00	0.00	11.66
	Gallup SS	20-22.99	0.56	1.00	0.56	0.00	0.00	0.49	0.00	0.49
Bernalillo	Crevasse	15-19.99	12.29	0.99	12.11	0.00	0.00	10.66	0.00	10.66
All	Subtotal	15-19.99	4,459.08	0.96	4,272.85	900.99	1,026.72	1,181.38	651.02	3,760.11
Counties	Subtotal	20-22.99	908.53	0.94	851.50	287.49	109.33	327.08	25.43	749.32
Subbituminous Surface Total			**5,367.61**	**0.95**	**5,124.35**	**1,188.48**	**1,136.04**	**1,508.45**	**676.45**	**4,509.43**
Minable Underground										
San Juan	Fruitland	15-19.99	1,458.28	0.82	1,191.41	560.72	91.06	15.41	0.00	667.19
		20-22.99	43.05	0.82	35.17	0.00	19.70	0.00	0.00	19.70
	Menefee	15-19.99	54.25	0.90	48.86	0.00	0.00	27.36	0.00	27.36
		20-22.99	34.76	0.90	31.31	1.69	0.00	15.84	0.00	17.53
McKinley	Fruitland	15-19.99	127.09	0.96	122.10	0.00	68.37	0.00	0.00	68.37
	Menefee	15-19.99	608.98	0.93	568.97	0.00	0.00	157.23	161.39	318.62
		20-22.99	294.94	0.93	275.56	77.61	0.00	76.70	0.00	154.32
	Crevasse	15-19.99	457.58	0.99	452.78	0.00	0.00	0.00	253.55	253.55
		20-22.99	131.30	0.99	129.92	14.04	13.39	45.33	0.00	72.76
	Gallup SS	20.22.99	11.15	0.93	10.36	0.00	0.00	5.18	0.62	5.80
Sandoval	Fruitland	15-19.99	52.21	0.96	50.16	0.00	28.09	0.00	0.00	28.09
	Menefee	20-22.99	186.07	0.94	174.61	29.43	10.53	57.82	0.00	97.78
	Crevasse	15-19.99	0.00	0.98	0.00	0.00	0.00	0.00	0.00	0.00
Cibola	Crevasse	20-22.99	5.80	0.99	5.76	3.23	0.00	0.00	0.00	3.23
	Gallup SS	20-22.99	1.33	0.99	1.32	0.00	0.00	0.74	0.00	0.74
All	Subtotal	15-19.99	2,758.39	0.88	2,434.28	560.72	187.52	200.01	414.94	1,363.19
Counties	Subtotal	20-22.99	708.40	0.94	664.01	126.00	43.62	201.61	0.62	371.85
Subbituminous Underground Total			**3,466.79**	**0.89**	**3,098.29**	**686.72**	**231.13**	**401.62**	**415.57**	**1,735.04**
Subbituminous Total			**8,834.40**	**0.93**	**8,222.64**	**1,875.20**	**1,367.17**	**1,910.07**	**1,092.02**	**6,244.47**

[a] DRB = Demonstrated reserve base of coal, data from Table NM2.
[b] Aggregated data resulting from applying county/formational accessibility factors to appropriate DRB data; detailed component data not shown.
Note: Data may not equal sum of components due to independent rounding.
Source: New Mexico Bureau of Mines and Mineral Resources, *Demonstrated Reserve Base for Coal in New Mexico.*

type of geostatistical analysis known as kriging was attempted on the coal quality data, but the mixture of clustered and sparse data produced invalid results. In smaller, less-explored districts, where there may be very few quality data, the NMBMMR geologist drew on field experience and familiarity with the geologic setting to select data from adjacent areas to supplement the DRB coal quality allocations.

Depletion of original resources was based on production figures determined from comparative analysis of four data sources. Percentages of total tonnage by depth and thickness for mining prior to 1962 were determined from individual mine data,[17] the NMBMMR mine and resource databases, and Territorial and State Mine inspector reports. New Mexico Energy Minerals and Natural Resources Department annual reports were used for

[17] New Mexico Bureau of Mines and Mineral Resources, *One Hundred Years of Coal Mining in the San Juan Basin, New Mexico*, Bulletin 111, by H.B. Nickelson (Socorro NM, 1988).

production data from 1970 through 1992. EIA production data were examined jointly with the data from the Territorial and State reports. Production data were assigned to thickness and depth categories based on a percentage determined from the individual mine production data divided by the average total production. Depletion was calculated using average total tonnage figures (county basis) for all years through 1992 with standard depletion factors of 1.25 for surface and 2.00 for underground. For recent years (1970–1992), mine production plus coal lost in mining were subtracted directly from the original demonstrated resources.

The San Juan Basin includes several coalfields defined by formational and political boundaries. The Fruitland, Menefee, and Crevasse Canyon formations are the major Late Cretaceous coal-bearing units, and the Gallup Sandstone contains small resources of coal. Original resources of these units were compiled by intermediate-scale (1:100,000) quadrangle and by county. The remaining DRB, Btu and sulfur ranges, and ash categories were calculated on a county basis. All the county evaluations were based on formation totals from individual field summaries in the database. Land use restrictions for accessibility factors were digitized on the 1:100,000 quadrangles and overlaid with digitized coal resource areas to determine inaccessible regions. The criteria used and the total areas affected by land-use restrictions within the coal resource area are listed in Table 3.

Inaccessible coal resource areas were compared to the total resource areas on individual 1:100,000-scale quadrangles to calculate the accessible percentages. These percentages were applied to the DRB to determine the accessible DRB. Estimated recoverable reserves were derived from the accessible DRB by applying recent weighted average recovery percentages for New Mexico from EIA coal mine survey files: 88 percent for surface mining and 56 percent for underground.

The DRB was compiled using USGS criteria for subbituminous and bituminous coals. Subbituminous coals were assigned a density factor of 1,770 tons per acre-foot and bituminous coal a density factor of 1,800, the standard values assigned by the USGS.[18] The NMBMMR and EIA geologists contemplated different values because of the high ash content of the San Juan Basin coal, but inconsistent coverage of analytical data made assigning different density values to all parts of the study area infeasible. Additional ash content categories of 10.01–15 percent and greater than 15 percent were added to accommodate the greater percentages of ash common in many San Juan Basin coals. The subbituminous DRB includes coal as thin as 2.5 feet, and the bituminous DRB includes coal as thin as 28 inches within surface-minable depths (Table 4). Coal with less than 20 feet of overburden was excluded from the original resource and DRB estimates because coal within this interval is generally weathered and cannot be used for energy production.

Table 3. Land use Restrictions for Coal Accessibility, San Juan Basin, New Mexico

Restrictions	Total Acreage in SanJuan Basin Coal Areas
Abandoned Mines	18,796
Streams, Lakes, Reservoirs	61,355
Residences, Towns, Public Buildings[a]	22,065
Historic Sites and Non-Federal Public Parks	320
Highways and Railroads	5,766
Powerlines, Pipelines	12,404
National Parks, Wildlife Refuges, Recreation Areas	17,558
Wilderness Study Areas	42,162
Oil and Gas Wells	151,476
Total Acreage Restricted	**331,902**
Total Acreage of Coal Resource Areas:	**4,013,693**
Accessible Acreage of Coal Resources Areas	**3,681,791**

[a]Cemeteries are included in acreages for towns.
Source: New Mexico Bureau of Mines and Mineral Resources, 1994.

[18]U.S. Geological Survey, *Coal Resource Classification System of the U.S. Geological Survey*, Circular 891 (Washington, DC, 1983).

Table 4. Coal Resource Criteria Used in the Demonstrated Reserve Base, San Juan Basin, New Mexico

Coal Seam Thickness (underground or surface mining)		Overburden Thickness (depth from surface)	
Bituminous	Subbituminous		
28-42 inches	2.5-5 feet	0 to 200 feet	Surface
> 42 inches	5-10 feet	200 to 500 feet	Underground
	> 10 feet	500 to 1,000 feet	Underground

Source: New Mexico Bureau of Mines and Mineral Resources, 1994.

Raton Basin

The DRB for the New Mexico portion of the Raton Coal Field was updated with data and information published in 1991.[19] The author of the 1991 report has done geologic mapping and coal resource investigations in the Raton Basin over three decades and also brings to bear extensive contacts with coal company personnel in the area. Although rounded to protect sources, the new data reflect more thorough and timely knowledge of the coal resources than EIA's former data source.[20]

The Raton Basin lies astride the Colorado-New Mexico border, roughly half of its area in each State (Figure 3). The New Mexico portion, covering 900–1,000 square miles, is in Colfax County in the northeastern corner of the State. Coal resources occur in two geologic formations: the Vermejo formation, of Upper Cretaceous age, and the Raton Formation, of transitional Upper Cretaceous-Paleocene age.

The resources are of bituminous rank, reported by coalbed or coal zone for six mining districts in the Vermejo Formation and eight districts in the Raton Formation. The 1.48 billion short tons of resources documented in the report are demonstrated (having measured and indicated geologic reliability), with average thicknesses ranging from 2.5 to 6.5 feet. Of that amount, 1.29 billion short tons were usable in the DRB. The previous DRB published by EIA included 1.30 billion short tons after adjustments for cumulative depletion to 1993. Although the apparent difference is small, the revised DRB is based on more detailed thickness measurements and definitions of coalbeds and mining districts. The new DRB includes detailed coal quality data, more relevant to resources still in the ground.

The Raton Basin DRB as of January 1, 1991, based on remaining resource estimates in the 1991 report, included the following:

Raton Basin, New Mexico Demonstrated Reserve Base	Vermejo Formation (million short tons	Raton Formation (million short tons)	Raton Basin Total (million short tons)
Surface Minable	0.00	60.20	60.20
Underground Minable	775.00	453.20	1,228.20
Totals	**775.00**	**513.40**	**1,288.40**

The DRB was depleted to January 1, 1995, to account for coal mining and losses, using EIA annual coal production data and standard 1.25 surface and 2.00 underground depletion factors.

The Btu and sulfur ranges for the coal were allocated from data on ranges of sulfur content and on representative proximate analyses in the 1991 report. These were used in preference to NMBMMR data and EIA data because they include coal sampled at active mines and in undeveloped parts of the field corresponding with remaining DRB. EIA adjusted surface and underground DRB for accessibility using 0.90 accessibility factors for both. This is based on assumed land use restrictions of 5 percent or less in the Raton Field and assumed unmined barrier areas of 5 percent or more, for an average accessibility of

[19] Pillmore, Charles L., "Geology and Coal Resources of the Raton Coalfield," in *Coalfields of New Mexico: Geology and Resources*, U.S. Geological Survey, Bulletin 1972 (Reston, VA, 1991), pp. 49-68.

[20] U.S. Geological Survey, *Coal Resources of New Mexico*, Circular 89 (Washington, DC, 1950).

90 percent. Recovery rates of 0.88 surface and 0.56 underground were based on regional averages of mine recovery rates collected on EIA's annual coal production survey.

The Raton Field bituminous coal data, allocated by Btu and sulfur range, are included with the San Juan Basin subbituminous and bituminous coal data, as of January 1, 1995, in Tables B1 and B2. Those tables also include 37.9 million short tons of bituminous and 2.3 million short tons of anthracite DRB in four other small districts in New Mexico. These data are based on the earlier DRB source, USGS Circular 89.[21]

Illinois

Overview

The identified resource, DRB, and estimated recoverable reserves for the State of Illinois are being updated in a two-part cooperative agreement between EIA and the Illinois State Geological Survey (ISGS). The first part was completed in November 1995 for resources in all parts of the Illinois coalfield using new data that were immediately available and could be fully implemented in a 12-month project period.[22] The second part will incorporate existing data that require broader analysis and will focus on potential DRB estimates in coal seams with low to medium sulfur content and on areas currently lacking reliable DRB estimates.

The new DRB of coal in Illinois was 90.05 billion short tons, as of January 1, 1994 (Table 5). This compares with 78.01 billion short tons in EIA's most recent DRB, as of January 1, 1993. The new estimate includes revised resource calculations based on recent mapping in a number of counties, as well as significant adjustments for depletion due to past mining. The new estimate for identified resources is 188 billion short tons, as compared with the previous estimate of 181 billion short tons.

The new resource estimates also incorporate analyses of sulfur and heat content and rank data appropriate for characterizing the remaining coal resources in Illinois. Available coal quality data were examined in conjunction with coal resource mapping. Samples from exploration drill holes, channel samples from mines and outcrops, and geologic trends were compiled and mapped to allocate coal resources to ranges of sulfur and heat content and to rank group. The new allocations place almost 1 percent of the DRB of Illinois in the two lowest sulfur categories, as compared with none in EIA's previous allocation. These allocations also place 89 percent of the DRB in the highest sulfur category, as compared with EIA's previous allocation of 69 percent.

By comparing depletion of reserves as calculated from maps of mined areas with reported production and recovery rates, ISGS uncovered some potential pitfalls in estimating depletion based on reported production, and demonstrated the need for knowledge of mine operations. Issues included production data reported on the basis of tipple location rather than point of extraction and depletion of reserves classified as surface-minable by underground mining. The destruction of unmined reserves by preferential mining of lower seams is an important issue but could not be estimated from the statistics.

The January 1, 1994, accessible reserve base was estimated at 61.61 billion short tons (Table 5). EIA's previous (January 1, 1992) accessible reserve base estimate of 56.49 billion tons excluded surface-minable coal under prime farm land, an exclusion that is no longer considered valid. The new estimate excludes resources under towns, interstate highways, and public land; underground-minable resources less than 4 feet thick; resources in small, irregular blocks between mines; and coal allocated for barriers and small blocks left in future mines. For underground mining, the coal accessibility related to surface-feature land use restrictions ranges from 42 percent to 100 percent, varying by coalbed and county. These accessibility rates were further reduced to account for irregular blocks of coal and barriers expected to be left unmined, and to exclude coal less than 42 inches thick.[23] For surface mining, a net accessibility factor of 80 percent or less was applied to all coalbeds and counties. This was based on determinations that: (1) On average, 15 percent of future mining will be inaccessible because of barriers between mine blocks and at property boundaries and because of irregularly shaped isolated resource blocks that cannot economically be accessed; and (2) another 6 percent, on average, is expected to be restricted due to land use conflicts. In addition, specific limited-accessibility restrictions were identified in several counties.

[21]Ibid.

[22]Illinois State Geological Survey, *Illinois Coal Reserve Assessment and Data Base Development:* Final Report for Part 1, Open-File Series, 1995-11, published report prepared for the Energy Information Administration (Champaign, IL, 1995).

[23]About 5 percent of the coal in the less than 42-inch category was mapped using prior criteria and includes beds as thick as 47 inches.

Table 5. Estimates of the Demonstrated Reserve Base and Estimated Recoverable Reserves of Bituminous Coal in Illinois by Btu/Sulfur Range and Type of Mining
(Million Short Tons Remaining as of January 1, 1994)

Heat content (million Btu per short ton)	Sulfur Content (pounds of sulfur per million Btu)							Total All Sulfur Categories
	< 0.40	0.41–0.60	0.61–0.83	0.84–1.24	1.25–1.67	1.68–2.50	> 2.50	
Demonstrated Reserve Base								
Minable from Surface								
< 20	–	–	–	–	–	8.84	121.98	130.82
20 – 22.99 . .	–	–	–	3.59	18.37	421.74	14,020.05	14,463.76
23 – 24.99 . .	–	–	1.36	26.42	20.12	80.81	1,089.44	1,218.15
25 – 25.99 . .	–	–	–	–	–	–	373.88	373.88
Total	**–**	**–**	**1.36**	**30.01**	**38.49**	**511.39**	**15,605.35**	**16,186.60**
Minable Underground								
20 – 22.99 . .	72.71	498.09	805.51	1,322.16	1,103.43	2,169.84	43,707.90	49,679.65
23 – 24.99 . .	0.02	16.92	245.26	890.21	703.86	1,490.37	19,662.01	23,008.65
25 – 25.99 . .	–	–	–	–	–	–	1,170.13	1,170.13
> 25.99	–	–	–	–	–	–	9.45	9.45
Total	**72.73**	**515.01**	**1,050.76**	**2,212.38**	**1,807.29**	**3,660.21**	**64,549.48**	**73,867.88**
Minable Total								
<20	–	–	–	–	–	8.84	121.98	130.82
20 – 22.99 . .	72.71	498.09	805.51	1,325.76	1,121.80	2,591.58	57,727.95	64,143.41
23 – 24.99 . .	0.02	16.92	246.62	916.63	723.98	1,571.18	20,751.45	24,226.80
25 – 25.99 . .	–	–	–	–	–	–	1,544.01	1,544.01
> 25.99	–	–	–	–	–	–	9.45	9,45
Total	**72.73**	**515.01**	**1,052.12**	**2,242.39**	**1,845.79**	**4,171.60**	**80,154.84**	**90,054.48**
Estimated Recoverable Reserves								
Recoverable from Surface								
< 20	–	–	–	–	–	4.91	68.22	73.13
20 – 22.99 . .	–	–	–	1.53	9.79	233.51	8,038.30	8,283.13
23 – 24.99 . .	–	–	0.92	17.94	13.67	52.73	716.71	801.97
25 – 25.99 . .	–	–	–	–	–	–	214.61	214.61
Total	**–**	**–**	**0.92**	**19.47**	**23.45**	**291.14**	**9,037.85**	**9,372.84**
Recoverable Underground								
20 – 22.99 . .	5.31	108.89	274.45	433.94	355.58	688.95	14,363.69	16,230.82
23 – 24.99 . .	0.01	4.36	75.40	349.88	275.53	588.70	6,821.03	8,114.91
25 – 25.99 . .	–	–	–	–	–	–	284.01	284.01
> 25.99	–	–	–	–	–	–	1.85	1.85
Total	**5.32**	**113.25**	**349.85**	**783.82**	**631.12**	**1,277.66**	**21,470.58**	**24,631.59**
Recoverable Total								
< 20	–	–	–	–	–	4.91	68.22	73.13
20 – 22.99 . .	5.31	108.89	274.45	435.47	365.37	922.46	22,402.00	24,513.95
23 – 24.99 . .	0.01	4.36	76.32	367.83	289.20	641.43	7,537.74	8,916.88
25 – 25.99 . .	–	–	–	–	–	–	498.61	498.61
> 25.99	–	–	–	–	–	–	1.85	1.85
Total	**5.32**	**113.25**	**350.77**	**803.29**	**654.57**	**1,568.80**	**30,508.43**	**34,004.43**

Note: Data may not equal sum of components due to independent rounding.
Source: Illinois State Geological Survey, *Illinois Coal Reserve Assessment and Data Base Development: Final Report for Part I.*, Open-File Series 1995-11.

The ISGS is currently involved in a multiyear study supported by the USGS to assess the availability of coal for mining. When complete, the findings from the Coal Availability Studies are expected to lead to additional adjustments in the accessible reserve base.

Estimated recoverable reserves, 34.00 billion short tons as of January 1, 1994, were calculated using recovery factors of 50 percent for underground-minable reserves and 70 to 85 percent (depending on location and thickness) for surface-minable reserves (Table 5). These rates were selected based on data on the depletion of reserves and on mine production from January 1979 to January 1994. The recovery rates account for coal that would be lost in cleaning and handling or left as pillars or barriers in mines.

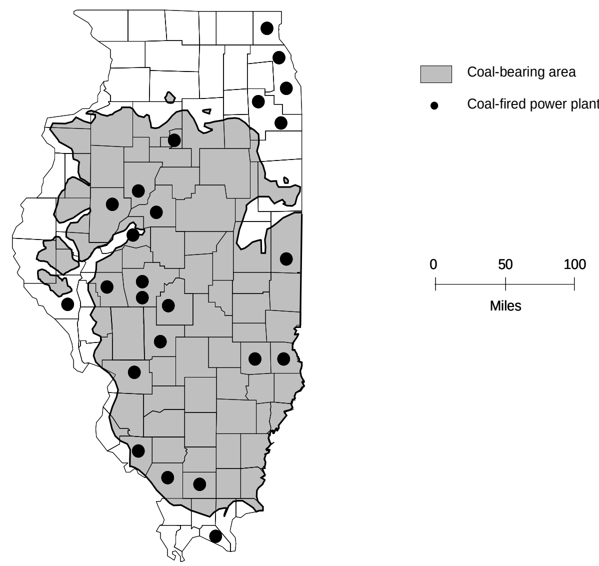
Study Area

Illinois has the largest DRB of bituminous coal and the second largest DRB of any State. The Illinois coalfield (Figure 4) is in the Interior Region of the country and covers most of Illinois as well as western portions of Indiana and Kentucky. Minable coal is found in the Pennsylvanian-age strata of the basin. The rank of the coals is high volatile bituminous, ranging from the A rank group at the extreme southern margin of the basin to rank groups B and C in the southern, central, and northern portions of the basin.

Since the development of modern surface mining equipment, coals as deep as 150 feet have commonly been mined by surface methods. Large dragline and shovel mining or small truck and shovel operations are the primary forms of surface mining. Augering is sometimes used to recover additional coal from the final cut of a surface mine.

Shafts and slopes are the most common means of access to underground mines, but some mines employ a drift entrance constructed at an abandoned surface mine highwall or a box cut.[24] Partial and high extraction room-and-pillar mining and longwall mining methods are used. During the past 10 years, production has shifted from entirely room and pillar to more than 30 percent from longwall operations.

Figure 4. Coal-Bearing Areas of Illinois



Source: United States Geological Survey, *Coalfields of the United States*, 1960.

Methodology and Criteria

In the early 1950s, members of the ISGS Coal Section staff completed the first comprehensive survey of coal resources in the State.[25] The landmark report on the survey results, published in 1952, provided a framework and format generally followed in subsequent resource assessments. In particular, it established reliability categories adapted to reflect the lateral continuity of most coals found in Illinois (Table 6). The 1952 report is also the only source of resource and reserve estimates for a few seams in some counties that have not attracted sufficient interest to warrant revised mapping.

The ISGS categories of reliability are comparable to those defined by the USGS. Because of the considerable lateral continuity of most Illinois coals, however, the radii of influence assigned to each datum point are larger than those used by the USGS. The ISGS categories of class I-A, I-B, and II-A are considered equivalent to the USGS categories of measured, indicated, and inferred resources and had previously been accepted as such in EIA coal resource data.

[24]A drift mine enters the coalbed directly at a location where the coal and overlying rocks are exposed, typically in a natural hillside. In Illinois, drift mines sometimes access the coal seam via an artificial exposure, such as a "final cut" high wall, where the overburden becomes too thick for further surface mining, or in a box-like pit excavated specifically to create an exposure surface in the coal seam.

[25]Illinois State Geological Survey, *Minable Coal Reserves of Illinois*, Bulletin 78 (Champaign, IL, 1952) 138 pp.

Table 6. Reliability Classifications for Coal Resources in Illinois

Class	Maximum Distance from Datum Points*	Accepted Datum Points	Remarks
I-A Proved (Measured)	0.5 mile	Mined-out areas Diamond drill holes Outcrops Coal test geophysical logs	Approximately equivalent to *measured* category of the U.S. Geological Survey
I-B Probable (Indicated)	2 miles	All points of Class I-A plus coal-test churn drill holes	Approximately equivalent to *indicated* category of the U.S. Geological Survey
II-A Strongly Indicated (Inferred)	4 miles	All points of Classes I-A and I-B plus churn drill holes drilled for oil or water with unusually good records, control rotary drill holes and oil-test geophysical logs	Approximately equivalent to *inferred* category of the U.S. Geological Survey

* Distances modified in practice by geological considerations.
Source: Adapted from ISGS Bulletin 78, 1952.

Although the DRB did not exist at the time of the 1952 report, the criteria used in the study are compatible with current DRB definitions and would indicate a DRB of 61 billion tons. Additional mapping since 1950 raised the DRB to 78 billion tons as of January 1, 1993.

The ISGS began computerizing its coal resource mapping in the 1960s. Computers expedite merging of coal thickness data with data on coal depth, sulfur, rank, heating value, and mined areas, and with other information such as calculated depletion, accessibility, and recoverability of reserves. Future updates, revisions, and accessibility adjustments can also be made more efficiently with a digital database.

Many of the coal resource maps needed for this study were already in a digital format of some kind. For this study, all data were combined into a common digital map database to facilitate processing as well as to provide a suitable foundation for future updates and revisions. All remaining paper maps were digitized into the common database and numerous adjustments were made to edge match and correlate all data from earlier databases and base maps.

Resources and reserves were divided into categories based on the type of mining method most likely to be used. The surface-minable category consists of coals most likely to be mined by removing the overburden to expose and mine the coal. The underground-minable category consists of resources that will be extracted by underground methods such as room-and-pillar or longwall mining.

The factors that determine the method used to mine a particular deposit are primarily economic rather than technical. The main factors are thickness of the coal, average stripping ratio of the mine block, nature of the overburden material, surface ownership and land use, proximity to other surface features, as well as the capital and previous mining experience of individual companies.

The ISGS has found the 150-foot depth line to be the most representative average delimiter between surface-minable and underground-minable resources. Surface-minable resources are defined by ISGS convention as having a minimum thickness of 18 inches. Underground-minable resources are defined as having a minimum thickness of 28 inches. These minimum thicknesses are based on historical mining practice in the State. For economic reasons, seams less than 48 inches thick have not been extensively mined underground in Illinois for the past three decades or more; however, reserves less than 48 inches thick were retained in the DRB for this study in order to provide compatibility with current DRB estimates of other midwestern States. As explained later, they are excluded from the accessible reserve base.

The categories of coal seam thickness and overburden thickness followed in Illinois are summarized below (Tables 7 and 8). No maximum depth was established for underground-minable reserves. The deepest mapped

Table 7. Categories of Coal Seam Thickness in Illinois

Thickness Range[a] (inches)	Average Thickness (feet)
18-28	[b]2
28-42	3
42-54	4
54-66	5
66-78	6
78-90	7
90-102	8
102-114	9
≥ 114	10

[a]Thickness ranges expressed in even-inch values represent the isopach contour lines mapped to define areas of average thickness. Isolated thicknesses corresponding to the upper limit of a range are included in the next thicker range.

[b]Surface-minable coal only.

Source: *Illinois Coal Reserve Assessment and Data Base Development,* Open-File Series 1995-11, 1995.

Table 8. Categories of Overburden Thickness

Underground Mining (feet)	Surface Mining (feet)
150-500	0-50
500-1,000	50-100
1,000-2,000	100-150

Note: Thickness ranges expressed in even-foot values represent the isopach contour lines mapped to define areas of average thickness. Isolated thicknesses corresponding to the upper limit of a range are included in the next thicker range.

Source: *Illinois Coal Reserve Assessment and Data Base Development,* Open-File Series 1995-11, 1995.

resources in the State are slightly more than 1,500 feet deep. Interviews with representatives of mining companies indicated that this depth does not prevent mining.

Coal tonnages were calculated using a density factor of 1,800 tons per acre per foot of coal thickness (equivalent to 1.32 specific gravity). The mean value of the two contours defining an area was used for this calculation. For example, the area between the 5.5-foot and 6.5-foot isopachs was assumed to have an average thickness of 6 feet.

Depletion was calculated and analyzed both using information on mined areas, production data, and recovery factors. The results were compiled to update the DRB to January 1, 1994, and to provide comparative statistics on reported production and depletion of reserves. EIA depleted January 1, 1994, data to January 1, 1995, for Appendix Tables B1 and B2, using EIA production data and standard depletion factors.

Resources were allocated to EIA coal quality categories for sulfur, rank, and calorific value. ISGS has on file more than 4,000 analyses of Illinois coal. The majority of these samples are of the face channel type; other sample types include column, bench, drill core, grid, run of plant, run of mine, and various float/sink fractions. These samples were collected and analyzed by ISGS staff, the U.S. Bureau of Mines, or coal companies. Face channel, column, composite bench, and drill core samples were used in the study. All Illinois coals are high-volatile bituminous. Coal rank changes systematically with distribution and depth of the deposit in the coal field. Rank is determined by calculating the heating value of samples on a moist, mineral-matter-free basis, according to formulas of Standard D388, American Society for Testing and Materials.[26] The coal analyses were used to map million Btu per ton and pounds of sulfur per million Btu on an as-received basis and to assign corresponding coal resources to the Btu/Sulfur ranges used in EIA allocations.

Coal Accessibility Adjustments

The accessible reserve base can be thought of as the portion of the DRB that can be mined at present, when local or regional mining practice and technologies and physical or geologic conditions are taken into account. For recent resource studies and revisions, EIA has broadened the concept of accessibility to include the limiting effects of certain technological and geologic conditions. In the past, such adjustments were made in the resource database, by the field investigator or within the DRB derivation, and were difficult to reassess. EIA is using the assessment capabilities of computerized resource mapping systems to enhance the comparability of EIA coal accessibility and USGS coal availability. The expanded definition has been incorporated into the Illinois study. The accessible reserve base includes essentially that portion of what the USGS would define as available resources that would meet DRB criteria. For all new

[26]American Society for Testing and Materials, *Annual Book of ASTM Standards,* Section 5, Petroleum Products, Lubricants, and Fossil Fuels, Volume 5.05: Gaseous Fuels, Coal and Coke (Philadelphia, PA, 1990).

resource updates, EIA will coordinate coal accessibility and coal availability to the extent feasible.

At the time of the EIA cooperative agreement, the ISGS was in the third year of a multiyear USGS Coal Availability Study (CAS). Five quadrangles had been evaluated, about 20 percent of the number needed to reliably assess availability of resources in Illinois. The amount of coal available for mining in the sample areas ranged from 18 percent to 61 percent of the original resources. Technical factors such as thickness of the coal and overlying bedrock, roof and floor conditions, faults, and size of the mining block account for most of the restrictions on coal availability. Land use restricts from less than 1 percent to 16 percent of the resources in the quadrangles studied. Although it was too early to apply most of the initial findings of this study, some preliminary observations were incorporated into this estimate of accessible resources. Final findings of the CAS are expected to significantly alter the accessible reserve base. The factors considered for estimating the accessible reserve base are listed in Table 9.

Almost 60 percent of the 36 million acres of land in Illinois are classified as prime farmland. EIA's estimate of accessible coal in Illinois had excluded surface-minable reserves in areas of prime farmland, but Illinois surface mine regulations do not preclude mining prime farmland. Further, surface mine operators in Illinois are successfully mining and reclaiming prime farmland, and in CAS interviews with operators, they did not consider it a limit to reserve accessibility. For these reasons, prime farmland was not a factor in estimating the new accessible reserve base.

Since 1952, the ISGS had excluded areas densely drilled for oil from its calculation of reserves. Coal mining experts interviewed by Treworgy and Bargh in 1981[27] confirmed this restriction and the amount of coal excluded (9.6 billion tons) was documented. The thinking was that safety considerations prevent mining coal in such areas. In the CAS, however, it was found that mining companies no longer regard closely spaced oil wells as an absolute barrier to mining. Although regulations require that a barrier pillar be left around wells, experienced mining companies have been allowed to reduce the size of the pillar. In many cases of abandoned wells, it has been feasible to plug the well to meet specifications and then mine through it.

The decrease in the amount of coal recovered and/or the increase in the cost of mining is not severe enough to consider the reserves inaccessible.

Table 9. Factors Considered and Applied in Illinois to Estimate the Accessible Reserve Base

Factor Considered	Applied?	Remarks
Technical		
Prime farmland	No	There is no evidence that prime farmland restricts access.
Areas densely drilled for oil	No	The presence of wells does not raise costs enough to restrict access.
Barrier pillars and small blocks between mines	Yes	Tonnage of existing blocks and barriers was calculated from maps. Tonnage of blocks and barriers created by future mining was estimated to be 15 percent of reserves otherwise accessible.
Thin coal	Yes	Underground-minable reserves <48 inches thick were excluded.
Land Use		The tonnage of underground-minable reserves restricted by all land use categories was estimated from previous mapping; 6 percent of all surface-minable reserves was assumed to be inaccessible because of land use.
Interstate highways	Yes	
Towns	Yes	
Cemeteries	Yes	
Public lands	Yes	

Source: *Illinois Coal Reserve Assessment and Data Base Development,* Open-File Series 1995-11,1995.

[27]Illinois State Geological Survey, *Deep-Minable Coal Resources of Illinois*, Circular 504 (Champaign, IL, 1982).

The five CAS quadrangles completed by the end of the Coal Reserves Data Base (CRDB) study contain about 2 percent of the underground-minable resources in the State and include all the major seams. Six of the eight companies operating major underground mines in the State were interviewed. All six considered coal less than 42 inches thick as presently too thin to mine economically by underground methods. Because there are few natural outcrops, most underground mines require extensive exploratory and development drilling to obtain data for mine planning and permitting and for the construction of slopes and shafts for the movement of air, miners, materials, and coal. To recoup these expenses, mines must produce large tonnages of low-cost coal. Mining in thin seams requires more acreage and the mining costs are higher. For these reasons, underground-minable reserves less than 42 inches thick[28] have been excluded from accessibility in this update.

A significant portion of inaccessible resources consists of blocks of coal left as barrier pillars (the law requires 200 feet between mines) or simply left out because of the geometry of the mine plan, early abandonment of a mine, inability to obtain land ownership or mineral rights, or unfavorable geology. Once surrounded by abandoned mines, these blocks are too small or irregular to be minable. The approximate area of coal rendered inaccessible by mining was calculated by creating a 200-foot buffer around each mine and adding to that any areas of coal considered to be unminable because of the small size of a mining area, convoluted geometry, or proximity to mined areas. The tonnage of coal in the adjusted buffer areas was calculated and excluded from the accessible reserve base.

Additional blocks will become inaccessible as mining continues. The ISGS found that, on a county-by-county basis, the amount of inaccessible coal ranged from 6 percent to more than 40 percent of the original resources in mined areas, or roughly 20 percent on a Statewide basis. Since some of this coal may have been left because of surface features, which are accounted for separately, it was assumed that 15 percent of the coal otherwise qualified for the accessible reserve base will be rendered inaccessible by future mining.

Earlier investigations have identified land uses such as interstate highways, railroads, cemeteries, towns, and public lands as factors that limit the accessibility of coal. However, changes in mining practice and findings from CAS indicate that land use restrictions have changed. For this assessment, an interim 94-percent rate of accessibility was applied to the surface-minable DRB in all counties to account for land use restrictions. This figure was chosen because it coincides with the statewide average for underground-minable reserves and is mid-range for the surface-minable resources in the CAS quadrangles studied to date.

Other factors that restrict the accessibility of reserves include insufficient thickness of the bedrock overburden, insufficient thickness of or incompetent interburden, and unfavorable roof and floor conditions. The impacts of these factors are not understood well enough at this time, but at the completion of the Illinois CAS, the accessible reserve base may be adjusted to include as many of these factors as practical. The January 1, 1994, accessible reserve base is considered more accurate than the previous data even though based partly on preliminary CAS data.

Recovery Rates

EIA provided data on reported recovery rates from individual mines in Illinois for the years of 1991 to 1993. These data were compared with regional recovery rates calculated from depletion (measured from resource maps) and production data (compiled from State reports).

Recovery rates for underground reserves were calculated by comparing cumulative depletion of underground reserves with reported production. For those counties where a valid comparison could be made, recovery rates for the period 1979 through 1993 ranged from 40 percent to 58 percent on a county and seam basis, averaging 48 percent for all seams and counties combined. This agrees with EIA's data for 1991 through 1993, which show a weighted average recovery rate of 50 percent for all underground mines. Based on these statistics, a factor of 50 percent was used to calculate remaining recoverable underground-minable reserves.

Consideration was given to using a higher recovery rate in counties where longwall mining is being practiced; however, EIA data did not show consistently higher recovery rates at mines operating longwalls. This is probably due to the influence of such factors as geology, amount of coal preparation, and development stage of individual mines. A valid comparison between depletion and production could not be made in several counties where reported production included production from outside the county, or underground-minable reserves were depleted by surface mining, or production was too limited to measure depletion at the scale of mapping.

EIA data for individual surface mines for 1991 through 1993 showed recovery rates ranging from 60 to 90 percent, with a weighted average of 75 percent. These figures compare favorably with recovery rates in selected counties, as calculated from cumulative depletion of surface-minable resources and reported cumulative production from surface mines. Both the EIA data and the ISGS cumulative depletion data from base year of mapping to 1994 indicate that recovery rates are lower for thinner seams or seams with many impurities. The Herrin Coal in the northwestern part of the State commonly contains impurities—a widespread parting known as the "blue band" and prevalent occurrences of "white top" and clay dikes. Based on these data, a recovery rate of 70 percent was used in this study to calculate surface-minable reserves for seams less than 42 inches thick or for the Herrin Coal in northwestern Illinois. A recovery rate of 85 percent was used for all other surface-minable reserves.

Eastern Kentucky

Overview

The Kentucky Geological Survey (KGS), working in cooperation with the EIA, compiled a new DRB estimate for coal in the eastern Kentucky coalfield of 12.86 billion short tons remaining as of January 1, 1993 (Table 10).[29] This compares with 8.60 billion short tons in EIA's eastern Kentucky DRB for the same date. The new estimate is based on previously calculated KGS coal resource data, but includes thicker overburden criteria for the surface-minable DRB and a new methodology to estimate surface minability in eastern Kentucky. The updated DRB also includes adjustments for resource accessibility and recoverability.

The new estimates incorporate analyses of sulfur and heat content data from KGS files suitable for characterizing eastern Kentucky coal resources. Coal quality data were examined in conjunction with coal resource mapping. The new allocations place 9.4 percent of the DRB in the highest sulfur category (2.5 or more pounds of sulfur per million Btu), as compared with 2.3 percent in EIA's previous allocation. The difference derives from the profile of the KGS coal quality database.

Certain factors affecting coal resource availability and recent data on mining recovery rates were also examined. These resulted in new (January 1, 1993) estimates of the accessible reserve base for eastern Kentucky of 9.64 billion short tons and estimated recoverable reserves of 7.18 billion short tons (Table 10). This project was the first to utilize results of USGS Coal Availability Studies (CAS). A proposed methodology to incorporate information from the U.S. Bureau of Mines Coal Recoverability Studies (CRS) in the region could not be implemented because of insufficient CRS data during the project period. The estimated recoverable reserves instead used EIA recoverability factors, verified against recovery rates reported on EIA's annual Coal Production Report, Form EIA-7A.

The KGS delivered its study results in July 1994. Although some data could not be developed to the extent both KGS and EIA planned due to unavailability of source data, the two agencies continue to cooperate to improve the coal reserve database.

Study Area

The eastern Kentucky coalfield is the part of the Appalachian coal basin that lies within Kentucky (Figure 5). The eastern Kentucky field covers more than 10,400 square miles and includes all or parts of 39 counties underlain by Pennsylvanian age rocks. Minable coal resources have been mapped by the KGS in 36 of those counties. The coalfield lies in rugged mountainous terrain in the southeast, in steep hills and uplands dissected by tributaries to the Ohio and the Big Sandy Rivers to the northeast, and in eroded plateaus and rolling hills in the central and western counties. The coalfield is broken into six coal resource districts, based on mining centers, geology, physiography, common coalbed nomenclature, and transportation patterns.

This study does not involve the second major coalfield in the State (in western Kentucky) which is also in Pennsylvanian-age rocks (Figure 5). The centers of the eastern and western Kentucky coalfields are about 230 miles apart, and they are separated by 80 miles at their closest margins. The western Kentucky field is found in the nonmountainous counties south of the Ohio River, opposite southwestern Indiana and southeastern Illinois.

Coal production from all of Kentucky in 1994 was 161.6 million short tons, just behind that of second-place West Virginia at 161.7 million short tons. The Kentucky production included 124.4 million short tons from eastern Kentucky, which even by itself was exceeded by the production of only two States, Wyoming and West Virginia.[30] Counting the production from western Kentucky, the State was the leading U.S. producer as recently as 1987.

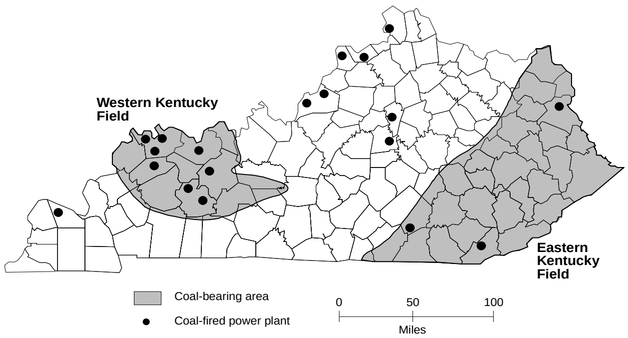
[28]About 5 percent of the coal in the less than 42-inch category was mapped using prior criteria and includes beds as thick as 47 inches.
[29]Energy Information Administration, *New Demonstrated Reserve Base of the Eastern Kentucky Coal Field,* Final Report by the Kentucky Geological Survey, as amended, July 26, 1994 (Washington, DC, 1994).
[30]Energy Information Administration, *Coal Industry Annual 1994*, DOE/EIA-0584(94) (Washington, DC, October 1995) p. 5.

Table 10. Demonstrated Reserve Base and Estimated Recoverable Reserves of Bituminous Coal in Eastern Kentucky by Btu/Sulfur Range and Type of Mining
(Million Short Tons Remaining as of January 1, 1993)

Heat Content (million Btu per short ton)	Sulfur Content (pounds of sulfur per million Btu)							Total All Sulfur Categories
	< 0.40	0.41–0.60	0.61–0.83	0.84–1.24	1.25–1.67	1.68–2.50	> 2.50	
Demonstrated Reserve Base								
Minable from Surface								
< 20	0.00	20.17	50.42	100.85	60.51	40.34	141.18	413.47
20-22.99	0.00	201.69	121.02	151.27	50.42	211.78	211.78	947.95
23-24.99	0.00	262.20	292.45	221.86	141.18	231.95	252.11	1,401.75
25-25.99	10.09	302.54	453.81	262.20	151.27	151.27	110.93	1,442.09
> 25.99	242.03	2,208.52	1,149.64	816.85	594.99	605.07	231.95	5,849.05
Total	**252.11**	**2,995.11**	**2,067.34**	**1,553.02**	**998.37**	**1,240.40**	**947.95**	**10,054.31**
Minable Underground								
< 20	0.00	5.63	14.07	28.15	16.89	11.26	39.41	115.40
20-22.99	0.00	56.29	33.78	42.22	14.07	59.11	59.11	264.59
23-24.99	0.00	73.18	81.63	61.92	39.41	64.74	70.37	391.25
25-25.99	2.81	84.44	126.66	73.18	42.22	42.22	30.96	402.51
> 25.99	67.55	616.43	320.88	227.99	166.07	168.88	64.74	1,632.55
Total	**70.37**	**835.98**	**577.02**	**433.47**	**278.66**	**346.21**	**264.59**	**2,806.30**
Minable Total								
< 20	0.00	25.80	64.49	129.00	77.40	51.60	180.59	528.88
20-22.99	0.00	257.98	154.80	193.49	64.49	270.89	270.89	1,212.53
23-24.99	0.00	335.38	374.08	283.78	180.59	296.69	322.48	1,793.00
25-25.99	12.90	386.98	580.47	335.38	193.49	193.49	141.89	1,844.58
> 25.99	309.58	2,824.95	1,470.52	1,044.84	761.06	773.95	296.69	7,481.59
Total	**322.48**	**3,831.09**	**2,644.36**	**1,986.49**	**1,277.03**	**1,586.61**	**1,212.54**	**12,860.61**
Estimated Recoverable Reserves								
Recoverable from Surface								
< 20	0.00	11.26	28.16	56.32	33.79	22.53	78.85	230.92
20-22.99	0.00	112.64	67.59	84.48	28.16	118.27	118.27	529.42
23-24.99	0.00	146.44	163.33	123.91	78.85	129.54	140.80	782.86
25-25.99	5.63	168.96	253.45	146.44	84.48	84.48	61.95	805.39
> 25.99	135.17	1,233.43	642.06	456.20	332.30	337.93	129.54	3,266.63
Total	**140.80**	**1,672.74**	**1,154.58**	**867.35**	**557.58**	**692.75**	**529.42**	**5,615.22**
Recoverable Underground								
< 20	0.00	3.14	7.86	15.72	9.43	6.29	22.01	64.45
20-22.99	0.00	31.44	18.86	23.58	7.86	33.01	33.01	147.76
23-24.99	0.00	40.87	45.58	34.58	22.01	36.15	39.30	218.49
25-25.99	1.57	47.16	70.74	40.87	23.58	23.58	17.29	224.78
> 25.99	37.73	344.24	179.20	127.32	92.74	94.31	36.15	911.70
Total	**39.30**	**466.85**	**322.24**	**242.07**	**155.62**	**193.34**	**147.76**	**1,567.18**
Recoverable Total								
< 20	0.00	14.41	36.02	72.04	43.22	28.82	100.86	295.36
20-22.99	0.00	144.08	86.45	108.06	36.02	151.28	151.28	677.18
23-24.99	0.00	187.30	208.92	158.49	100.86	165.69	180.10	1,001.36
25-25.99	7.20	216.12	324.18	187.30	108.06	108.06	79.24	1,030.17
> 25.99	172.90	1,577.68	821.26	583.52	425.04	432.24	165.69	4,178.32
Total	**180.10**	**2,139.59**	**1,476.82**	**1,109.42**	**713.20**	**886.09**	**677.18**	**7,182.40**

Note: Data may not equal sum of components due to independent rounding.
Source: Energy Information Administration, *New Demonstrated Reserve Base of the Eastern Kentucky Coal Field*, as amended, July 26, 1994.

Figure 5. Coal-Bearing Areas of Kentucky



Source: United States Geological Survey, *Coalfields of the United States*, 1960.

Methodology and Criteria

In 1983 the KGS completed a 7-year assessment of the coal resources of the eastern Kentucky coalfield. The results of that research, referred to as the 1983 Coal Resources, were original identified resources, compiled for coalbeds thicker than 14 inches by seam thickness and data reliability for each coalbed, county, and district. The 1983 Coal Resources were calculated following standard USGS criteria for “measured,” “indicated,” and “inferred” data reliability. All major coalbeds in all the counties of eastern Kentucky were included in the study. A database of approximately 20,000 coalbed thicknesses was used in calculating the resources at a scale of 1:24,000 (7.5-minute quadrangles). Results were aggregated at the county level by coalbed.

A joint study was begun in 1986 by the USGS and KGS to examine the coal resources available for development in selected 7.5-minute quadrangles in eastern Kentucky.[31] This pilot project was successful and became the first study in the CAS program. As of 1993, fifteen CAS had been completed in the central Appalachian coal basin, nine of which were suitably located for the EIA Coal Reserves Data Base (CRDB) project in eastern Kentucky. Eight of the nine CAS quadrangles were in eastern Kentucky. The ninth, completed by the Virginia Division of Mineral Resources, was located on the Kentucky–Virginia state line and was useful in the eastern Kentucky study.

The initial research in the U.S. Bureau of Mines CRS program was also done in eastern Kentucky. During the EIA project period, CRS were in progress in four Kentucky quadrangles, and the results would be used in the CRDB project had they been available. By the end of the project, however, only the pilot study was near completion and no final reports had been released. The KGS had developed a methodology to incorporate data from the 1983 Coal Resource Program, CAS, and CRS, as well as from the KGS Coal-Quality Data Base and production data from the Kentucky Department of Mines and Minerals into a single database, but delays in data from the CRS and inadequate detail in production data eventually led to alternative analyses for recoverability and depletion.

The DRB for bituminous coal in eastern Kentucky includes measured and indicated resources for coalbeds of 28 inches or greater thickness. The surface-minable DRB includes measured and indicated resources 14 to 28 inches thick as well as 28 inches or thicker.

EIA keeps the depth cutoff for the surface-minable DRB flexible to allow for variations in local geology and mining practice, and for evidence that the resources can be mined economically at present. Based on that policy, the surface-minable criterion was extended from 120 feet to 200 feet of overburden in eastern Kentucky. This maintains compatibility with the USGS criteria for identified resources being used in eastern Kentucky CAS, which recognize that some mines have been removing as much as 200 feet of overburden in eastern Kentucky—especially when mining several coalbeds (“multi-seam operations”). Also, mountain-top removal surface mines commonly remove as much as 200 feet of overburden. The overburden thickness criterion for deep- or underground-minable resources was extended from 1,000 feet, in the previous DRB, to 2,500 feet in mountainous locations. This reflects current mining practice for underground drift mines in mountainous terrain in eastern Kentucky and was the depth cutoff in effect for the 1983 Resource Program. EIA's previous DRB did not include mapping information by which to distinguish resources situated for drift mining beneath overburden of more than 1,000 feet.

Surface- and underground-minable DRB were estimated using district average thickness-of-overburden factors developed from the data in the nine CAS completed by project end. Measured and indicated coal resources in qualified bed thickness ranges were allocated to underground and surface categories for each county / coalbed,

[31]U.S. Geological Survey, *Coal Resources Available for Development--A Methodology and Pilot Study*, by J.R. Eggleston, M.D. Carter (and J.C. Cobb, J. C., Circular 1055 (Washington, DC, 1990).

according to the district in which they occur. Resources in the inferred reliability category were not allocated.

The KGS compiled allocations separately for measured and indicated resources. The ratio of measured and indicated resources varies from one quadrangle to another and is typically related in this region to the degree of topographic dissection and the number of coal measurements at outcrops and highwalls versus at drill holes or working face. The topographic relationships that affect the measured and the indicated resources, by bed thickness and overburden thickness categories, also affect coal availability factors to varying degrees.

Depletion adjustments were applied to the original DRB data to account for coal recovered or lost in past mining. No depletion adjustments were made to inferred resources. In a few instances in which calculated depletion tonnages exceeded the DRB, the remaining DRB was reduced to zero. This situation indicates either that mining has taken place in areas of inferred resources or in areas with insufficient KGS file data to calculate **any** resource estimate, or that DRB estimates are incomplete. The depletion estimates, covering more than 200 years' production in some counties, were compiled using EIA standard depletion factors of 1.25 (surface) and 2.00 (underground) for county-level production tonnages supplied by the Kentucky Department of Mines and Minerals (KDMM) for the years 1790 through 1992, from underground and surface production allocations by KDMM, KGS, and EIA. The DRB data were depleted to January 1, 1995, using EIA coal production data.

Coal Quality Allocations

The surface and underground DRB were allocated to heat value and sulfur-content categories using data and locations from field samples and mines within traditional coal resource districts. The KGS Coal Quality Data Base and data from the Kentucky Center for Applied Energy Research were used to subdivide the resources. Together, these databases contain approximately 2,000 coal-quality analyses for the eastern Kentucky coalfield. Of these, the 1,291 KGS analyses were primarily from channel samples taken in roadcuts or mines or from borehole cores. These analyses are believed to represent remaining coal resources better than historical data, largely from preparation plants or loading points. Only data from beds 14 inches or thicker were used in this analysis because the quality of thinner-bedded coals is highly variable and would not be representative of the coal thicknesses in the DRB. Analytical values in Btu per pound and percent sulfur by weight were converted to millions of Btu per short ton and pounds of sulfur per million Btu, which are more relevant to emission standards governing combustion of the coal.

Coal quality of the DRB and the associated accessible resources and reserve estimates were characterized by one of three methods: (1) using analyses from specific coalbeds with numerous samples, aggregated at the county level; (2) using analyses with fewer samples from specific coalbeds, but aggregating at the district level; and (3) using characteristics of all remaining coalbeds occurring in a district. Method 1 was used where at least 20 samples per county for a specific coalbed were on file. Method 2 was used for coalbeds without sufficient samples for Method 1 but with at least 40 samples per district. Btu and sulfur content data were statistically distributed to EIA Btu and sulfur content ranges and coal resources were allocated proportionately at the county/coalbed level or at the district/coalbed level. Method 3 was used in the many cases where the number of coal quality data points were insufficient to characterize the coalbeds in a county or district. In these cases, coal-quality data for the coalbeds in a district were first aggregated, then their resources statistically distributed to EIA Btu/sulfur ranges.

The portion of the updated 1993 DRB allocated to the highest sulfur content category (2.5 or more pounds of sulfur per million Btu) was 1.21 billion short tons, or 9.4 percent of the total DRB, six times higher than the 0.20 billion short tons, or 2.3 percent of the total, in EIA's 1992 DRB. On the other hand, the updated DRB tonnage in the compliance coal sulfur content category (less than 0.61 pounds of sulfur per million Btu) was virtually equal to EIA's previous estimate. It was 4.15 billion short tons, or 32.2 percent of the total DRB, compared with 4.02 billion short tons in EIA's 1992 DRB. Since the EIA tonnage was apportioned from a smaller total DRB, however, compliance coal represented 45.7 percent of the former total.

The KGS attests that the updated DRB and estimated recoverable reserves allocations are more accurate because the data in its coal quality database better reflect remaining resources. Samples in areas already mined were used to a much smaller extent in the KGS allocations than was possible using the EIA coal quality data. Only a small proportion of the KGS data were collected from mine sites. The KGS geologists found that current and historic mines were largely concentrated in higher-quality coalbeds and that analyses from these sites consequently may be more representative of past mining than of remaining resources. The true distribution of quality in future resources will be known with certainty only when the coals are accessed, but the KGS findings indicate that a large part of the remaining DRB will be of poorer quality than in the past and that some of that coal may be economically uncompetitive for mining.

Coal Accessibility Adjustments

A methodology was developed to apply appropriate data from the detailed study areas of the CAS to the resources data of the 1983 Coal Resource Program. The methodology draws on the nine CAS quadrangles and projects average values from the two or three quadrangles judged most representative of conditions in each of the six coal resource districts, based on location, geologic setting, and topography. The CAS examined the effects on resource availability of land use constraints, geologic or physical constraints, mining restrictions due to regulations, and mined-out blocks of coal. In the CAS, these constraints were correlated with specific features or trends, delineated on the maps, and their areas and affected coal resource tonnages calculated. The types of constraints included in the present study were land use restrictions (cemeteries, faults, oil and gas wells, powerlines, roads, streams, towns) and technological restrictions (barriers, oil and gas wells, coal too thin to mine at present). Applied to resources already meeting DRB criteria for geologic assurance, coalbed thickness, and overburden thickness, these constraints yielded the accessibility factors. The net accessibility for the six districts ranged from 80.2 percent to 91.2 percent.

The updated criteria used to calculate a surface-minable DRB were broadened from EIA's previous criteria—a more conservative maximum "highwall" of 120 feet—to a limit of 200 feet in this study. The highwall is the escarpment in the overburden produced by excavating to the coal in a surface mine. Resources beneath more than 200 feet of overburden are assumed to be recoverable only by underground mining technologies. Coal resources in the CAS quadrangles had been mapped at standard USGS thickness increments. To distinguish surface- and deep-minable resources, the critical limitation in eastern Kentucky is the 28-inch coalbed thickness. Therefore, resources were compiled for 14-to-28-inch and greater-than-28-inch categories. Coal thinner than 14 inches (very thin bedded) was not evaluated in the 1983 Resources because such beds are not commonly surface-mined. When they are, it is the unusual, very thin beds of high quality that may be recovered, in association with thicker beds that can sustain a profitable operation.

Because of the 200-foot highwall criterion, three significant changes are reflected in the revised DRB:

1. The surface-minable DRB now includes resource data greater than 28 inches thick and beneath 100[32] to 200 feet of cover that formerly would have been in the underground-minable DRB. The underground DRB is reduced by that same amount. It is not feasible to calculate that amount precisely because of differences in methodologies. The EIA assessment was based on analysis of surface topography and potential surface-minable acreages and the KGS assessment was based on three-dimensional CAS mapping of coalbeds and topography, extrapolated to coal resource districts.[33]

2. In addition, the surface-minable DRB is increased by the resources 14 to 28 inches thick and beneath 100 to 200 feet of cover. Since such resources are too thin to mine by conventional underground techniques, they formerly were not included in either the underground DRB or the surface DRB. It happens that more than half of the original resource estimates in eastern Kentucky are 14 to 28 inches thick, so adding a part of those resources in the better-mapped, near-surface areas adds a significant amount of coal.

3. Finally, the new DRB for surface-minable coal contains a smaller percentage of recoverable coal (i.e., estimated recoverable reserves) than the old surface DRB. This is because the economics of surface reserves, assuming there is a market for the coal at the time, is sensitive to the overburden ratio—the ratio of tons of overburden that must be moved to tons of recoverable coal in the mined rock sequence. Thin-bedded resources with 100 feet of overburden may be economically minable based on market value alone because they can be recovered with low levels of technology: that is, without investment in high-capacity equipment or expensive techniques. To mine the same thin beds under 200 feet of overburden may be profitable only in association with one or more thicker beds or only if some of the thin beds are of exceptional quality.

During data reviews, EIA recognized that an increase in the surface-minable DRB relative to the underground DRB in eastern Kentucky was appropriate; however, the large

[32]EIA's maximum 120 foot overburden thickness included coal with as little as 80 feet and as much as 120 feet of cover. The average thickness was 100 feet.

[33]In 1986, in connection with a correction to its own underground-minable DRB (with 100+ feet of overburden), EIA estimated that 14-28 inch beds comprised 8.68 billion short tons, or 46 percent of the measured and indicated resources deeper than 100 feet in 14-inch or thicker beds. Energy Information Administration, *Coal Production 1985*, DOE/EIA-0118(85) (Washington, DC, November 1986), p. 119.

quantity of thin-bedded resources in the rock sequence and the costs of mining to a 200-foot surface-mining cutoff would depress net recovery factors by an unknown amount. Since available data from the single Bureau of Mines CRS was insufficient to revise regional recovery factors, and no operable public database has data on overburden ratios or on amount of overburden at active mines, EIA turned to alternative information to evaluate recoverability of thin-bedded resources under 200-foot surface-mining limits.

EIA estimated the effects of bed thickness on net recoverability of surface-minable resources by reassessing accessibility restrictions for beds too thin to mine at present. The EIA methodology included statistical analyses of all surface production from 14– to 27–inch beds in selected years between 1983 and 1993 to determine the distribution of production by bed thickness. The production was analyzed by 1-inch increments from 14 through 27 inches (production reported from 28 inch beds is depleted from the 28– to 42–inch DRB) and for single-seam and multi-seam mines. Single-seam mines were found to account for only 12 percent of the 14– to 27–inch production. Further, in only one district, the “Big Sandy,” did recent production trends involve the **entire** 14– to 27–inch category. Another district normally produces thin coal only from beds 20 inches or thicker, two districts only from beds 24 inches or thicker, and two districts produce no appreciable coal from 14– to 27–inch beds.

EIA designated that bed thicknesses with no appreciable recent production be considered as accessibility-restricted because they are too thin to mine at present. The accessible reserve bases in the six districts were adjusted as follows:

- In the Big Sandy the 14– to 28–inch DRB was not restricted.
- In one district the DRB thinner than 20 inches was restricted.
- In two districts the DRB thinner than 24 inches was restricted.
- In two districts the entire DRB thinner than 28 inches was restricted.

Because the KGS resource data were hand-planimetered in the late 1970s and early 1980s for set bed-thickness intervals, the resources in smaller thickness increments between 14 and 28 inches were not known. The KGS could, however, supply statistics on the total number of measurement points used in the 1983 Resources and for each 1-inch increment in the 14– to 27–inch range.

EIA used the statistics on measurement points to calculate the relative amounts of coal in the DRB in beds 28 inches or thicker and in each 1-inch increment from 14 through 27 inches. These same measurement points were the basis of the measured and indicated resource estimates in the DRB. The relative value of each thickness increment was calculated as the number of measurement points in each increment weighted by the overall number of measurement points and by the effects of thickness on the tonnage within the 14– to 28–inch DRB. These calculations indicated that a net 47.3 percent of the 14– to 28–inch DRB is restricted because beds are generally too thin to mine at present. That factor was used to adjust the accessible DRB. The effect of this adjustment was to reduce the net accessibility of surface-minable DRB in eastern Kentucky from 86.5 percent to 70.7 percent.

Coal Recoverability Adjustments

Coal recoverability adjustments for eastern Kentucky could not be based on the results from the four CRS in the study area. Projected CRS release schedules during the project period did not materialize and only preliminary results from the Matewan Quadrangle CRS were available for review. Also, the preliminary Matewan recoverability data were for only one bed, the Upper Elkhorn No. 3B, which is a dominant resource in the Matewan quadrangle but may not be typical of some other major beds in eastern Kentucky. Interestingly, the recovery rates for surface and underground mining in the Matewan quadrangle were within 2 percentage points of the average of recent rates reported by active mine operators throughout eastern Kentucky on EIA's annual coal production surveys. Therefore, EIA retained the recoverability rates used since 1992 to derive estimated recoverable reserves from the accessible reserve base, a regional average of 0.79 for surface mining and 0.62 for underground.

After analyses of all the CRS in the region have been completed, the KGS will incorporate the results into the KGS/DRB computer routines and regenerate estimated recoverable reserves for the coalfield. These results will be made available to the EIA.

The extrapolation factors employed in the KGS cooperative agreement with EIA were calculated based on general geographic regions and geologic settings. A methodology is being tested by KGS and the USGS that uses geologically mappable factors to reflect local conditions more accurately within regional summaries. The test methodology used a limited sample of detailed CAS digital mapping data and has shown that the technologic restriction of coal too thin to mine by underground methods is the principal controlling factor, at least for coal availability in eastern Kentucky. Since this restriction is a function of overburden thickness (which was not measured in the 1983 Resources), proxy variables using data that have been mapped in all 7.5-minute quadrangles are being sought to predict the coal-too-thin-to-mine parameter. It remains, however, undetermined whether this would be applicable to DRB accessibility adjustments.

Implications of New Eastern Kentucky DRB

The eastern Kentucky DRB increased by nearly 4.3 billion short tons as a result of the EIA cooperative study with the KGS. Most of the increase is due to changes in the criteria used and the data available to estimate surface-minable coal. Expanding the overburden limit for resources potentially minable from the surface reflects changes in mining practice and mapping criteria. The DRB increase results from an increase of about 8.5 billion short tons in surface-minable DRB and a decrease of about 4.3 billion short tons in the underground DRB.

The databases at the KGS do not include automated means to remap and recalculate old hand-planimetered coal thickness areas or to calculate corresponding overburden thicknesses or ratios in the complex topography and geologic structures. Some coal that is minable by surface methods is also minable by underground methods. The categories are not mutually exclusive in marginal overburden and bed thickness conditions. Some portion of the coalbeds that are 28 inches thick or thicker, with overburden of 100 to 200 feet, will likely be recovered by underground mining. The method of recovery depends on factors such as the equipment available, the type of mining committed to, and the sequence of mining in the area.

Because recovery is generally higher for surface mining, the EIA assumes that surface mining is the preferred option. Coal that is potentially recoverable by surface mining is assigned to the surface DRB and, as in this case, thinner beds may be included that would not be in the underground DRB. From what is known about the distribution of bed thicknesses and measurement point locations in eastern Kentucky, EIA estimates that as much as 5 billion short tons of the surface-minable DRB may be minable by either method, underground or surface. The portions of that 5 billion short tons ultimately recovered by each method could not be anticipated. It will depend on the variables mentioned in the paragraph above, as well as the quality of the coal and the market and prices at the time of mining.

The underground-minable estimated recoverable reserves for 1995 are 1.41 billion short tons. At the current rate of production at underground mines, this would be depleted in 19 or 20 years. Some portion of the 5 billion tons of surface-minable DRB noted above will probably be recovered in the shallow sections of underground mines, but some of the associated thinner beds that could be mined in a surface operation will thereby be rendered unminable.

Based on the supplemental evidence of the established mining and coal delivery infrastructure in eastern Kentucky, EIA has included inferred resource data in the database used in National Energy Modeling System (NEMS) coal supply projections for EIA's *Annual Energy Outlook*. The existence of these inferred resources are well enough documented to allow their limited use to develop more realistic projections of future coal supplies than can be done with the DRB alone. The small ratio of reserves to production is also an indication that, despite a long-term mapping program, there are areas in eastern Kentucky where coverage of publicly available data and drilling programs is inadequate for a complete DRB or resource assessment.

Recoverable coal reserves at active mines are low in eastern Kentucky (see Chapter 4). For underground mines, the recoverable reserves of low-sulfur coal are sufficient to meet projected levels of production for only about 5 years. This projection is not a measure of *all* attainable reserves, and the actual dates of depletion would vary from mine to mine, but it does give insight into the relative amount of reserves that can be mined in eastern Kentucky with the current capital investment. To add to this capacity will require new investments in new mines.

3. 1995 Demonstrated Reserve Base and Estimated Recoverable Reserves

Demonstrated Reserve Base

The demonstrated reserve base (DRB) of coal in the United States as of January 1, 1995, contains an estimated 496 billion short tons. This is an increase of nearly 22 billion short tons over the previous (January 1, 1993) DRB estimate of 474 billion short tons.[34] The increase is attributable to updated coal resource data from EIA's Coal Reserves Data Base (CRDB) projects in New Mexico (+ 8 billion short tons), Illinois (+ 12 billion short tons), eastern Kentucky (+ 4 billion short tons), including adjustments for the effects of resource depletion (– 3 billion short tons).

Not all the coal in the DRB is recoverable. EIA's latest estimates of the recoverable portions of the DRB indicate that about 55 percent of the national DRB estimate may be recovered by mining.

The DRB includes coal from States in all geographic regions. Nearly half the DRB is found in the Western Coal-Producing Region (Table 11). Coal resources believed to be minable by surface mining make up one-third of the DRB, the major part of which (58 percent) occurs in the West. On the other hand, two-thirds of the DRB may be recoverable only by underground mining, and more than half of that amount (56 percent) is found in the Interior and Appalachian Coal-Producing Regions.

Coal ranks, which are generally related to coal heating values, increase from the lowest rank, lignite, toward the highest rank, anthracite, with the highest heat values found in the low-volatile bituminous coals just below anthracite in rank. Fifty-two percent of the DRB is comprised of bituminous coals, which are found primarily in the Interior and Appalachian Regions. Subbituminous coals account for nearly 38 percent of the total and is all located in the Western States. Lignite makes up 9 percent of the DRB, primarily located in the West. The anthracite DRB includes only 1.5 percent of the DRB and almost all of it is located in northeastern Pennsylvania.

DRB summary data by State, coal rank, and potential mining method are presented in Tables 11 through 14, along with the previous (January 1, 1993) DRB for comparison. With the exception of New Mexico, Illinois, and eastern Kentucky, the 1995 DRB is based on the same data sources used for the previous DRB. All data are updated to the current base year to account for the estimated effects of resource depletion due to mining and coal lost in the mining process.

The sulfur content of the coal in the DRB has been estimated by EIA according to six ranges of pounds of sulfur per million Btu and five ranges of heat value, in millions of Btu per short ton (Table B1). For more general discussion, however, EIA refers to three major sulfur ranges: low, medium, and high (Table 15). The quantities of low-sulfur, medium-sulfur, and high-sulfur coals in the DRB are in relative balance (Table 16). Nationwide, low-sulfur coal is estimated to amount to 170.8 billion short tons, or 34 percent of all coal included in the DRB. Medium-sulfur coal totals 141.1 billion short tons, or 28 percent of the DRB, and high-sulfur coal amounts to 183.7 billion short tons, or 37 percent.

In contrast to the relative parity nationwide, coal-type distribution by region is markedly uneven. Most of the low-sulfur coal included in the DRB (84 percent) is in the West. Appalachia encompasses 15 percent of the low-sulfur DRB and the Interior only 1 percent (or less than 2 billion short tons of low-sulfur resources), located entirely in Illinois, Oklahoma, and Indiana. Similarly, an estimated 87 billion short tons (61 percent) of the medium-sulfur DRB coal is in the West, about 27 percent of the total is estimated to be in Appalachia, and only 12 percent is in the Interior Region. Most of the high-sulfur DRB is in the Interior Region. EIA estimates that the Interior contains nearly 69 percent of the total high-sulfur DRB coal in the United States; Appalachia, less than 25 percent; and the West, less than 7 percent.

[34]Energy Information Administration, *Coal Production 1992*, DOE/EIA-0118 (92) (Washington, DC, October 1993), pp. 71-75. This report was discontinued in 1993 and superseded by the *Coal Industry Annual*. The DRB had been updated annually in the Coal Production series but updates are not included in the Coal Industry Annual reports.

Table 11. Demonstrated Reserve Base of Coal by State and Rank, 1993, 1995
(Million Short Tons)

Coal Producing Region and State	Anthracite 1995	Anthracite 1993	Bituminous 1995	Bituminous 1993	Subbituminous 1995	Subbituminous 1993	Lignite 1995	Lignite 1993	Total 1995	Total 1993
Alabama	–	–	3,552.0	3,634.6	–	–	1,083.0	1,083.0	4,635.0	4,717.6
Alaska	–	–	697.5	697.5	5,418.4	5,422.3	14.0	14.0	6,129.9	6,133.9
Arizona	–	–	188.8	220.4	–	–	–	–	188.8	220.4
Arkansas	104.1	104.2	287.5	287.6	–	–	25.4	25.4	417.0	417.1
Colorado	25.5	25.5	8,776.6	8,837.6	3,851.8	3,871.7	4,189.9	4,189.9	16,843.8	16,924.6
Georgia	–	–	3.6	3.6	–	–	–	–	3.6	3.6
Idaho	–	–	4.4	4.4	–	–	–	–	4.4	4.4
Illinois	–	–	89,956.0	78,006.9	–	–	–	–	89,956.0	78,006.9
Indiana	–	–	9,991.0	10,070.7	–	–	–	–	9,991.0	10,070.7
Iowa	–	–	2,189.5	2,189.7	–	–	–	–	2,189.5	2,189.7
Kansas	–	–	975.6	976.4	–	–	–	–	975.6	976.4
Kentucky Total	–	–	32,564.7	28,804.3	–	–	–	–	32,564.7	28,804.3
Kentucky, Eastern	–	–	12,484.8	8,600.8	–	–	–	–	12,484.8	8,600.8
Kentucky, Western	–	–	20,079.8	20,203.5	–	–	–	–	20,079.8	20,203.5
Louisiana	–	–	–	–	–	–	471.3	479.6	471.3	479.6
Maryland	–	–	731.4	744.1	–	–	–	–	731.4	744.1
Michigan	–	–	127.7	127.7	–	–	–	–	127.7	127.7
Missouri	–	–	5,995.7	5,997.5	–	–	–	–	5,995.7	5,997.5
Montana	–	–	1,385.4	1,385.4	102,627.4	102,723.6	15,760.5	15,761.3	119,773.3	119,870.3
New Mexico	2.3	2.3	3,740.7	1,918.1	8,803.8	2,478.7	–	–	12,546.8	4,399.1
North Carolina	–	–	10.7	10.7	–	–	–	–	10.7	10.7
North Dakota	–	–	–	–	–	–	9,470.0	9,550.3	9,470.0	9,550.3
Ohio	–	–	23,754.0	23,845.4	–	–	–	–	23,754.0	23,845.4
Oklahoma	–	–	1,579.6	1,584.4	–	–	–	–	1,579.6	1,584.4
Oregon	–	–	–	–	17.5	17.5	–	–	17.5	17.5
Pennsylvania Total	7,225.2	7,230.3	21,642.6	21,841.0	–	–	–	–	28,867.8	29,071.2
Anthracite	7,225.2	7,230.3	–	–	–	–	–	–	7,225.2	7,230.3
Bituminous	–	–	21,642.6	21,841.0	–	–	–	–	21,642.6	21,841.0
South Dakota	–	–	–	–	–	–	366.1	366.1	366.1	366.1
Tennessee	–	–	827.1	841.5	–	–	–	–	827.1	841.5
Texas	–	–	–	–	–	–	13,064.9	13,197.6	13,064.9	13,197.6
Utah	–	–	5,954.6	6,046.0	1.1	1.1	–	–	5,955.7	6,047.1
Virginia	125.5	125.5	2,201.8	2,341.0	–	–	–	–	2,327.3	2,466.5
Washington	–	–	303.7	303.7	1,089.2	1,100.6	8.1	8.1	1,400.9	1,412.4
West Virginia	–	–	35,983.1	36,498.2	–	–	–	–	35,983.1	36,498.2
Wyoming	–	–	4,354.4	4,364.2	64,141.4	64,694.3	–	–	68,495.8	69,058.5
Appalachian Total[a]	7,350.7	7,355.8	101,191.1	98,360.8	–	–	1,083.0	1,083.0	109,624.8	106,799.6
Interior Total[a]	104.1	104.2	131,182.3	119,444.2	–	–	13,561.6	13,702.5	144,848.0	133,250.9
Western Total[a]	27.8	27.8	25,406.2	23,777.3	185,950.4	180,309.7	29,808.5	29,889.6	241,193.0	234,004.5
East of the Miss. River	7,350.7	7,355.8	221,345.6	206,769.5	–	–	1,083.0	1,083.0	229,779.3	215,208.3
West of the Miss. River	131.9	132.0	36,434.0	34,812.9	185950.4	180,309.7	43,370.1	43,592.1	265,886.4	258,846.7
U.S. Total	**7,482.6**	**7,487.7**	**257,779.5**	**241,582.4**	**185,950.4**	**180,309.7**	**44,453.1**	**44,675.1**	**495,665.6**	**474,054.9**

[a]For a definition of coal-producing regions, see Table 17.

Note: Totals based on available data. Totals may not equal sum of components because of independent rounding. Data are reported as of the first day of the year.

Sources: State geological and mineral resource surveys, and other geological reports.

Table 12. Demonstrated Reserve Base of Coal by State and Potential Method of Mining, 1993, 1995
(Million Short Tons)

Coal Producing Region and State	Underground		Surface		Total	
	1995	1993	1995	1993	1995	1993
Alabama	1,361.9	1,421.9	3,273.1	3,295.7	4,635.0	4,717.6
Alaska	5,423.0	5,423.0	706.9	710.9	6,129.9	6,133.9
Arizona	101.6	101.6	87.3	118.8	188.8	220.4
Arkansas	272.5	272.5	144.5	144.6	417.0	417.1
Colorado	12,049.1	12,107.5	4,794.7	4,817.2	16,843.8	16,924.6
Georgia	1.9	1.8	1.7	1.7	3.6	3.6
Idaho	4.4	4.4	–	–	4.4	4.4
Illinois	73,781.3	62,637.5	16,174.7	15,369.3	89,956.0	78,006.9
Indiana	8,872.8	8,884.6	1,118.1	1,186.0	9,991.0	10,070.7
Iowa	1,732.5	1,732.5	457.0	457.3	2,189.5	2,189.7
Kansas	–	–	975.6	976.4	975.6	976.4
Kentucky Total	18,884.8	23,517.1	13,679.8	5,287.2	32,564.7	28,804.3
Kentucky, Eastern	2,525.0	7,071.8	9,959.9	1,529.0	12,484.8	8,600.8
Kentucky, Western	16,359.9	16,445.3	3,720.0	3,758.2	20,079.8	20,203.5
Louisiana	–	–	471.3	479.6	471.3	479.6
Maryland	649.2	659.9	82.2	84.2	731.4	744.1
Michigan	123.1	123.1	4.6	4.6	127.7	127.7
Missouri	1,479.1	1,479.1	4,516.5	4,518.4	5,995.7	5,997.5
Montana	70,958.7	70,958.7	48,814.6	48,911.6	119,773.3	119,870.3
New Mexico	6,205.4	2,121.4	6,341.4	2,277.8	12,546.8	4,399.1
North Carolina	10.7	10.7	–	–	10.7	10.7
North Dakota	–	–	9,470.0	9,550.3	9,470.0	9,550.3
Ohio	17,846.7	17,894.8	5,907.3	5,950.6	23,754.0	23,845.4
Oklahoma	1,237.4	1,237.8	342.2	346.5	1,579.6	1,584.4
Oregon	14.5	14.5	2.9	2.9	17.5	17.5
Pennsylvania Total	24,408.2	24,561.7	4,459.6	4,509.6	28,867.8	29,071.2
Anthracite	3,850.4	3,851.5	3,374.9	3,378.8	7,225.2	7,230.3
Bituminous	20,557.9	20,710.2	1,084.7	1,130.8	21,642.6	21,841.0
South Dakota	–	–	366.1	366.1	366.1	366.1
Tennessee	539.0	550.5	288.2	291.0	827.1	841.5
Texas	–	–	13,064.9	13,197.6	13,064.9	13,197.6
Utah	5,687.8	5,779.2	267.9	267.9	5,955.7	6,047.1
Virginia	1,630.0	1,746.5	697.3	720.0	2,327.3	2,466.5
Washington	1,332.3	1,332.3	68.7	80.1	1,400.9	1,412.4
West Virginia	31,419.5	31,818.9	4,563.6	4,679.4	35,983.1	36,498.2
Wyoming	42,525.1	42,534.8	25,970.7	26,523.6	68,495.8	69,058.5
Appalachian Total[a]	80,392.0	85,738.4	29,232.8	21,061.2	109,624.8	106,799.6
Interior Total[a]	103,858.6	92,812.5	40,989.4	40,438.4	144,848.0	133,250.9
Western Total[a]	144,301.8	140,377.3	96,891.1	93,627.1	241,193.0	234,004.5
East of the Mississippi River	179,529.1	173,828.9	50,250.2	41,379.3	229,779.3	215,208.3
West of the Mississippi River	149,023.3	145,099.3	116,863.1	113,747.4	265,886.4	258,846.7
U.S. Total	**328,552.3**	**318,928.2**	**167,113.3**	**155,126.7**	**495,665.6**	**474,054.9**

[a]For a definition of coal-producing regions, see Table 17.

Note: Totals based on available data. Totals may not equal sum of components because of independent rounding. Data are reported as of the first day of the year.

Sources: State geological and mineral resource surveys, and other geological reports.

Table 13. Demonstrated Reserve Base of Coal by State and Rank, Potentially Minable by Underground Methods, 1993, 1995
(Million Short Tons)

Coal Producing Region and State	Anthracite		Bituminous		Subbituminous		Lignite		Total	
	1995	1993	1995	1993	1995	1993	1995	1993	1995	1993
Alabama	–	–	1,361.9	1,421.9	–	–	–	–	1,361.9	1,421.9
Alaska	–	–	617.0	617.0	4,805.9	4,805.9	–	–	5,423.0	5,423.0
Arizona	–	–	101.6	101.6	–	–	–	–	101.6	101.6
Arkansas	88.6	88.6	183.9	183.9	–	–	–	–	272.5	272.5
Colorado	25.5	25.5	8,188.1	8,245.0	3,835.5	3,837.0	–	–	12,049.1	12,107.5
Georgia	–	–	1.9	1.8	–	–	–	–	1.9	1.8
Idaho	–	–	4.4	4.4	–	–	–	–	4.4	4.4
Illinois	–	–	73,781.3	62,637.5	–	–	–	–	73,781.3	62,637.5
Indiana	–	–	8,872.8	8,884.6	–	–	–	–	8,872.8	8,884.6
Iowa	–	–	1,732.5	1,732.5	–	–	–	–	1,732.5	1,732.5
Kentucky Total	–	–	18,884.8	23,517.1	–	–	–	–	18,884.8	23,517.1
Kentucky, ...	–	–	2,525.0	7,071.8	–	–	–	–	2,525.0	7,071.8
Kentucky, Western	–	–	16,359.9	16,445.3	–	–	–	–	16,359.9	16,445.3
Maryland	–	–	649.2	659.9	–	–	–	–	649.2	659.9
Michigan	–	–	123.1	123.1	–	–	–	–	123.1	123.1
Missouri	–	–	1,479.1	1,479.1	–	–	–	–	1,479.1	1,479.1
Montana	–	–	1,385.4	1,385.4	69,573.3	69,573.3	–	–	70,958.7	70,958.7
New Mexico	2.3	2.3	2,736.3	1,230.1	3,466.8	889.0	–	–	6,205.4	2,121.4
North Carolina	–	–	10.7	10.7	–	–	–	–	10.7	10.7
Ohio	–	–	17,846.7	17,894.8	–	–	–	–	17,846.7	17,894.8
Oklahoma	–	–	1,237.4	1,237.8	–	–	–	–	1,237.4	1,237.8
Oregon	–	–	–	–	14.5	14.5	–	–	14.5	14.5
Pennsylvania Total	3,850.4	3,851.5	20,557.9	20,710.2	–	–	–	–	24,408.2	24,561.7
Anthracite	3,850.4	3,851.5	–	–	–	–	–	–	3,850.4	3,851.5
Bituminous	–	–	20,557.9	20,710.2	–	–	–	–	20,557.9	20,710.2
Tennessee	–	–	539.0	550.5	–	–	–	–	539.0	550.5
Utah	–	–	5,686.7	5,778.1	1.1	1.1	–	–	5,687.8	5,779.2
Virginia	125.5	125.5	1,504.6	1,621.0	–	–	–	–	1,630.0	1,746.5
Washington	–	–	303.7	303.7	1,028.6	1,028.6	–	–	1,332.3	1,332.3
West Virginia	–	–	31,419.5	31,818.9	–	–	–	–	31,419.5	31,818.9
Wyoming	–	–	3,862.0	3,871.7	38,663.1	38,663.1	–	–	42,525.1	42,534.8
							–	–		
Appalachian[a]	3,975.9	3,977.0	76,416.1	81,761.4	–	–	–	–	80,392.0	85,738.4
Interior Total[a]	88.6	88.6	103,770.0	92,723.9	–	–	–	–	103,858.6	92,812.5
Western Total[a]	27.8	27.8	22,885.2	21,537.0	121,388.8	118,812.5	–	–	144,301.8	140,377.3
							–	–		
East of the Mississippi River .	3,975.9	3,977.0	175,553.2	169,852.0	–	–	–	–	179,529.1	173,828.9
West of the Mississippi River .	116.4	116.4	27,518.1	26,170.4	121,388.8	118,812.5	–	–	149,023.3	145,099.3
							–	–		
U.S. Total	**4,092.3**	**4,093.4**	**203,071.2**	**196,022.3**	**121,388.8**	**118,812.5**	**–**	**–**	**328,552.3**	**318,928.2**

[a]For a definition of coal-producing regions, see Table 17.

Note: Totals based on available data. Totals may not equal sum of components because of independent rounding. Data are reported as of the first day of the year.

Sources: State geological and mineral resource surveys, and other geological reports.

Table 14. Demonstrated Reserve Base of Coal by State and Rank, Potentially Minable by Surface Methods, 1993, 1995
(Million Short Tons)

Coal Producing Region and State	Anthracite		Bituminous		Subbituminous		Lignite		Total	
	1995	1993	1995	1993	1995	1993	1995	1993	1995	1993
Alabama	–	–	2,190.1	2,212.7	–	–	1,083.0	1,083.0	3,273.1	3,295.7
Alaska	–	–	80.5	80.5	612.4	616.4	14.0	14.0	706.9	710.9
Arizona	–	–	87.3	118.8	–	–	–	–	87.3	118.8
Arkansas	15.5	15.6	103.6	103.6	–	–	25.4	25.4	144.5	144.6
Colorado	–	–	588.5	592.7	16.3	34.7	4,189.9	4,189.9	4,794.7	4,817.2
Georgia	–	–	1.7	1.7	–	–	–	–	1.7	1.7
Illinois	–	–	16,174.7	15,369.3	–	–	–	–	16,174.7	15,369.3
Indiana	–	–	1,118.1	1,186.0	–	–	–	–	1,118.1	1,186.0
Iowa	–	–	457.0	457.3	–	–	–	–	457.0	457.3
Kansas	–	–	975.6	976.4	–	–	–	–	975.6	976.4
Kentucky Total	–	–	13,679.8	5,287.2	–	–	–	–	13679.8	5287.2
Kentucky, Eastern	–	–	9,959.9	1,529	–	–	–	–	9,959.9	1,529.0
Kentucky, Western	–	–	3,720.0	3,758.2	–	–	–	–	3,720.0	3,758.2
Louisiana	–	–	–	–	–	–	471.3	479.6	471.3	479.6
Maryland	–	–	82.2	84.2	–	–	–	–	82.2	84.2
Michigan	–	–	4.6	4.6	–	–	–	–	4.6	4.6
Missouri	–	–	4,516.5	4,518.4	–	–	–	–	4,516.5	4,518.4
Montana	–	–	–	–	33,054.1	33,150.3	15,760.5	15,761.3	48,814.6	48,911.6
New Mexico	–	–	1,004.4	688.0	5,337.0	1,589.7	–	–	6,341.4	2,277.8
North Dakota	–	–	–	–	–	–	9,470.0	9,550.3	9,470.0	9,550.3
Ohio	–	–	5,907.3	5,950.6	–	–	–	–	5,907.3	5,950.6
Oklahoma	–	–	342.2	346.5	–	–	–	–	342.2	346.5
Oregon	–	–	–	–	2.9	2.9	–	–	2.9	2.9
Pennsylvania Total	3,374.9	3,378.8	1,084.7	1,130.8	–	–	–	–	4,459.6	4,509.6
Anthracite	3,374.9	3,378.8	–	–	–	–	–	–	3,374.9	3,378.8
Bituminous	–	–	1,084.7	1,130.8	–	–	–	–	1,084.7	1,130.8
South Dakota	–	–	–	–	–	–	366.1	366.1	366.1	366.1
Tennessee	–	–	288.2	291.0	–	–	–	–	288.2	291.0
Texas	–	–	–	–	–	–	13,064.9	13,197.6	13,064.9	13,197.6
Utah	–	–	267.9	267.9	–	–	–	–	267.9	267.9
Virginia	–	–	697.3	720.0	–	–	–	–	697.3	720.0
Washington	–	–	–	–	60.6	72.0	8.1	8.1	68.7	80.1
West Virginia	–	–	4,563.6	4,679.4	–	–	–	–	4,563.6	4,679.4
Wyoming	–	–	492.4	492.5	25,478.3	26,031.2	–	–	25,970.7	26,523.6
Appalachian Total[a]	3,374.9	3,378.8	24,775.0	16,599.4	–	–	1,083.0	1,083.0	29,232.8	21,061.2
Interior Total[a]	15.5	15.6	27,412.3	26,720.3	–	–	13,561.6	13,702.5	40,989.4	40,438.4
Western Total[a]	–	–	2,521.0	2,240.3	64,561.7	61,497.2	29,808.5	29,889.6	96,891.1	93,627.1
East of the Mississippi River	3,374.9	3,378.8	45,792.3	36,917.5	–	–	1,083.0	1,083.0	50,250.2	41,379.3
West of the Mississippi River	15.5	15.6	8,915.9	8,642.5	64,561.7	61,497.2	43,370.1	43,592.1	116,863.1	113,747.4
U.S. Total	**3,390.4**	**3,394.4**	**54,708.3**	**45,560.1**	**64,561.7**	**61,497.2**	**44,453.1**	**44,675.1**	**167,113.3**	**155,126.7**

[a]For a definition of coal-producing regions, see Table 17.

Note: Totals based on available data. Totals may not equal sum of components because of independent rounding. Data are reported as of the first day of the year.

Sources: State geological and mineral resource surveys, and other geological reports.

Table 15. EIA Sulfur Content Categories for Coal

Qualitative Rating	Pounds of Sulfur per Million Btu[a]	Approximate Correlation with Sulfur Criteria for Coal
Low Sulfur	≤ 0.40	Exceeds NSPS Requirements[b]
	0.41-0.60	Meets NSPS Requirements[b]
Medium Sulfur	0.61-0.83	Low-Sulfur Coal; Fails NSPS Requirements[c]
	0.84-1.67	Sulfur Content Approximately 1-2 Percent
High Sulfur	1.68-2.50	Sulfur Content Approximately 2-3 Percent
	> 2.50	Sulfur Content Approximately > 3 Percent

[a]As-received basis.
[b]NSPS = New Source Performance Standards of 1.2 pounds of emissions of sulfur dioxide per million Btu of coal burned.
[c]Coal in this category contains less than 1 percent sulfur by weight; although it does not meet emission requirements by itself, if blended with lower-sulfur coals, it may meet them.
Source: Energy Information Administration.

Table 16. Demonstrated Reserve Base of Coal in the United States by Sulfur Range and Coal-Producing Region
(Million Short Tons Remaining as of January 1, 1995)

	Summary Sulfur Content Categories[a] (Pounds of Sulfur per Million Btu)							
	Low Sulfur (≤ 0.60)		Medium Sulfur (0.61-1.67)		High Sulfur (≥ 1.68)		Total	
Coal-Producing Region	Million Short Tons	Percent of Total	Million Short Tons	Percent of Total	Million Short Tons	Percent of Total	Million Short Tons	Percent of Total
Surface								
Appalachia	9,406.2	15.6	11,505.2	19.5	8,321.4	17.2	29,232.8	17.4
Interior	205.1	0.3	9,343.4	15.8	31,440.9	65.2	40,989.4	24.5
West	50,414.5	83.9	38,083.3	64.6	8,393.3	17.4	96,891.1	57.9
U.S. Total	**60,025.8**	**100.0**	**58,931.9**	**100.0**	**48,155.6**	**100.0**	**167,113.3**	**100.0**
Underground								
Appalachia	16,972.8	15.3	26,518.6	32.2	36,900.6	27.2	80,391.9	24.4
Interior	1,531.2	1.3	7,708.2	9.3	94,619.2	69.7	103,858.6	31.6
West	92,261.9	83.2	47,968.2	58.3	4,071.7	3.0	144,301.8	43.9
U.S. Total	**110,765.8**	**100.0**	**82,195.0**	**100.0**	**135,591.5**	**100.0**	**328,552.3**	**100.0**
Total								
Appalachia	26,379.0	15.4	38,023.8	26.9	45,221.9	24.6	109,624.7	22.1
Interior	1,736.2	1.0	17,051.6	12.0	126,060.2	68.6	144,848.0	29.2
West	142,676.4	83.5	86,051.5	60.9	12,465.1	6.7	241,192.9	48.6
U.S. Total	**170,791.6**	**100.0**	**141,126.9**	**100.0**	**183,747.1**	**100.0**	**495,665.6**	**100.0**

[a]For detailed analyses, the EIA uses six sulfur content ranges. For general discussion and summary data, however, those six ranges are combined into the three qualitative ratings of coal presented here (low-, medium-, and high-sulfur content).
Notes: Coal supply regions that comprise each coal-producing region above are listed in Table 17. Data may not equal sum of components due to independent rounding.
Source: Energy Information Administration.

The DRB in the three coal-producing regions of the United States present different profiles (Table 16). In regard to overall quantities of coal, estimates for Appalachia are at 110 billion short tons, or 22 percent of the DRB. Coal resources in the region are almost entirely bituminous. Low-sulfur coal accounts for 24 percent of the region's DRB, medium-sulfur coal for nearly 35 percent, and high-sulfur coal for more than 41 percent. Low-sulfur coal in Appalachia is concentrated in eastern Kentucky, Virginia, southern West Virginia, and in the Pennsylvania anthracite field.

The Interior Region is estimated to contain 144.8 billion short tons, or 29 percent of the DRB of U.S. coal. All of the DRB coal in the region is bituminous, except for 14 billion short tons of lignite deposits, primarily in Texas, and 0.1 billion short tons of anthracite in Arkansas. More than 87 percent of the region's DRB is high-sulfur coal and less than 1 percent is low-sulfur coal.

In the Western Region, the DRB is estimated at 241.2 billion short tons, which is 49 percent of the U.S. total. Subbituminous coal is the norm in the West, where it constitutes 77 percent of the DRB, with the vast majority occurring in Montana and Wyoming. Lignite makes up more than 12 percent of the DRB in the West, primarily in the Fort Union-age geologic deposits of Montana and North Dakota and the relatively young, Tertiary-age Gulf Coast deposits of Texas. The remainder, nearly 11 percent of the Western DRB, is bituminous coal, found mostly in Colorado, Utah, and Wyoming, plus small areas of anthracite in several scattered locations. The EIA estimates that 59 percent of the DRB coal in the West is low-sulfur, that 36 percent is medium-sulfur, and that 5 percent is high-sulfur.

Accessible Resources

Although the 496 billion short tons of coal in the DRB is more than 480 times the Nation's coal production in 1995, almost half of the DRB is not expected to be recovered. First, more than 16 percent of the DRB is estimated as inaccessible for mining. Then, of the accessible portion of the DRB, EIA estimates that only 66 percent can actually be recovered by mining, with the other 34 percent likely to be lost in the mining process, based on recent mining experience. The result is that only a net 55 percent of the DRB is believed to be recoverable.

The EIA no longer publishes the accessible reserve base, that is, the allocated tonnages of the DRB that it estimates will be accessible for future mining. There has been no discernible demand for detailed allocation tables of the accessible reserve base, probably because it is an intermediate product. Most data analysts wish either to review the DRB itself and, perhaps, make particular assumptions and adjustments appropriate for their task, or to use EIA's estimated recoverable reserves directly for analyses of future coal supplies which may impose additional downstream assumptions. Also, accessibility adjustments are recognized in EIA as a useful intermediate procedure in which to make and document internal adjustments to the DRB that account for variations from standard DRB criteria due to local mining practice. (For example, in Chapter 2, the exclusion of 42-inch or thinner beds from underground mining in Illinois.)

The accessibility data of most interest are the net accessibility factors compiled or estimated for each coal supply region (Table 17). Note that the data reported, i.e., the accessibility factors, are the converse of the “inaccessible resource factors” listed in earlier versions of this report. Accessibility factors represent the fraction of the DRB—surface and underground—that is presently considered accessible for future development. Accessibility factors are usually determined by measuring or estimating the areas or tonnages of *inaccessible* coal resources in a study area, but accessibility factors are applicable directly to adjustments to the DRB and other coal resources and are closely comparable with U.S. Geological Survey (USGS) Coal Availability Study data. Recovery factors (Table 17) follow the same format.

Estimated Recoverable Reserves

The estimated recoverable reserves of coal in the United States (Table B2) represent the estimated portion of the DRB, allocated by Btu and sulfur ranges, that can be recovered by standard mining technologies, assuming a market and an adequate selling price at the time of mining. These reserves are summarized by low-, medium-, and high-sulfur levels in Table 18.

The 1995 estimated recoverable reserves are 9.2 billion short tons, or 3.4 percent, larger than the previous recoverable reserve estimates, for 1992.[35] At 37 percent, low-sulfur estimated recoverable reserves make up the largest part of the total. Medium- and high-sulfur reserves each make up about 31.5 percent. Based on current mining trends, however, (see Chapter 4) much of the 63

[35]Energy Information Administration, *U.S. Coal Reserves: An Update by Heat and Sulfur Content*, DOE / EIA-0529(92) (Washington, DC, February 1993) p. 24.

Table 17. Net Accessibility and Recovery Factors for Coal Resources, by Coal-Producing Region

Coal-Producing Region / State	Accessibility Factor		Recovery Factor	
	Surface	Underground	Surface	Underground
Appalachia				
Alabama	83	90	86	56
Georgia	85	90	80	50
Kentucky, Eastern	71	91	79	62
Maryland	85	90	80	61
North Carolina	85	90	80	50
Ohio	82	88	80	50
Pennsylvania, Anthracite	14	18	90	50
Pennsylvania, Bituminous	85	90	82	59
Tennessee	85	90	80	61
Virginia	80	90	80	62
West Virginia, Northern	75	90	79	59
West Virginia, Southern	82	90	79	59
Interior				
Arkansas	85	90	82	52
Illinois	77	67	76	50
Indiana	71	80	82	52
Iowa	85	90	82	52
Kansas	85	90	82	60
Kentucky, Western	75	80	83	53
Louisiana	90	90	82	60
Michigan	85	90	80	50
Missouri	85	90	82	52
Oklahoma	85	90	82	52
Texas	90	90	86	60
Western				
Alaska, Northern	50	50	00	00
Alaska, Southern	90	90	88	56
Arizona	90	90	88	56
Colorado	89	90	88	58
Idaho	86	90	80	50
Montana, Eastern	86	90	91	56
Montana, Western	90	90	91	56
New Mexico	90	90	88	56
North Dakota	85	90	90	50
Oregon	90	90	80	50
South Dakota	84	90	90	60
Utah	90	90	88	54
Washington	90	90	88	56
Wyoming	98	90	89	60

Sources: Energy Information Administration, *Estimation of U.S. Coal Reserves by Coal Type: Heat and Sulfur Content*, 1987 data (1989); also Coal Reserves Data Base Program, Office of Coal, Nuclear, Electric and Alternate Fuels (1996) and Form EIA-7A, "Coal Production Report" (1992).

Table 18. Estimated Recoverable Reserves of Coal in the United States by Sulfur Range and Major Region
(Remaining as of January 1, 1995)

Coal-Producing Region	Summary Sulfur Content Categories[a] (Pounds of Sulfur per Million Btu)							
	Low Sulfur (≤ 0.60)		Medium Sulfur (0.61-1.67)		High Sulfur (≥ 1.68)		Total	
	Million Short Tons	Percent of Total	Million Short Tons	Percent of Total	Million Short Tons	Percent of Total	Million Short Tons	Percent of Total
Surface								
Appalachia	4,399.5	9.5	6,880.6	15.3	5,238.0	16.3	16,518.1	13.4
Interior	131.0	0.2	7,081.7	15.8	20,048.5	62.6	27,261.2	22.1
West	41,647.3	0.1	30,766.8	68.7	6,731.4	21.0	79,145.5	64.3
U.S. Total	**46,177.9**	**100.0**	**44,729.1**	**100.0**	**32,017.9**	**100.0**	**122,924.9**	**100.0**
Underground								
Appalachia	7,561.4	13.7	13,809.2	33.2	18,260.3	33.5	39,630.9	26.2
Interior	527.3	0.9	2,900.0	6.9	34,064.3	62.6	37,491.6	24.8
West	46,889.9	85.2	24,884.4	59.8	2,091.2	3.8	73,865.5	48.9
U.S. Total	**54,978.6**	**100.0**	**41,593.6**	**100.0**	**54,415.8**	**100.0**	**150,988.0**	**100.0**
Total								
Appalachia	11,961.0	11.8	20,689.8	23.9	23,498.3	27.1	56,149.1	20.4
Interior	658.4	0.6	9,981.7	11.5	54,112.8	62.6	64,752.8	23.6
West	88,537.2	87.5	55,651.2	64.4	8,822.7	10.2	153,011.0	55.8
U.S. Total	**101,156.5**	**100.0**	**86,322.7**	**100.0**	**86,433.7**	**100.0**	**273,912.9**	**100.0**

[a]For detailed analyses, the EIA uses six sulfur content ranges. For general discussion and summary data, however, those six ranges are combined into the three qualitative ratings of coal presented here (low-, medium-, and high-sulfur content).

Notes: Coal supply regions that comprise each coal-producing region above are listed in Table 17. Data may not equal sum of components due to independent rounding.

Source: Energy Information Administration.

percent of recoverable coal reserves containing medium and high sulfur levels may not soon be mined because of unfavorable quality, prices, mining costs, location, and / or transportation infrastructure. These aspects are extremely important in meeting the environmental requirements of the Clean Air Act Amendments of 1990 and in addressing concerns over global warming and greenhouse gas emissions.

Although the summary data in Tables 16 and 18 are both derived from the DRB database, they do not follow precisely the same distribution. Certain characteristics of the mines and coal types in the three regions may be discerned in these summary tables. For example, the surface-minable DRB in Appalachia constitutes 17 percent of the DRB of the United States but only 13 percent of the estimated recoverable reserves, while in the West the surface-minable DRB is 58 percent of the national DRB but makes up a higher portion—64 percent—of the estimated U.S. recoverable reserves. The differences between DRB and recoverable reserve portions reflect accessibility and recovery rate differences.

In Appalachia, the surface accessibility factors average only 70 percent. They are lower than in the West because of more land use constraints and physical minability restrictions. The Appalachian accessibility is also skewed by the extremely low rate of accessibility in the Pennsylvania anthracite region (14 percent). With that region excluded, the surface accessibility factor would rise to 77 percent. Surface accessibility in eastern Kentucky at 71 percent is also well below the regional average. This low percentage reflects the fact that in eastern Kentucky (see Chapter 2) many of the thin coalbeds in the surface-minable DRB are mined only selectively.[36] The DRB for thin coalbeds in districts and thicknesses currently not

[36]As the results of more USGS Coal Availability Studies become available and, in general, as more up-to-date accessibility estimates are made, it is likely that additional instances of diminished accessibility to coal resources will be determined in Appalachia.

commercially minable in eastern Kentucky was considered to be presently inaccessible.

Finally, the rates of recovery are lower in Appalachia owing to the need to mine in thinner beds and (to varying degrees) in more difficult topography, in more indurated overburdens, and with more frequent groundwater and surface water concerns than in the major Western coal supply areas. Appalachian recovery rates average about 81 percent for the coal resources considered accessible.

In the West the accessibility factors average 91 percent. They are relatively high primarily because of fewer land use constraints and fewer known physical minability restrictions than in the East. The Geological Survey of Wyoming has estimated that 98 percent of the DRB in that State may be accessible. Only in northern Alaska has EIA estimated a low rate of accessibility (50 percent), because of the difficulties of mining in tundra and permafrost and the lack of recent experience mining under those conditions in the United States.

The rates of surface recovery are also high in the West, averaging 90 percent for accessible coal resources. Many of the most productive mines recover thick coalbeds (40 to 100 feet are not uncommon) with relatively thin overburden developed in soft types of rock or unconsolidated sediments. Even in harder rock, where more blasting is required, the overburden ratios tend to be low and the mechanical loading of the thicker coalbeds efficient. Net recovery rates in Western coals may also tend to be higher because the coal in some areas, such as New Mexico and Washington, contain thin partings of shale that cannot be avoided by mining equipment. These rock contaminants are mined through, raising the tonnage mined and the rate of recovery, and the coal is generally not washed. Consequently, some coals are accepted for combustion with 20 percent or more ash-forming material and lower heat value than if they were cleaned. The reported rates of recovery, with no losses of product due to coal cleaning, are therefore very high.

Another case in which differences in the DRB / reserves profiles indicate differences in coal types, markets, and mining patterns is the comparison of underground DRB and estimated recoverable reserves in Appalachia and the Interior (Tables 16 and 18). Appalachian underground coal makes up 24 percent of the DRB but accounts for 26 percent of the estimated U.S. recoverable reserves. Accessibility is not as restricted for underground mining in Appalachia and has fewer restrictions than the surface mines of the region. Again, the exception to the rule is Pennsylvania anthracite, where access for deep mining is severely restricted now and for the foreseeable future as a result of catastrophic flooding that occurred years ago, drowning many of the mines and impairing adjacent resources. In general, however, net recovery of Appalachian deep coal deposits is good, primarily because much of the coal being mined is relatively high-quality, high-Btu fuel. This coal fetches prices that can support more costly mining technologies, including longwalls (67 percent of U.S. longwall production is in Appalachia[37]).

By contrast, 32 percent of the national DRB for underground mining is found in the Interior Region, but the estimated recoverable reserves constitute only 25 percent. The coalbeds in the Interior include a high percentage of thick beds, yet their net recovery is relatively low (51 percent versus 58 percent in Appalachia[38]). This lower recovery correlates with a region of high average sulfur contents, flat markets, and relatively low prices ($24.31 for Interior bituminous versus $28.01 for Appalachian bituminous, mined underground, average price per ton for calendar year 1994[39]).

[37]Energy Information Administration, *Coal Industry Annual 1994*, DOE / EIA-0584(94) (Washington, D.C. October 1995), p. 12.
[38]Ibid. p. 40.
[39]Ibid. p. 152.

4. Recoverable Coal Reserves at Active Mines

Overview

Active coal mines and their associated reserves[40] represent real financial commitments of U.S. coal producers. Substantial investments in capital equipment and other mine development activities have been committed to produce coal from specific blocks of reserves. Although changing market conditions or unforeseen geological conditions may result in premature closing of a coal mine, existing mines are a good gauge of where production will originate from in coming years.

As of December 31, 1994, U.S. coal producers reported 21.0 billion short tons of recoverable coal reserves at active mines (Table 19 and Figure 6).[41] By mining method, 6.0 billion short tons were at underground coal mines, and 15.0 billion short tons were at surface mines. By rank, the distribution of recoverable reserves was: bituminous, 8.3 billion short tons; subbituminous, 9.8 billion short tons; and lignite, 2.7 billion short tons.[42] Virtually all of the subbituminous and lignite reserves were associated with surface mines. By contrast, 72 percent of the bituminous reserves were at underground mines.

In this chapter, recoverable reserves at existing active mines are linked to mid-term projections of coal supply and demand from EIA's National Energy Modeling System's (NEMS) Coal Market Module (CMM) to estimate where additional investments by the coal mining industry may be needed. In essence, existing coal mines represent committed investments on the supply side, and the NEMS CMM forecasts provide a link between these investments and projected market conditions in future years. The analysis makes use of the reference case projections published in EIA's *Annual Energy Outlook 1996 (AEO96)*, which provides an integrated forecast of U.S. energy demand, supply, distribution, and prices for all market-based sources of energy through 2015.

Estimation of U.S. Coal Production and Recoverable Reserves at Active Mines by Heat and Sulfur Content

Coal quality information for recoverable coal reserves at active mines is not collected on any EIA energy surveys. For purposes of this analysis, recoverable reserves at active mines for 1994, aggregated by supply region and mining method, are allocated to sulfur content categories using the distribution estimated for U.S. coal production in 1994. Three sulfur content categories are represented: (1) low-sulfur (≤ 0.6 pounds of sulfur per million Btu (MMBtu)); (2) medium-sulfur (>0.6 – ≤1.67 pounds of sulfur per MMBtu); and (3) high-sulfur (>1.67 pounds of sulfur per MMBtu).

Estimates of U.S. coal production by heat and sulfur content are a required input to the CMM. The CMM projects U.S. coal production for 16 supply regions, by 16 coal types (combinations of four heat and four sulfur content categories) and two mining methods (underground and surface).[43] Data collected on Form EIA-7A, *Coal Production Report*, provides information on U.S. coal production by region, mining method, and coal rank.

[40]In this section, active mines represent mines that produced coal in 1994, and coal reserves represent the quantity of coal that can be recovered (i.e., mined) from the total *in-situ* quantity of coal located at these mines in 1994, as reported at year's end by U.S. coal producers on Energy Information Administration Form EIA-7A, "Coal Production Report." For the years 1995 through 2015, coal reserves, as used in this analysis, represent the quantity of reserves at active mines in 1994 less the amount of cumulative production as projected in the reference case forecast published in the *Annual Energy Outlook 1996*. For example:

Coal reserves for 1996 (year end)

= coal reserves at active mines in 1994 (year end) – projected production for 1995 – projected production for 1996

[41]For 1994, reserves were reported by or estimated for 1,331 mines, representing 70 percent of the mines whose production was 10,000 or more short tons. In turn, these mines produced 973.6 million short tons, or 94 percent of total U.S. coal production

[42]The 8.3 billion short tons of bituminous coal reserves include a small amount of anthracite. The data for reserves by coal rank exclude data for Arkansas, Kansas, Iowa, and Louisiana, which were withheld to avoid disclosure of individual company data. At the end of 1994, recoverable reserves at active mines in these States totaled 163.3 million short tons.

[43]The four CMM heat content categories include: two for bituminous coal; one for subbituminous coal; and one for lignite. The four CMM sulfur content categories include: one for low-sulfur, two for medium-sulfur, and one for high-sulfur.

Table 19. Estimates of Recoverable Reserves at Active Mines in 1994 by Sulfur Range, Coal-Producing Region, and Type of Mining
(Million Short Tons, as of December 31, 1994)

Coal-Producing Region	Summary Sulfur Content Categories[a] (Pounds of Sulfur per Million Btu)							
	Low Sulfur (≤ 0.60)		Medium Sulfur (0.61-1.67)		High Sulfur (≥ 1.68)		Total	
	Million Short Tons	Percent of Total	Million Short Tons	Percent of Total	Million Short Tons	Percent of Total	Million Short Tons	Percent of Total
Surface								
Appalachia . .	252.4	3.0	599.9	11.5	274.1	23.8	1,126.4	7.6
Interior	7.8	0.1	711.8	13.7	787.5	68.4	1,507.2	10.1
West	8,245.0	96.9	3,887.4	74.8	89.5	7.8	12,221.8	82.3
U.S. Total . . .	**8,505.1**	**100.0**	**5,199.1**	**100.0**	**1,151.1**	**100.0**	**14,855.3**	**100.0**
Underground								
Appalachia . .	1,304.0	60.1	1,668.2	77.7	756.5	45.0	3,728.7	62.2
Interior	56.0	2.6	417.2	19.4	925.1	55.0	1,398.3	23.3
West	810.2	37.3	60.7	2.8	0.0	0.0	870.9	14.5
U.S. Total . . .	**2,170.3**	**100.0**	**2,146.1**	**100.0**	**1,681.5**	**100.0**	**5,997.9**	**100.0**
Total								
Appalachia . .	1,556.4	14.6	2,268.1	30.9	1,030.5	36.4	4,855.0	23.3
Interior	63.8	0.6	1,129.0	15.4	1,712.6	60.5	2,905.4	13.9
West	9,055.2	84.8	3,948.1	53.8	89.5	3.2	13,092.7	62.8
U.S. Total . . .	**10,675.4**	**100.0**	**7,345.2**	**100.0**	**2,832.6**	**100.0**	**20,853.2**	**100.0**

[a]For detailed analyses, the EIA uses six sulfur content ranges. For general discussion and summary data, however, those six ranges are combined into the three qualitative ratings of coal presented here (low-, medium-, and high-sulfur content).

Notes: Coal supply regions that comprise each coal-producing region above are listed in Table 17. Totals exclude data for Arkansas, Kansas, Iowa, and Louisiana, which were withheld to avoid disclosure of individual company data. At the end of 1994, reserves at active mines in these States totaled 163.3 million short tons. Data may not equal sum of components due to independent rounding.

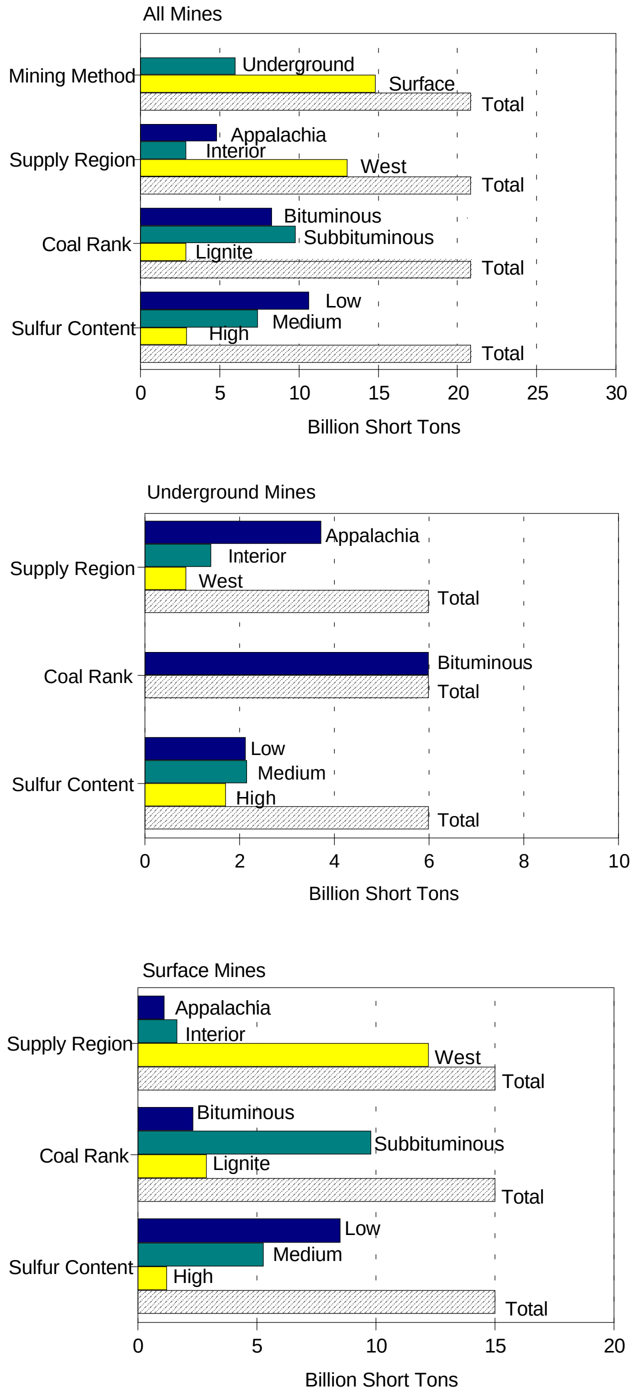
Source: Energy Information Administration.

Comprehensive data on coal quality, however, are not available. Estimates of U.S. coal production by heat and sulfur content are developed using quality data collected for coal distributed to electric utilities, independent power producers, industrial consumers, and coke plants.[44] Coal quality data are not available for coal exports or for coal consumed in the residential/commercial sector.

By applying this distribution of U.S. coal production to recoverable reserves at active mines (year-end 1994), an estimate of reserves by sulfur content is obtained. For underground mines, the estimated distribution of recoverable reserves at active mines by sulfur content is as follows: low-sulfur, 2.2 billion short tons; medium-sulfur, 2.1 billion short tons; and high-sulfur, 1.7 billion short

[44]Coal quality data are derived using information from the following energy surveys: 1) Federal Energy Regulatory Commission Form-423, “Monthly Report of Cost and Quality of Fuels for Electric Plants”; 2) Form EIA-867, “Annual Nonutility Power Producer Report”; 3) Form EIA-3A, “Annual Coal Quality Report—Manufacturing Plants”; 4) Form EIA-5A, “Annual Coal Quality Report—Coke Plants”; and 5) Form EIA-6, “Coal Distribution Report.” For receipts of coal at coke plants, EIA collects quality data on volatile matter, sulfur content, and ash content, but not on heat content. Heat content of coking coal is assumed to be 26.8 million Btu per short ton.

Figure 6. Recoverable Coal Reserves at Active Mines, 1994



Source: Energy Information Administration, Form EIA-7A, "Coal Production Report," and Table B3.

tons. For surface mines, the estimated distribution of recoverable reserves by sulfur content is: low-sulfur, 8.5 billion short tons; medium-sulfur, 5.2 billion short tons; and high-sulfur, 1.2 billion short tons. Surface mines in eastern Wyoming were estimated to have 6.3 billion short tons of low-sulfur recoverable coal reserves in 1994, representing 74 percent of total low-sulfur recoverable reserves at active surface mines. In Appendix B, an estimation of recoverable reserves at active mines is provided by region, type of mining, coal rank, and sulfur content (Table B3).

Analysis Description and Structure

This analysis assumes that no new mines will be opened until recoverable reserves at active mines (i.e., those active in 1994) are completely exhausted. Recoverable reserves at active mines are assumed to be depleted based on projected levels of production from the *AEO96* reference case forecast. In reality, new mines are opened every year, supplementing production from existing mines.[45] Therefore, it is inappropriate to conclude that recoverable reserves at active mines for a particular region, mining method, and coal type will be exhausted in a specific year. Rather, the reserves currently reported at active mines and the years of production they can support are used to provide some indication of where and how much new mine capacity may be needed to meet the projected levels of demand.

The projected quantities of remaining recoverable reserves at active mines are presented as a time series by region, mining method, and sulfur content. To avoid the disclosure of individual company data, it was necessary to combine some of the 16 regions represented in the NEMS CMM. As a result, 11 regions are represented in the analysis (Table 20). The projections are reported by sulfur content to capture the relative impact of the more stringent restrictions on sulfur dioxide emissions legislated by the Clean Air Act Amendments of 1990 (CAAA90). Also presented are the associated levels of average annual production between 1995 and 2015.

Implications for New Mine Capacity

Summary of the AEO96 Reference Case

The *AEO96* reference case forecast is the basis for which recoverable reserves at active mines are evaluated. In the

[45]This report is limited to an analysis of recoverable reserves at active mines, not extending to the reserves which will be brought on by new mines in the future. Data needed to evaluate reserves at future mines are neither readily available nor comprehensive. These data include factors such as the age profile of existing coal mines, expectations of future coal prices and production costs, and the average reserve block size for new mines.

Table 20. Coal Supply Regions[a]

Region	Number	Included Sub-Regions
Appalachia		
Northern Appalachia	1	Pennsylvania, Ohio, Maryland
	2	West Virginia (north)
Central Appalachia	3	West Virginia (south)
	4	Kentucky (east)
	5	Virginia, Tennessee
Southern Appalachia	6	Alabama
Interior		
Illinois Basin and West Interior	7	Illinois, Indiana, Kentucky (west), Arkansas, Iowa, Kansas, Missouri, Oklahoma
Gulf Lignite	8	Texas, Louisiana
West		
Powder River Basin North and Fort Union Lignite	9	Montana, North Dakota, South Dakota
Powder River Basin South	10	Wyoming (east)
Other West	11	Wyoming (west), Arizona, New Mexico, Colorado, Utah, Washington, Alaska

[a]Adjusted supply regions, aggregated for this analysis to avoid disclosure of company-confidential reserve data.
Source: Energy Information Administration.

AEO96 reference case, U.S. coal production is projected to increase from 1,034 million short tons in 1994 to 1,240 million short tons in 2015, an increase of 206 million short tons. Most of this growth is attributable to increasing electricity coal consumption. By major supply region, annual coal production is projected to rise by 103 million short tons in Appalachia and by 142 million short tons in the West. In addition to growth in coal consumption for electricity generation, Appalachian production also benefits from a projected increase in U.S. coal exports over the forecast period, as most exports should continue to originate from mines in this region. Coal production in the Interior, a predominately high-sulfur coal region, is projected to decline by 38 million short tons.

Due to the stricter sulfur dioxide emission controls of the CAAA90, low-sulfur coal displaces high-sulfur coal throughout the forecast. Medium-sulfur coal production declines through 2000, and then recovers as compliance strategies shift from fuel switching to flue gas desulfurization in Phase 2 of CAAA90. Between 1994 and 2015, low-sulfur coal production is projected to increase by 206 million short tons and medium-sulfur coal by 33 million short tons. High-sulfur coal production declines by 33 million short tons.

Recoverable Coal Reserves at Active Underground Mines

The *AEO96* reference case forecast for low-sulfur coal indicates that substantial investments in new underground mine capacity will be needed in central Appalachia (Regions 3, 4, and 5 of Table 21), because recoverable reserves at existing mines are sufficient to meet the projected levels of coal production for only the next 5 to 10 years. Southern West Virginia (Region 3) is estimated to require the most investment, as low-sulfur coal production from underground mines in this region is expected to average more than 100 million short tons per year over the forecast period. In the Other West region (Region 11), underground mines have an estimated 810 million short tons of recoverable low-sulfur coal reserves; however, projections of increased demand for this region's low-sulfur coal indicate the need for new mine capacity toward the end of the forecast.

For medium-sulfur coal, substantial investments in new underground mine capacity are indicated for Alabama (Region 6), southern West Virginia, and the Other West region (Region 11). Alabama is estimated to require the most investment, as medium-sulfur coal production from underground mines in this region is expected to average 35 million short tons per year over the forecast.

For high-sulfur coal, the only area where substantial investments are indicated is the Pennsylvania/Ohio supply region (Region 1), where recoverable reserves of high-sulfur coal at underground mines are sufficient to meet the projected levels of coal production for only about 10 years. In this region, high-sulfur coal production from underground mines is projected to average more than 30 million short tons per year.

Table 21. Remaining Recoverable Coal Reserves at Active Underground Mines, 1994-2015
(Million Short Tons at End of Year)

	Region	1994	1995	2000	2005	2010	2015	Average Annual Production 1995-2015
	Low-Sulfur Recoverable Coal Reserves at Active Underground Mines, 1994-2015							
1	PA, OH, MD[a]	128	122	89	53	21	0	6
2	WV (north)	58	56	41	16	0	0	5
3	WV (south)	447	400	0	0	0	0	104
4	KY (east)	192	168	45	0	0	0	22
5	VA, TN[b]	192	177	93	4	0	0	15
6	AL	286	282	255	218	185	156	6
7	KY (west), IN, IL, AR, IA, KS, MO, OK[c]	56	56	53	53	53	53	0
11	WY (west), AZ, NM, CO, UT, WA, AK	810	765	538	296	2	0	54
	U.S. Total	**2,170**	**2,026**	**1,113**	**641**	**261**	**209**	**213**
	Medium-Sulfur Recoverable Coal Reserves at Active Underground Mines, 1994-2015							
1	PA, OH, MD[a]	547	520	386	233	82	0	32
2	WV (north)	290	273	190	99	0	0	19
3	WV (south)	119	105	23	0	0	0	20
4	KY (east)	440	396	276	247	219	173	13
5	VA, TN[b]	143	132	75	28	26	19	6
6	AL	129	110	0	0	0	0	35
7	KY (west), IN, IL, AR, IA, KS, MO, OK[c]	417	393	285	176	80	0	20
11	WY (west), AZ, NM, CO, UT, WA, AK	61	41	0	0	0	0	23
	U.S. Total	**2,146**	**1,971**	**1,235**	**783**	**407**	**192**	**167**
	High-Sulfur Recoverable Coal Reserves at Active Underground Mines, 1994-2015							
1	PA, OH, MD[a]	353	334	202	39	0	0	32
2	WV (north)	397	378	280	189	103	20	18
3	WV (south)	[d]0	0	0	0	0	0	1
4	KY (east)	3	2	0	0	0	0	2
5	VA, TN[b]	2	2	1	0	0	0	0
6	AL	1	1	0	0	0	0	2
7	KY (west), IN, IL, AR, IA, KS, MO, OK[c]	925	875	643	452	281	132	38
	U.S. Total	**1,682**	**1,592**	**1,127**	**681**	**385**	**153**	**93**

[a]PA, OH, MD excludes reserves data for Maryland.
[b]VA, TN includes reserves data for Maryland to avoid disclosure of individual company data.
[c]Data for Arkansas, Iowa, and Kansas were withheld to avoid disclosure of individual company data.
[d]Less than 500,000 short tons.

Note: Remaining recoverable coal reserves represent the amount of recoverable reserves estimated at active mines in 1994, less the amount of cumulative production projected in the reference case forecast of the *Annual Energy Outlook 1996.*

Source: **Coal Reserves**: Energy Information Administration, Form EIA-7A, "Coal Production Report"; Form EIA-3A, "Annual Coal Quality Report–Manufacturing Plants"; Form EIA-5A, "Annual Coal Quality Report–Coke Plants"; Form EIA-6, "Coal Distribution Report"; Form EIA-867, "Annual Nonutility Power Producer Report"; and Federal Energy Regulatory Commission, Form-423, "Monthly Report of Cost and Quality of Fuels for Electric Plants." **Production Forecast**: Energy Information Administration, *Annual Energy Outlook 1996*, reference case forecast, National Energy Modeling System run AEO96B.D101995C.

As discussed above, continued growth in coal consumption for electricity generation and the response of electric utilities to CAAA90 are the two key determinants of future coal usage in the *AEO96* reference case forecast. In recent years, demand for high-sulfur coal has declined substantially as the result of actions taken by utilities to meet the requirements of CAAA90. The share of total receipts of coal at electric utilities in the high-sulfur category has declined from 26 percent in 1992 to 19 percent in 1995.[46] During this same period, low-sulfur's share of total receipts has increased from 37 percent to 47 percent. Over the forecast period, some further decline in the use of high-sulfur coal in the electricity sector is projected. More importantly, however, is the substantial growth in low-sulfur coal usage that is expected to occur. By 2015, high-sulfur coal is projected to account for only 14 percent of total electricity coal consumption, compared with 61 percent for low-sulfur coal.[47]

Recoverable Coal Reserves at Active Surface Mines

The *AEO96* reference case forecast for low-sulfur coal indicates that substantial investments in new surface mine capacity will likely be needed in Montana / North Dakota (Region 9) (Table 22). Although existing surface mines in this region currently have nearly 700 million short tons of low-sulfur recoverable reserves, this amount would satisfy the projected levels of production for only a little more than 10 years. In Appalachia, some investments in new mine capacity are indicated for eastern Kentucky and Virginia / Tennessee (Regions 4 and 5). Estimated recoverable reserves at active surface mines in these regions, however, are small, reflecting the relatively small minable reserve blocks associated with surface mines in Appalachia.

Of the predominately low-sulfur regions, eastern Wyoming, with 6.3 billion short tons of low-sulfur coal reserves at its existing surface mines, is best positioned to meet increasing demand for low-sulfur coal. For example, these amounts of low-sulfur reserves are larger than the 5.6 billion short tons of cumulative low-sulfur coal production projected between 1995 and 2015 from eastern Wyoming's surface mines. However, substantial growth in production projected for this region implies that some new mines with additional reserves will be needed.

For medium-sulfur coal, substantial investments in new surface mine capacity are indicated for eastern Kentucky, while somewhat smaller investments are indicated for Virginia / Tennessee and Alabama. Like reserves of low-sulfur coal, recoverable reserves of medium-sulfur coal at active surface mines in these regions are also small. For high-sulfur coal, recoverable reserves at active surface mines are sufficient to meet projected demand in all supply regions over most of the forecast period.

Initial Capital and Mine Development Costs

Initial capital and mine development costs represent a significant portion of total coal mining costs. Some of the capital and mine development costs of opening a new mine include the costs of production equipment, costs associated with the construction of shafts and slopes for seam access and mine ventilation, costs of preparation and loading facilities, and costs associated with the construction of haul roads or rail transport.

Although future requirements of new mine capacity have been described in light of the *AEO96* reference case forecast and the current stock of recoverable reserves at active mines, it is not feasible to provide firm estimates of the capital and mine development investment funds required to bring this new capacity on-line. However, a paper presented at a recent coal conference provides a range of cost estimates for selected complements of production equipment (Table 23). Costs are shown to vary substantially for different types of mines, ranging from a low of approximately $2 million for an average-sized continuous miner operation with shuttle cars or continuous haulage equipment, to a high of $54 million for a surface mine dragline operation with an annual run of mine (ROM) production capacity of 8 million short tons.

In a report prepared for EIA in 1991, initial capital costs for a typical eastern longwall operation (shaft / slope mine) were estimated at $56 million (in 1996 dollars) and capital costs for a typical western longwall (drift mine) were estimated at $37 million.[48] The ROM production

[46]Energy Information Administration, *Quarterly Coal Report, October-December 1992*, DOE / EIA-0121(92 / 4Q) (Washington, DC, May 1993), Table 35 and *Quarterly Coal Report, October-December 1995*, DOE / EIA-0121(95 / 4Q) (Washington, DC, May 1996), Table 35.

[47]Energy Information Administration, *Annual Energy Outlook 1996*, reference case forecast, National Energy Modeling System run AEO96B.D101995C.

[48]Science Applications International Corporation, “Development of Resource Allocation and Mine Costing Model Longwall Model Mines,” Unpublished final report prepared for the Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels (Norristown, PA, March 1991), pp. 6, 144-147, and 176-178.

Table 22. Remaining Recoverable Coal Reserves at Active Surface Mines, 1994-2015
(Million Short Tons at End of Year)

	Region	1994	1995	2000	2005	2010	2015	Average Annual Production 1995-2015
	Low-Sulfur Recoverable Coal Reserves at Active Surface Mines, 1994-2015							
1	PA, OH, MD[a]	12	12	9	1	0	0	1
2	WV (north)	17	15	1	0	0	0	3
3	WV (south)	179	161	89	65	18	0	13
4	KY (east)	33	19	0	0	0	0	18
5	VA, TN[b]	5	1	0	0	0	0	4
6	AL	7	7	6	6	6	6	0
7	KY (west), IN, IL, AR, IA, KS, MO, OK[c]	8	5	1	0	0	0	2
9	MT, ND[e]	663	620	364	76	0	0	57
10	WY (east)	6,327	6,108	4,931	3,535	2,105	675	269
11	WY (west), AZ, NM, CO, UT, WA, AK	1,255	1,223	1,061	900	744	598	31
	U.S. Total	**8,505**	**8,170**	**6,462**	**4,583**	**2,873**	**1,278**	**399**
	Medium-Sulfur Recoverable Coal Reserves at Active Surface Mines, 1994-2015							
1	PA, OH, MD[a]	127	124	108	67	26	0	8
2	WV (north)	60	55	28	0	0	0	6
3	WV (south)	221	197	158	98	31	0	12
4	KY (east)	137	82	0	0	0	0	35
5	VA, TN[b]	25	14	0	0	0	0	14
6	AL	30	19	0	0	0	0	8
7	KY (west), IN, IL, AR, IA, KS, MO, OK[c]	54	46	19	0	0	0	6
8	TX, LA[d]	658	623	450	261	14	0	43
9	MT, ND[e]	2,224	2,183	1,981	1,784	1,595	1,397	39
10	WY (east)	205	199	157	112	64	0	10
11	WY (west), AZ, NM, CO, UT, WA, AK	1,458	1,441	1,354	1,258	1,175	1,089	18
	U.S. Total	**5,199**	**4,983**	**4,255**	**3,580**	**2,904**	**2,487**	**198**
	High-Sulfur Recoverable Coal Reserves at Active Surface Mines, 1994-2015							
1	PA, OH, MD[a]	226	202	136	135	57	0	12
2	WV (north)	39	38	34	30	26	22	1
3	WV (south)	1	1	0	0	0	0	1
4	KY (east)	4	3	0	0	0	0	5
5	VA, TN[b]	[f]0	0	0	0	0	0	1
6	AL	4	3	0	0	0	0	1
7	KY (west), IN, IL, AR, IA, KS, MO, OK[c]	419	391	267	174	82	0	20
8	TX, LA[d]	368	350	259	168	72	0	19
9	MT, ND[e]	89	88	80	80	73	65	1
	U.S. Total	**1,151**	**1,076**	**776**	**587**	**310**	**87**	**60**

[a]PA, OH, MD excludes reserves data for Maryland.
[b]VA, TN includes reserves data for Maryland to avoid disclosure of individual company data.
[c]Data for Arkansas, Iowa, and Kansas were withheld to avoid disclosure of individual company data.
[d]Data for Louisiana were withheld to avoid disclosure of individual company data.
[e]South Dakota is in this region but has no active mines, hence no reserves at active mines.
[e]Less than 500,000 short tons.

Note: Remaining recoverable coal reserves represent the amount of recoverable reserves estimated at active mines in 1994 less the amount of cumulative production projected in the reference case forecast of the *Annual Energy Outlook 1996*.

Source: **Coal Reserves**: Energy Information Administration, Form EIA-7A, "Coal Production Report"; Form EIA-3A, "Annual Coal Quality Report–Manufacturing Plants"; Form EIA-5A, "Annual Coal Quality Report–Coke Plants"; Form EIA-6, "Coal Distribution Report"; Form EIA-867, "Annual Nonutility Power Producer Report"; and Federal Energy Regulatory Commission, Form-423, "Monthly Report of Cost and Quality of Fuels for Electric Plants." **Production Forecast**: Energy Information Administration, *Annual Energy Outlook 1996*, reference case forecast, National Energy Modeling System run AEO96B.D101995C.

Table 23. Range of Capital Costs for Selected Complements of Production Equipment

Mining Method	Capital Costs (million 1996 dollars) Low	Capital Costs (million 1996 dollars) High	Annual Production Capacity (thousand short tons) Low	Annual Production Capacity (thousand short tons) High
Underground				
Basic Continuous Miner With Shuttle Cars	1.9	2.3	400	700
Basic Continuous Miner With Continuous Haulage	1.9	2.3	600	1,000
Longwall With 3 Continuous Miner Support Units	23.7	30.9	3,000	6,000
Surface				
Basic Large Loader/Dozer/Trucks	8.2	13.1	500	800
Basic Shovel Operation	8.7	14.1	500	1,000
Dragline Operation	22.4	54.0	2,000	8,000
Add – Highwall Miner	2.5	4.0	500	800

Source: Alan K. Stagg, Stagg Engineering Services, Inc., "U.S. Coal Production for the Next Decade: Where Will It Come From and What Will It Cost?," unpublished paper presented at the 14th Annual World Coal Conference, New Orleans, LA, February 14-16, 1996.

capacity for these mines were 3.0 million short tons for the eastern mine and 2.6 million short tons for the western mine. These cost estimates are not directly comparable to those provided in Table 23, because they include costs associated with additional equipment and structures. The longwall cost estimates provided for EIA include all of the underground and surface equipment used to support the production and development units, as well as all surface facilities exclusive of the preparation plant.

Historical Perspective

Between 1980 and 1994, recoverable reserves at active mines declined from 26.6 billion short tons to 21.0 billion short tons, a decrease of 5.6 billion short tons (Figure 7). Despite this substantial decline, cumulative coal production (1980 through 1994) amounted to 13.8 billion short tons, indicating the fact that new mines, with additional reserves, were opened during this period. By region and type of mining, two trends are noteworthy. In Appalachia, recoverable reserves at active mines declined steadily, decreasing by 5.3 billion short tons between 1980 and 1994. In the West, however, recoverable reserves at active surface mines grew substantially between 1980 and 1985, increasing by 2.3 billion short tons, but have changed by little thereafter.

In Appalachia, the substantial decline in recoverable reserves at underground mines would appear to indicate that there was little investment in new mining operations. To the contrary, an analysis completed by EIA in 1991 found that many new mines actually were opened during the 1980s.[49] By 1989, production from more than 800 new underground mines that opened during the 1980s in Appalachia amounted to 124 million short tons. Recoverable reserves associated with these new mines were estimated at 0.9 billion short tons, reflecting a relatively short remaining mine life of only 7 years.[50] By contrast, reserves at underground mines in Appalachia in 1980 corresponded to a much longer mine life of 39 years, indicating that mine operators in this region secured much larger blocks of reserves in the past.

A number of factors affected the Appalachian coal industry during the 1980s, resulting in many premature mine closings. Thus, recoverable reserves at active mines declined by much more than would be indicated by the quantities of cumulative production and additions to reserves from the opening of new mines.[51] Factors affecting the Appalachian coal industry included:

1. Excess production capacity that resulted from the opening of many new mines during the late 1970s,

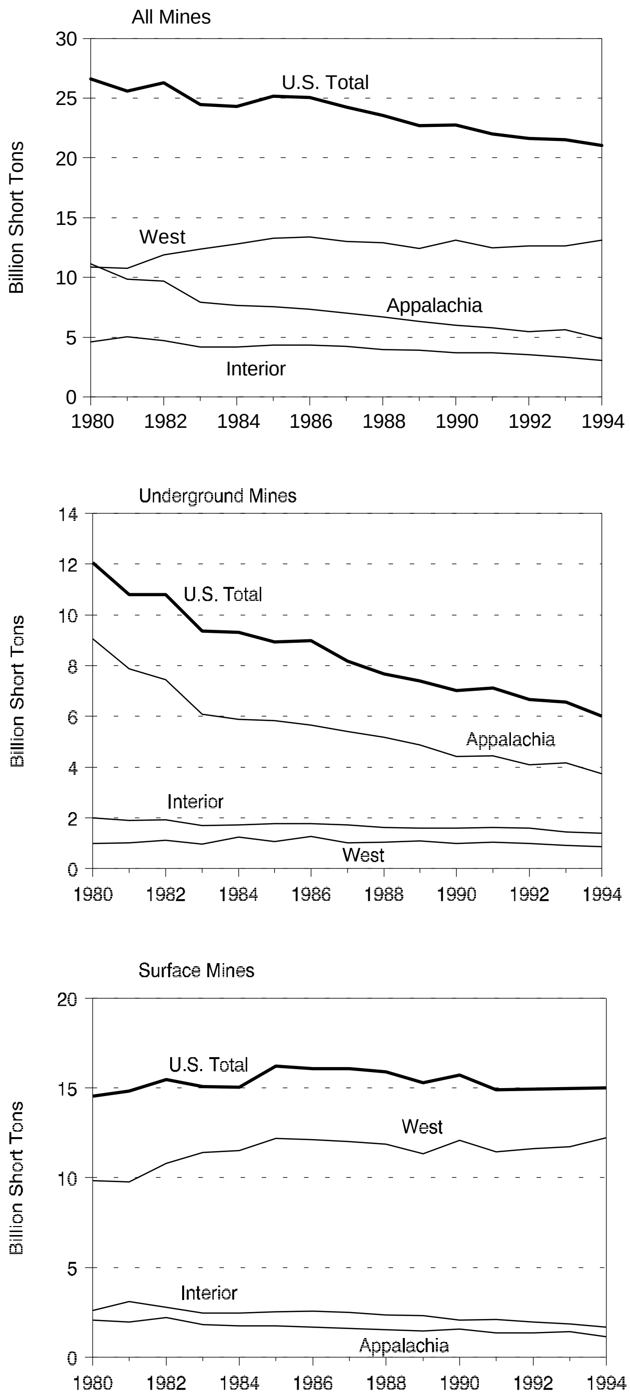
[49] Energy Information Administration, *Coal Production 1990*, "A Profile of New Coal Mines in the 1980's," DOE/EIA-0118(90) (Washington, DC, September 1991), pp. 1-12. Data for mines that did not produce at least 50,000 short tons or more of coal in any single year were excluded. The share of total U.S. coal production accounted for by excluded mines ranged from a high of 4.7 percent in 1981 to a low of 1.8 percent in 1989.

[50] Mine life was estimated by dividing recoverable reserves at active mines in 1989 by annual production in 1989.

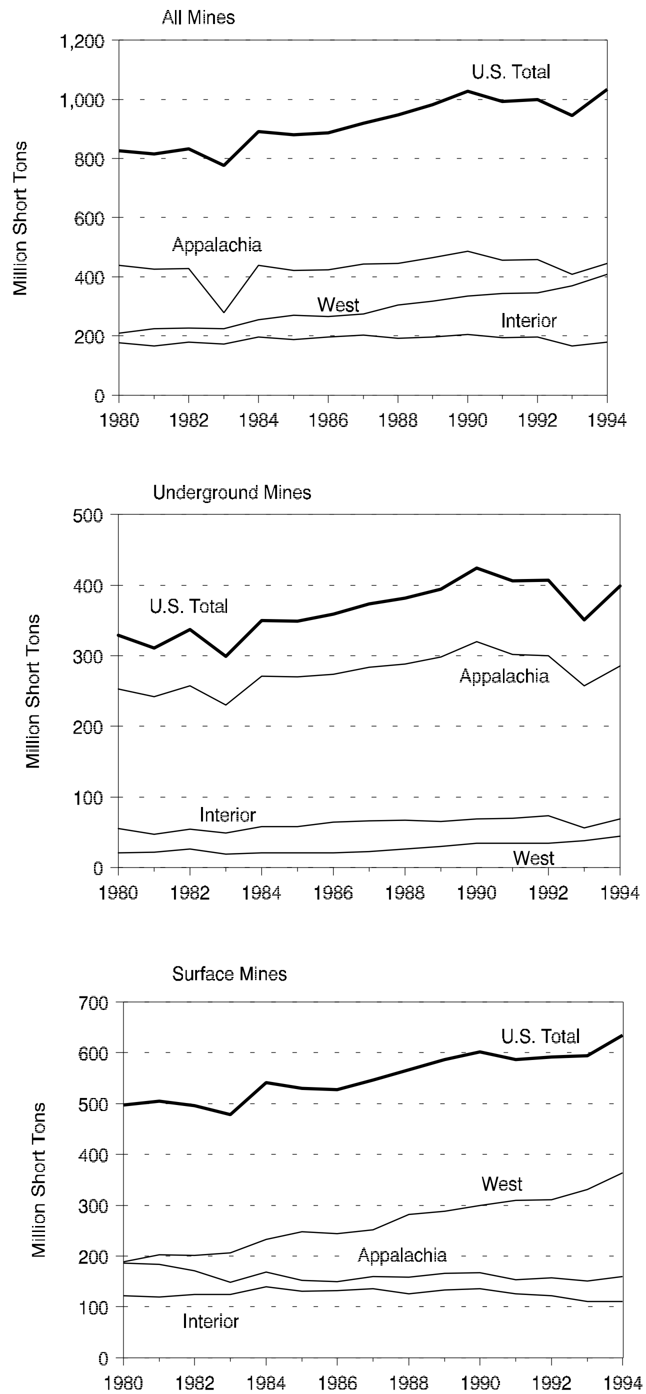
[51] Assuming that no existing mines close prematurely, the change in reserves over time should be equal to reserves at new mines at the end of the period minus cumulative production. Other factors that can affect estimates of reserves over time include: 1) re-estimations of in-mine reserves by reporting companies; 2) the acquisition of additional reserves by existing mines; and 3) the accuracy with which reserves are estimated.

Figure 7. Comparative Trends in Recoverable Coal Reserves at Active Mines and Production, 1980-1994

Recoverable Reserves at Active Mines by Region, 1980-1994



Coal Production by Region, 1980-1994



Source: Energy Information Administration, Form EIA-7A, "Coal Production Report."

to meet an increase in demand that did not materialize to the extent expected

2. A substantial decline in industrial coal demand (particularly at coke plants)—a market for which Appalachian producers are the principal suppliers

3. The rapid penetration of longwall mines, whose lower production costs forced some existing mines out of business

4. Continuing penetration of lower-cost coal from the Powder River Basin into midwestern coal markets, displacing some production from Appalachian mines.

For the West, the EIA study regarding new mines revealed a different story. By 1989, production from 17 new surface mines in the West amounted to 59 million short tons. The recoverable reserves associated with these new mines amounted to 2.7 billion short tons, reflecting a very long average mine life of 46 years. Like Appalachia, an overly optimistic outlook for coal demand also led to the development of excess mining capacity in the West during the 1980s. However, unlike Appalachia, production from this region increased substantially, as continuing declines in both mining and transportation costs allowed coal from this region to penetrate into markets historically served by coal producers in the Appalachian and Interior Regions. Between 1980 and 1989, Western coal production increased by 108 million short tons (Figure 4). This compares with increases of 25 million short tons for Appalachia and 19 million short tons for the Interior Region.

Conclusion

The analysis indicates that recoverable reserves at existing active mines for some coal types and regions will be exhausted and that new mine capacity will be needed in many areas of the country. Projections of increased demand for low-sulfur coal indicate the need for substantial amounts of new mine capacity in low-sulfur coal regions, mostly in central Appalachia. Investments in new low-sulfur capacity are most critical in southern West Virginia, where low-sulfur production at underground mines is projected to average more than 100 million short tons per year over the forecast period. The estimated recoverable reserves of low-sulfur coal at existing active underground mines in this region can support the projected levels of production for only about 5 years.

Of the predominately low-sulfur regions, eastern Wyoming is best positioned to meet the increasing demand for low-sulfur coal over the forecast period. Active mines in eastern Wyoming report an estimated 6.3 billion short tons of recoverable low-sulfur reserves, which represents nearly 75 percent of the low-sulfur reserves at surface mines and almost 60 percent of low-sulfur reserves at all mines. For medium- and high-sulfur coal, projections for an expanding coal market and increased use of flue gas desulfurization equipment create a relatively stable market for these coal types. To meet demand, some new investments in medium-sulfur coal are indicated over the forecast period, primarily in Appalachia.

Investments in the coal industry have different implications by region and type of mining. Initial capital investments are relatively low for underground mines employing continuous miner units for both mine development and production activities. On the other hand, initial capital costs for underground mines using a longwall unit for production and continuous miner units for mine development work are much higher. Surface mines are very capital-intensive operations. For example, initial capital costs for production equipment at a large dragline operation are estimated to exceed $50 million.

Acronyms and Abbreviations Used

AEO 96	*Annual Energy Outlook 1996*
ASTM	American Society for Testing and Materials
BOM	U.S. Bureau of Mines
CAAA90	Clean Air Act Amendments of 1990
CAS	USGS Coal Availability Studies
CMM	Coal Market Module
CRDB	Coal Reserves Data Base
CRS	BOM Coal Recoverability Studies
DOE	U.S. Department of Energy
DRB	demonstrated reserve base
EIA	Energy Information Administration
FERC	Federal Energy Regulatory Commission
GIS	geographic information systems
ISGS	Illinois State Geological Survey
KDMM	Kentucky Department of Mines and Minerals
KGS	Kentucky Geological Survey
NCRA	National Coal Resource Assessment
NCRDS	National Coal Resource Data System
NEMS	National Energy Modeling System
NMBMMR	New Mexico Bureau of Mines and Mineral Resources
RAMC	Resource Allocation and Mine Costing
ROM	run of mine
USGS	U.S. Geological Survey

Glossary of Selected Coal Classification Terms

accessed—Coal deposits that have been prepared for mining by construction of portals, shafts, slopes, drifts, and haulage ways; by removal of overburden; or by partial mining (see also **virgin coal**).

accessibility—In reference to coal resources (core meaning), the absence of **land use restrictions** and the assumption that ownership or leaseholds will be obtainable for mining (see also **environmental restrictions, industrial restrictions**). Many **technological restrictions** were traditionally applied as demonstrated reserve base criteria, but (extended meaning) with the advent of **available resource** studies, specific technologic restrictions may be incorporated in **accessibility factors** (see also **restricted resources**).

accessibility factor—The estimated regional ratio of **accessible reserve base** to the **demonstrated reserve base** or of **accessible resources** to **identified resources**.

accessible reserve base—The portion of the **demonstrated reserve base** estimated by EIA to be accessible, determined by application of one or more **accessibility factors** within an area. An *accessible reserve base* may be referred to as **accessible resources** because it is a subset of accessible resources and is usually part of a single resource study.

accessible resources—The portion of **identified resources** estimated to be accessible, determined by application of one or more **accessibility factors** within an area.

as-received condition or as-received basis—Represents an analysis of a sample as received at a laboratory.

availability—In reference to coal resources, the absence of **land-use** or **environmental restrictions** and **technological restrictions**.

available reserves—In EIA coal supply modeling, the difference between **estimated recoverable reserves** and **recoverable reserves at active mines**; in modeling context, these reserves are considered not presently obligated for existing mines and, therefore, would be available to supply new mines in the future.

available resources—In U.S. Geological Survey studies, the quantity of remaining **identified resources** available for development and potential extraction at the time of determination after adjusting for geologic considerations, land-use restrictions, and/or **technological restrictions** (see also **accessible reserve base**).

bed—All the coal and partings lying between a roof and floor.

bench—A subdivision and (or) layer of a coal bed separated from other layers by partings of non-coal rock.

coal—A readily combustible rock containing more than 50 percent by weight and more than 70 percent by volume of carbonaceous material, including inherent moisture. It is formed from plant remains that have been compacted, indurated, chemically altered, and metamorphosed by heat and pressure during geologic time. *Discussion*: Differences in the kinds of plant materials, in the degree of metamorphism (rank), and in the range of impurities are characteristic of *coal* and are used in coal classification. Impure coal/coaly material containing more than 33 weight percent ash is excluded from resources and reserve estimates unless the ash is largely in associated partings so that the *coal* is cleanable to less than 33 weight percent ash.

coal preparation/washing—The treatment of coal to reject waste. In its broadest sense, preparation is any processing of mined coal to prepare it for market, including crushing and screening or sieving the coal to reach a uniform size, which normally results in removal of some non-coal material. The term *coal preparation* most commonly refers to processing, including crushing and screening, passing the material through one or more processes to remove impurities, sizing the product, and loading for shipment. Many of the processes separate rock, clay, and other minerals from coal in a liquid medium; hence the term *washing* is widely used. In some cases coal passes through a drying step before loading.

coal-producing region—An area that collectively encompasses a group of geographically contiguous or logically associated States or areas that currently or historically mine and market coal.

coal supply region—An area in which the EIA coal reserves data are aggregated and allocated to a set of uniform, typical criteria for purposes of modeling. The criteria of a *coal supply region* may include coal heat and sulfur content or other quality parameters, coal rank, geographic continuity, traditional mining regions, State or county boundaries, transportation corridors and barriers, and marketing factors. Coal supply regions may vary for different modeling criteria; they may include the coal reserves of an entire State or a contiguous group of States; some major producing States may be split into more than one region.

coal zone—A series of laterally extensive and (or) lenticular coal beds and associated strata that arbitrarily can be viewed as a unit. Generally, the coal beds in a *coal zone* are assigned to the same geologic member or formation.

committed reserves—In EIA coal supply modeling, synonymous with **recoverable reserves at active mines**; in modeling context, these reserves are considered obligated for existing mines and, therefore, not part of the reserves that would be available to supply new mines in the future.

compliance coal—A coal or a blend of coals that meets sulfur dioxide emission standards for air quality without the need for flue gas desulfurization.

cumulative depletion—The sum in tons of coal extracted and lost in mining to a stated date for a specified area or a specified coal bed.

demonstrated reserve base (DRB)—A collective term for the sum of coal in both measured and indicated resource categories of reliability; the DRB represents 100 percent of coal in place as of a certain date. Includes beds of bituminous coal and anthracite 28 inches or more thick and beds of subbituminous coal 60 inches or more thick that can be surface mined. Includes also thinner and / or deeper beds that presently are being mined or for which there is evidence that they could be mined commercially at this time. Represents that portion of the **identified resources** of coal from which reserves are calculated.

demonstrated resources—Same qualifications as **identified resources**, but includes measured and indicated degrees of geologic assurance and excludes the inferred.

depleted resources—Resources that have been mined; includes coal recovered, coal lost in mining, and coal reclassified as subeconomic because of mining. See **cumulative depletion**.

depletion—The subtraction of both the tonnage produced and the tonnage lost in mining from the **demonstrated reserve base** and **identified resources** to determine the remaining tonnage as of a certain time.

depletion factor—The multiplier of the tonnage produced that takes into account both the tonnage recovered and the tonnage lost due to mining. The depletion factor is the reciprocal of the **recovery factor** in relation to a given quantity of production.

dry, mineral-matter-free basis—A type of calculated analytical value of a coal sample expressed as if the total moisture and mineral matter had been removed. *Mineral matter free* is not the same as ash free.

economic—Term that implies that profitable extraction or production under realistic investment assumptions has been established, analytically demonstrated, or assumed with reasonable certainty.

environmental restrictions—**Land-use restrictions** that constrain, postpone, or prohibit mining in order to protect environmental resources of an area; for example, surface- or groundwater quality, air quality affected by mining, or plants or animals or their habitats.

estimate—A determination as to the amount or tonnage of coal in an area. The term *estimate* indicates that the quantities of resources are known imprecisely. An estimate differs from an assessment, which is an analysis of all data concerning an area's coal resources and reserves with the objective of reaching a judgment about the geologic nature and economic potential of the coal resources and reserves of the area.

estimated recoverable reserves—See **recoverable reserves**.

floor--The upper surface of the stratum underlying a coal seam. In coals that were formed in persistent swamp environments, the floor is typically a bed of clay, known as "underclay," representing the soil in which the trees or other coal-forming swamp vegetation was rooted.

geologic assurance—State of sureness, confidence, or certainty of the existence of a quantity of resources based on the distance from points where coal is measured or sampled and on the abundance and quality of geologic data as related to thickness of overburden, rank, quality, thickness of coal, areal extent, geologic history, structure, and correlations of coal beds and enclosing rocks. The degree of assurance increases as the nearness to points of control, abundance, and quality of geologic data increases.

geologic considerations—Conditions in the coal deposit or in the rocks in which it occurs that may complicate or preclude mining. *Geologic considerations* are evaluated in the context of the current state of technology and regulations, so the impact on mining may change with time.

hypothetical resources—**Undiscovered coal resources** in beds that may reasonably be expected to exist in known mining districts under known geologic conditions. In general, *hypothetical resources* are in broad areas of coalfields where points of observation are absent and evidence is from distant outcrops, drill holes, or wells. Exploration that confirms their existence and better defines their quantity and quality would permit their reclassification as **identified resources**. Quantitative estimates are based on a broad knowledge of the geologic character of coalbed or region. Measurements of coal thickness are more than 6 miles apart. The assumption of continuity of coalbed is supported only by geologic evidence.

identified resources—Specific bodies of coal whose location, rank, quality, and quantity are known from geologic evidence supported by engineering measurements. Included are beds of bituminous coal and anthracite 14 inches or more thick and beds of subbituminous coal and lignite 30 inches or more thick that occur at depths to 6,000 feet and whose existence and quantity have been delineated within specified degrees of geologic assurance as measured, indicated, or inferred.

indicated resources—Coal for which estimates of the rank, quality, and quantity have been computed partly from sample analyses and measurements and partly from reasonable geologic projections. *Indicated resources* are computed partly from specified measurements and partly from projection of visible data for a reasonable distance on the basis of geologic evidence. The points of observation are 0.5 to 1.5 miles apart. *Indicated* coal is projected to extend as a 0.5-mile-wide belt that lies more than 0.25 miles from the outcrop or points of observation or measurement.

industrial restrictions—**Land-use restrictions** that constrain, postpone, or prohibit mining in order to meet other industrial needs or goals; for example, resources not mined due to safety concerns or due to industrial or societal priorities, such as to preserve oil or gas wells that penetrate the coal reserves; to protect surface features such as pipelines, power lines, or company facilities; or to preserve public or private assets, such as highways, railroads, parks, or buildings.

inferred reserve base—the resources in the inferred reliability category that meet the same criteria of bed thickness and depth from surface as the **demonstrated reserve base**.

inferred resources—Coal in unexplored extensions of **demonstrated resources** for which estimates of the quality and size are based on geologic evidence and projection. Quantitative estimates are based largely on broad knowledge of the geologic character of the bed or region and where few measurements of bed thickness are available. The estimates are based primarily on an assumed continuation from demonstrated coal for which there is geologic evidence. The points of observation are 1.5 to 6 miles apart. Inferred coal is projected to extend as a 2.25-mile-wide belt that lies more than 0.75 miles from the outcrop or points of observation or measurement.

isopach—A line on a map drawn through points of equal thickness of a designated unit (such as a coal bed).

land-use restrictions—Constraints placed upon mining by societal policies to protect surface features or entities that could be affected by mining. Because laws and regulations may be modified or repealed, the restrictions, including industrial and environmental restrictions, are subject to change.

marginal reserves—Borders on being economic. See **economic**.

measured resources—Coal for which estimates of the rank, quality, and quantity have been computed, within a high degree of geologic assurance, from sample analyses and measurements from closely spaced and geologically well known sample sites. *Measured resources* are computed from dimensions revealed in outcrops, trenches, mine workings, and drill holes. The points of observation and measurement are so closely spaced and the thickness and extent of coals are so well defined that (for older estimates) the tonnage was judged to be accurate within 20 percent of true tonnage (statistical measures of error are no longer considered reliable for most measured resources). Although the spacing of the points of observation necessary to demonstrate continuity of the coal differs from region to region according to the character of the coalbeds, the points of observation are not greater than 0.5 mile apart. Measured coal is projected to extend as a 0.25-mile-wide belt from the outcrop or points of observation or measurement.

minable—Capable of being mined under current mining technology and environmental and legal restrictions, rules, and regulations.

original (resources/reserves)—The amount of coal in the ground before any production.

overburden—Any material, consolidated or unconsolidated, that lies between a coal deposit and the surface. *Overburden* is reported in feet and (or) meters and used to classify the depth to an underlying coal bed.

preparation plant—Broadly speaking, any facility where coal is prepared for market; usual accepted meaning is a rather elaborate collection of facilities where coal is separated from its impurities, washed and sized, and loaded for shipment. Also known as a wash plant or coal washer.

quality or grade—An informal classification of coal relating to its suitability for use for a particular purpose. Refers to individual measurements such as heat value, fixed carbon, moisture, ash, sulfur, phosphorus, major, minor, and trace elements, coking properties, petrologic properties, and particular organic constituents. The individual quality elements may be aggregated in various ways to classify coal for such special purposes as metallurgical, gas, petrochemical, and blending usages.

rank—The classification of coal relative to other coals, according to their degree of metamorphism, or progressive alteration, in the natural series from lignite to anthracite (Standard Classification of Coal by Rank, 1992, American Society for Testing and Materials, ASTM Designation D–388–91a).

recoverability—In reference to accessible coal resources, the condition of being physically, technologically, and economically minable. **Recovery rates** and **recovery factors** may be determined or estimated for coal resources without certain knowledge of their economic minability; therefore, the availability of recovery rates or factors does not predict recoverability.

recoverable coal—Coal that is, or can be, extracted from a coal bed during mining.

recoverable reserves, estimated recoverable reserves—Reserve estimates (broad meaning) based on a **demonstrated reserve base** adjusted for assumed **accessibility factors** and **recovery factors**. The term is used by EIA to distinguish *estimated recoverable reserves*, which are derived without specific economic feasibility criteria by factoring (downward) from a demonstrated reserve base for one or more study areas or regions, from **recoverable reserves at active mines**, which are aggregated (upward) from reserve estimates reported by currently active, economically viable mines on Form EIA–7A.

recoverable reserves at active mines—The amount of in situ coal that can be recovered by mining existing reserves at mines reporting on Form EIA-7A (see **committed reserves**).

recovery factor—The percentage of total tons of coal estimated to be recoverable from a given area in relation to the total tonnage estimated to be in the **demonstrated reserve base**. For the purpose of calculating **depletion factors** only, the estimated *recovery factors* for the **demonstrated reserve base** generally are 50 percent for underground mining methods and 80 percent for surface mining methods. More precise *recovery factors* can be computed by determining the total coal in place and the total coal recoverable in any specific locale.

recovery percentage/rate—The ratio of coal extracted from a bed as compared to the total quantity of coal originally in the bed.

remaining (resources/reserves)—The amount of coal in the ground after some mining, excluding coal in the ground spoiled or left in place for which later recovery is not feasible.

reserve(s)—Root meaning: The amount of in-situ coal in a defined area that can be recovered by mining at a sustainable profit at the time of determination. Broad meaning: That portion of the **demonstrated reserve base** that is estimated to be recoverable at the time of determination. The *reserve* is derived by applying a **recovery factor** to that component of the **identified resources** of coal designated as the **demonstrated reserve base**.

resources—Naturally occurring concentrations or deposits of coal in the Earth's crust, in such forms and amounts that economic extraction is currently or potentially feasible.

restricted coal resources—In U.S. Geological Survey studies, the quantity of remaining resources that is not available for development at the time of determination because of **geologic considerations, land-use restrictions**, and / or **technological restrictions.**

restricted resources—Those parts of any resource category that are restricted or prohibited from extraction by laws or regulations. Also, coal or a portion of the coal in categorically minable depths or thicknesses that is not economic at the time of determination.

roof—The rock immediately above a coal seam. The roof is commonly a shale, often carbonaceous and softer than rocks higher up in the roof strata.

run-of-mine—The raw coal recovered from a mine, prior to any treatment.

salable coal—The shippable product of a coal mine or **preparation plant**. Depending on customer specifications, *salable coal* may be **run-of-mine**, crushed-and-screened (sized) coal, or the clean coal yield from a preparation plant.

sample—A representative fraction of a coal bed collected by approved methods, guarded against contamination or adulteration, and analyzed to determine the nature; chemical, mineralogic, and (or) petrographic composition; percentage or parts-per-million content of specified constituents; heat value; and possibly the reactivity of the coal or its constituents.

seam—A bed of coal lying between a roof and floor. Equivalent term to bed, commonly used by industry.

speculative resources—**Undiscovered** coal in beds that may occur either in known types of deposits in a favorable geologic setting where no discoveries have been made, or in deposits that remain to be recognized. Exploration that confirms their existence and better defines their quantity and quality would permit their reclassification as **identified resources**.

strip or stripping ratio—The amount of overburden that must be removed to gain access to a unit amount of coal.

> *Discussion*: A *stripping ratio* may be expressed as (1) thickness of overburden to thickness of coal, (2) volume of overburden to volume coal, (3) weight of overburden to weight of coal, or (4) cubic yards of overburden to tons of coal. A *stripping ratio* commonly is used to express the maximum thickness, volume, or weight of overburden that can be profitably removed to obtain a unit amount of coal.

strip or surface mining—The extraction of coal by using surface mining methods such as area strip mining, contour strip mining, or open-pit mining. The overburden covering the coal is removed and the coal extracted using power shovels, front-end loaders, or similar heavy equipment.

technological restrictions—Constraints related to economics and safety placed upon mining by contemporary technology or prescribed by law; the restrictions may change with advances in science or modifications in the law. For purposes of assessing impacts on minability, **geologic considerations** are included as *technological restrictions*. A secondary basis for accessibility is the *technological restrictions* that may affect economic minability of specific coal resources in a locality at the time of the evaluation. *Technological restrictions* include constraints on the economic or safe mining of the coal with contemporary technologies, which constraints are related to the nature of the coalbeds or local geology; for example, specific coalbed thickness or overburden characteristics known to deter economic mining of coal meeting broad regional DRB criteria, localized geologic structural problems, or unsafe or illegal proximity to another mine.

underground mining—The extraction of coal or its products from between enclosing rock strata by underground mining methods, such as room and pillar, longwall, and shortwall, or through in-situ gasification.

undiscovered resources—Unspecified bodies of coal surmised to exist on the basis of broad geologic knowledge and theory. **Undiscovered resources** include beds of bituminous coal and anthracite 14 inches or more thick and beds of subbituminous coal and lignite 30 inches or more thick that are presumed to occur in unmapped and unexplored areas to depths of 6,000 feet. The **speculative** and **hypothetical resource** categories comprise *undiscovered resources.*

virgin coal—Coal that has not been accessed by mining. See **accessed**.

Appendix A

Review of U.S. Coal Resource and Reserve Data Criteria and Terminology

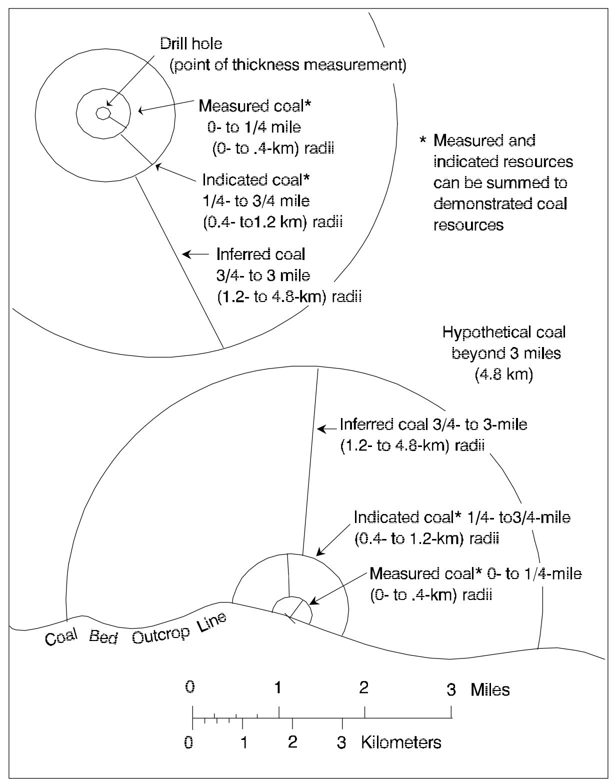
Appendix A

Review of U.S. Coal Resource and Reserve Data Criteria and Terminology

This appendix contains a review of the coal classification system used by EIA, the U.S. Geological Survey (USGS), and the U.S. Bureau of Mines (BOM). It also details the criteria used by those three agencies for coal resources and reserve assessments, including the demonstrated reserve base (DRB) of coal and EIA's estimated recoverable reserves of coal. Finally, it reviews the status of EIA's updates to the DRB and estimated recoverable reserves and of other data sources that have been or may be useful to improve EIA's Coal Reserves Data Base (CRDB). Finally, this appendix includes a discussion of the terms and contacts that apply to EIA, USGS, and BOM coal data.

Coal resources are naturally occurring concentrations or deposits of coal in the Earth's crust, in such forms that economic extraction is currently or potentially feasible. Efforts to quantify coal resources are based on observations and, more importantly, measurements of coal deposits: the thicknesses of the bedded deposits and of any noncoal materials within the coalbeds, the depths and elevations of the coalbeds, and the locations of the measurements, along with descriptions and samples representative of the coal deposits. Similar data are collected about the rocks within which the coal occurs and the topography, hydrology, and other geologic features that may affect minability. The precision and the level of confidence attributable to a resource estimate derive from the number of measurement points, including their locations relative to each other and to pertinent geologic features, and from carefully taken and properly recorded data. The spatial relationships of qualified coal measurement points and the standard USGS resource reliability categories are illustrated as a diagrammatic map in Figure A1.

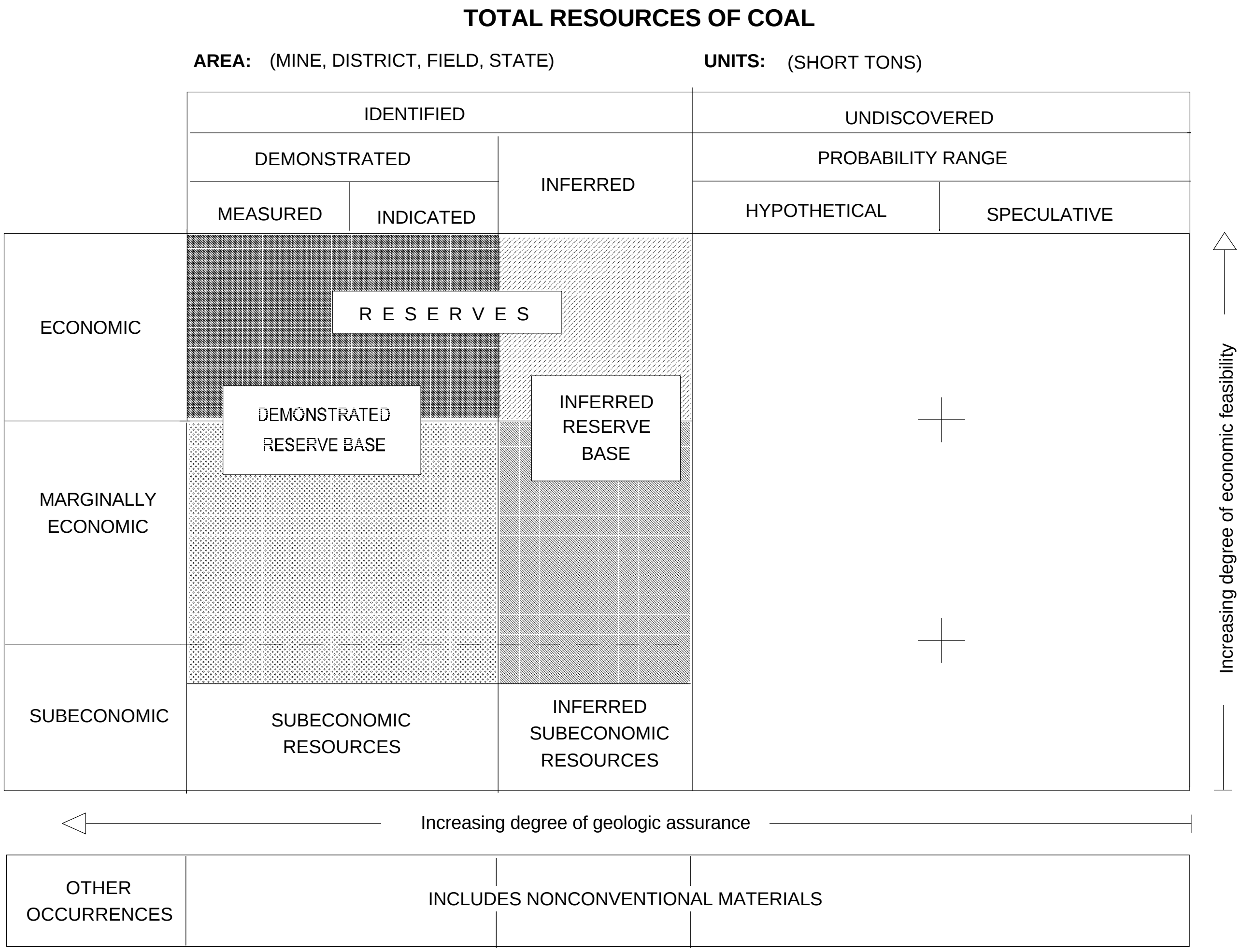
Figure A1. Diagram of Coal Resource Reliability Categories Based on Distances From Points of Measurement



Source: Adapted from U.S. Department of the Interior, *Coal Resource Classification System of the U.S. Geological Survey,* Geological Survey Circular 891 (1983).

The USGS originated a basic coal resource classification diagram that serves to this day, with minor modifications. In Figure A2 EIA has combined elements from several USGS diagrams and its own applications to diagram the hierarchy of coal resource data reliability and minability categories. Figure A2 represents resources conceptually and qualitatively. It does not indicate the specific sizes, thicknesses, depths, or geometries of coal deposits. The classification scheme is based on the relative degrees of assurance that coal resources do exist and extend throughout an area, at progressive levels of economic suitability for mining. These classes are, in turn, defined

Figure A2. Classification of Coal Resources and Reserves



Note: A portion of reserves of any category may be restricted from extraction by laws or regulations. This diagram represents resources conceptually and qualitatively. It does not indicate the specific sizes, thicknesses, depths, or geometries of coal deposits.

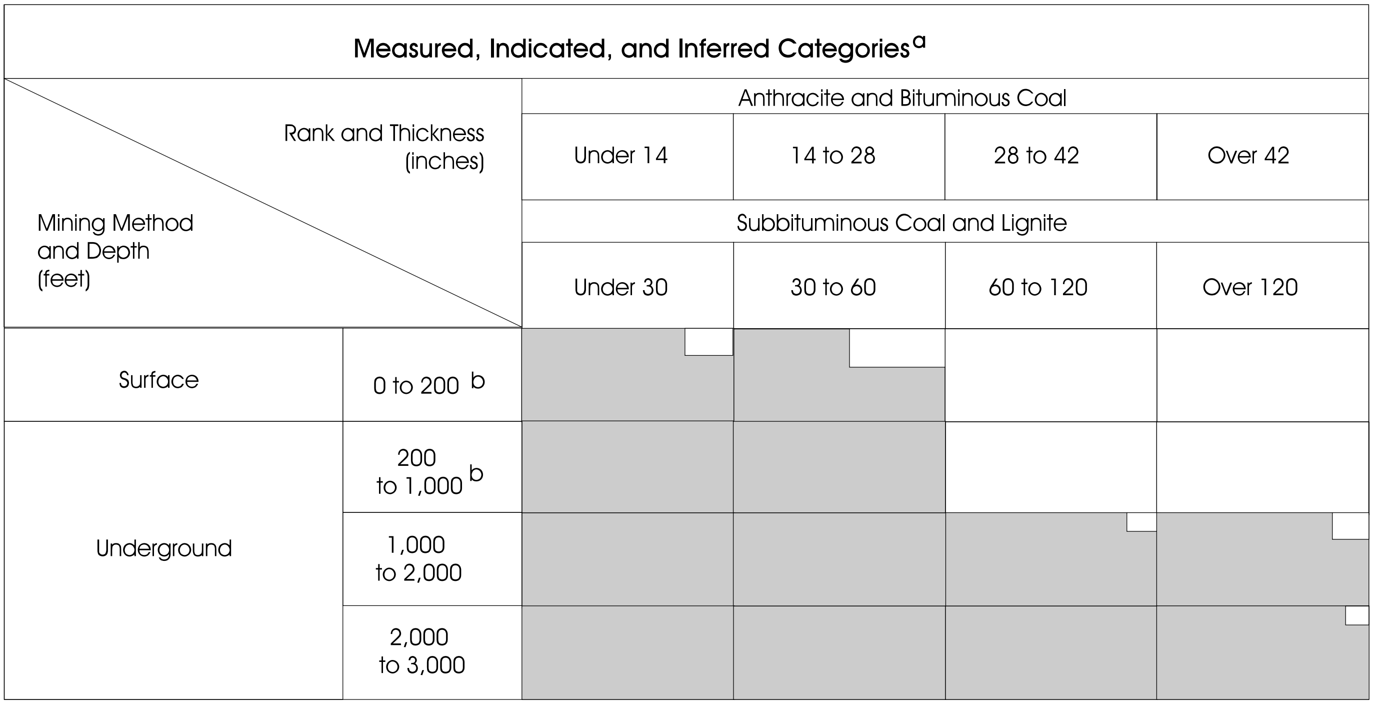
Source: Adapted from U.S. Department of the Interior, *Coal Resource Classification System of the U.S. Geological Survey,* Geological Survey Circular 891 (1983) and U.S. Geological Survey, *Principles of the Mineral Resource Classification System of the U.S. Bureau of Mines and U.S. Geological Survey,* Bulletin 1450-A (1976).

by criteria such as: coal deposit size; bed thickness, depth, or geometry; geologic considerations; and the quality or marketability of the coal—all of which can and do change over time. The classification is a framework in which to catalog the data on coal resources, whether or not data are available in all places.

DRB Criteria

The demonstrated reserve base, or DRB, is EIA's baseline of coal resource data that underlies projections of future coal supplies and other analyses. The DRB includes only resources of measured and indicated reliability meeting broad physical and coal grade criteria for coalbeds from which reserves would most likely be mined. The DRB minability criteria were selected from the contemporary resource assessment standards available in the 1970s (Figure A3). In general, they include measured and indicated resources in medium-to-thick beds at depths of 1,000 feet or less from the surface. For surface mining, the minable depths extend only to 200 feet or less and also include thin beds in some regions. Still thinner and/or deeper resources are included, if data are available, in locations where there is evidence that they are or could be mined commercially at this time. For bituminous coal and anthracite, coal 28 or more inches thick is generally included in the surface DRB in Appalachia and the

Figure A3. Identified Coal Resources



[a]The three categories denote degrees of geologic assurance and collectively make up the identified resource category. Excludes less than 0.02 percent of identified coal resources not classifiable under current criteria.

[b]Current surface-minable coal is predominantly within the depth range of 0 to 200 feet. Some surface mines exceed this depth range; conversely, some coal resources less than 200 feet deep can be mined only by underground methods.

Notes: Blocks represent combinations of rank, thickness, and depth that define broad criteria for minability. In the nonshaded blocks, measured and indicated resources are included in the DRB. In nonshaded partial blocks, measured and indicated resources are included in the DRB in specific locations only, where there is evidence that thinner and/or deeper beds could be mined commercially at this time. In shaded areas, coalbed rank, thickness, and depth combinations for measured and indicated resources are too thin and/or too deep to be included currently in the DRB.

Source: Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels.

Interior States. For subbituminous coal, beds 60 or more inches thick are included in both the surface and the underground DRB. For lignite, beds 60 or more inches thick are included in the surface DRB (lignite is not currently mined underground in the United States) and beds 30 to 60 inches thick are included in certain areas.

The DRB is not re-estimated when economic conditions, such as coal prices, change. Changing economic conditions, as well as laws and regulations governing coal supply, are analytical variables to be evaluated for a particular issue, and are not directly related to the criteria for the DRB. To the extent possible, reliability and minability criteria have been applied uniformly nationwide in order to maintain data compatibility and objectivity.

Even though changing economic factors cannot be taken into account in routine DRB updates, the physical DRB criteria can be amended to allow for enduring changes in mining practice, technology, and (indirectly) economics. Including measured and indicated resources and accommodating regional mining variations do not imply that those resources will be legally available, economically marketable, or technologically minable. Detailed local evaluations are normally required to determine ownership and regulatory limitations that may apply to the coal, to evaluate the quality of the coal and its value in current markets, and to detect impediments from natural geologic conditions (for example, weak roof rock or instability due to faulting) or societal restrictions (for example, in national parks).

The actual amount of coal recoverable from the DRB has always been speculative. For many years, engineering judgment, based on the cumulative experience of mine operators and government geologists and mining engineers, sufficed (especially in the eastern half of the United States). Roughly 50 percent of the DRB was thought to be recoverable nationally. In the late 1970's, separate percentages were estimated for the legal-to-mine fraction and the recoverable fraction of the surface-minable and deep-minable DRB of coal supply regions, for use in coal supply analyses. Recent EIA updates to coal resource data include data for the DRB, as well as new, more detailed factors for resource accessibility, and field data for coal quality. Updated average mine-level recovery rates come from EIA mine production reports and from the experience of geologists in the region.

Resource-Based Estimates

The DRB reports selected coal resources. Estimates of the reserves that will be recoverable from those resources are considered to be "resource-based" reserve estimates. Coal resource estimates are, in fact, of interest primarily to determine where coal is located and how much can be mined. Detailed assessments of reserves, with sufficient detail to ascertain coal quantities, characteristics, and values or marketability would be very instructive, but the economic and engineering data supporting the coal reserve assessments by owners or leaseholders are confidential and not available for Government databases. The only "reserve-based" reserve estimates EIA is authorized to collect are simple statistics on the remaining reserves and rates of recovery estimated by active mine operators each year. All EIA recoverable reserve data beyond outside current mining operations are derived from "resource-based estimates."

Published Resource Data Sources

Published studies are the sources for currently available national estimates of total resources and identified resources and for most of the data currently in the DRB. The published studies include reports from the USGS, BOM, State geological and mining agencies, EIA, and the U.S. Department of Energy. They also include reports in professional journals and, rarely, mining and engineering studies. Some studies cover the important coal resources of an entire State; others cover only resources in a county, a coalfield, a political jurisdiction, or a USGS quadrangle[52] mapping area. The ages of the source studies for the DRB date from 1907 for three counties of West Virginia to 1995 for Illinois. The ages of the USGS source studies for total and identified resources date from 1940 in West Virginia to 1975 in Colorado. Many of the USGS and the more recent EIA sources incorporate some data from older studies.

Computerized Resource Data Sources

Recent updates to the DRB have relied increasingly on computerized resource data. About 1980, coal resource data were becoming available through computerized databases, with or without descriptive reports. These databases were pioneered by the Illinois State Geological Survey (ISGS) and by the USGS in its National Coal Resources Data System (NCRDS). The NCRDS supplied partial funding through cooperative agreements with many State geological surveys for coal resource assessments between 1975 and the present. Both the ISGS and the USGS systems entered coal and stratigraphic data at measurement points and incorporated locational data in computerized map files.

The capabilities of the mapping systems improved over the years and were reengineered repeatedly to accommodate changing technology. Because NCRDS participation was requisite for the cooperative agreements, many States adopted the USGS technology and standards, but because the program was centrally coordinated and all data were for many years processed only through USGS computers, data processing delays were inevitable. The NCRDS program now incorporates mini-computer work stations, personal computer adaptations, and advances in commercial geographic information systems (GIS). At this time, only Kentucky, Illinois, and New Mexico, through their own systems, have processed enough data to update the resources for all economically important coal deposits of each State.

Accessibility and Recoverability Adjustments

During the past decade, significant improvements have been initiated to develop better data for coal resource accessibility and recoverability. Accessibility and recoverability factors are usually rooted in measurements or observations within representative coal resource study areas and are applied throughout entire coal resource supply areas.

During the late 1970s, for the Resource Allocation and Mine Costing (RAMC) model, EIA had developed

[52]The standard USGS quadrangle today is the 7.5–minute quadrangle, a nearly rectangular area bounded by 7.5 minutes of latitude and 7.5 minutes of longitude. In the coterminous United States this area averages about 6.5 miles east to west and 8.5 miles north to south, covering 55 to 56 square miles, but ranging from 66 square miles in south Texas to 49 square miles in northern Montana.

regional estimates of the proportion of resources expected to be free of environmental and land use restrictions and, thus, be accessible for mining by surface and underground methods. These estimates were based primarily on the professional judgment of analysts experienced in coal mining and coal supply modeling. Accessibility fractions were applied to the surface and underground DRB. The resulting accessible reserve base estimates were further adjusted by recovery factors for surface and underground mining. The recovery factors were based on recovery rates at operating mines reporting on Form EIA-7A, the annual *Coal Production Report*, averaged over mining provinces.

Starting in 1990, accessibility factors were updated, along with coal resource estimates, through EIA Coal Reserves Data Base (CRDB) studies. CRDB studies in Ohio, Wyoming, and New Mexico incorporated State geological survey resource mapping with available land use information to recalculate average accessibility factors within the studied area. In these cases, data counts, sampling studies, and/or area-wide measurements were done to quantify the impact of mapped surface features or land use boundaries on surface and underground coal accessibility. Some assumptions were necessary, based usually on either Federal regulations or State or local zoning, as to the effect of certain components on resource access.

Starting in 1993, EIA's CRDB studies in certain coal supply areas (eastern Kentucky and, later, Illinois) were able to draw on a new source, USGS Coal Availability Studies (CAS), to update accessibility data. The CAS started with a pilot study in 1986.[53] The premise of the CAS was that more accurate assessments of the portion of U.S. coal resources that will be accessible, or available, for development, can be made if accurate baseline data are available. Clearly, it would not be fiscally feasible to map coal resources and availability throughout the vast coal fields of the United States, but it may be feasible to select limited areas that typify the various coal provinces and map them accurately. The results would then be extrapolated to the coal provinces. Again, this is a resource-based approach, designed to distinguish the portion of total resources that is potentially minable from the portion that is not. The USGS criteria for coal availability consider both land use restrictions and technologic restrictions:

U.S. Geological Survey
Factors Affecting Coal Availability

Land Use Restrictions
- Cemeteries
- Streams, lakes, and reservoirs
- Residences, towns, and public buildings
- Historic sites and non-Federal public parks
- Highways and railroads
- Powerlines and pipelines
- Federal lands and endangered species habitat
- Oil and gas wells

Technological Restrictions
- Coalbed depth and thickness
- Geologic conditions that impact mining
- Proximity to another coalbed or mine

Source: U.S. Geological Survey, Circular 1055, *Coal Resources Available for Development.*

By May 1996, a total of 35 Coal Availability Studies were completed, in the States of Kentucky, West Virginia, Virginia, Illinois Indiana, Ohio, Pennsylvania, and Wyoming. An additional 30 studies are planned or underway in Kentucky, West Virginia, Tennessee, Illinois, Indiana, Ohio, Wyoming, New Mexico, Colorado, and Utah.[54] Thus far, methodologies to extrapolate the results to unstudied portions of the coalfields have not been completed (a single methodology may not be applicable from one coal province to another). In the meantime, in CRDB projects in eastern Kentucky and Illinois, EIA has employed weighted averages based on completed CAS as improved bases for accessibility adjustments.

Cross-Boundary Assessments

In the 1990s State and Federal geologists have initiated an alternative methodology to reassess coal resources, which may eventually offer an alternative to the DRB as a national coal resource database.

In 1993, the Kentucky Geological Survey (KGS) began the first of a planned series of cross-boundary coal resource mapping projects, the Fire Clay coal resource study. Most resource assessments of the past studied all the coalbeds in a geographic area and mapped and calculated resources for all beds thicker than a standard cutoff, such

[53]U.S. Geological Survey, Circular 1055, *Coal Resources Available for Development--A Methodology and Pilot Study* (Reston, VA 1990).
[54]Personal communication with M. Devereux Carter, U.S. Geological Survey, Reston, VA, April 1996.

as 14 inches, occurring within a certain depth from the surface, such as 3,000 feet (in practice, reliable coal measurement points deeper than 1,000 feet are relatively few in most regions). Knowing that funds to conduct coal resource assessments have declined steadily during the past 15 years, the KGS inferred that any study that would collect new data and conduct assessments on scores of coalbeds would probably never be completed.

The KGS considered the most significant coalbeds in eastern Kentucky and set out to bring mapping and resource calculations for at least one of those beds up to modern standards—including coal quality, geologic and structural information, environmental data, and digital elevation data. Although older resource mapping is far from complete, there are enough production data and geologic information to surmise which coalbeds in unmapped areas are likely to be thick, persistent, and high-quality. On those bases, the KGS identified the coalbeds that it expects to contain most of the coal minable in the next 30 years.

In the initial cross-boundary study, the KGS has mapped the Fire Clay coalbed over an area of occurrence in eastern Kentucky crossing several county boundaries. The study area includes fifteen 7.5-minute quadrangles where the Fire Clay lies within 1,200 feet of the surface. This study will give a much more accurate profile of the resources and reserve potential of the coal, including well integrated data on the thickness, depth, roof and floor rocks, and quality of the Fire Clay coal. One outcome of this study will be a test of the quantitative and qualitative differences that may be expected when a single coalbed is assessed with modern mapping and geologic data and completed in a relatively brief period of intense study.

Total resources of coal in the United States, including identified resources, were last compiled by the USGS in 1975, from published source studies dating from 1940 through 1975. In 1993, the USGS announced plans to initiate a National Coal Resource Assessment (NCRA) to provide a new national database of identified resources. Total resources (i.e., the hypothetical and speculative resources, in addition to the identified) are not part of the NCRA because of their lack of relevance to near- and mid-term planning.

The NCRA will be a series of cross-boundary studies of the currently important coals in the United States. The results of the NCRA are expected to supplant the 1975 identified resource data, although it will not include as many coalbeds as did the 1975 sources. However, with more data points, more coverage, and better map bases and available geologic mapping, the NCRA is expected to produce a more accurate and versatile database for reliable (identified or better) resources of coal for use in the first quarter of the 21st century. It may be possible to develop a uniformly updated database for the coal that will supply 85-90 percent of the production through 2025. In that case, the older data for the other 10-15 percent would be a minor concern.

The NCRA is currently the highest-priority coal resource program at USGS. If completed, the NCRA program will include coal resources in five major regions by 1999. The regions being reassessed are: the central and northern Appalachian Basin, the Illinois Basin, the onshore Gulf of Mexico sediments, the Powder River Basin/northern Great Plains, and the Rocky Mountains/Colorado Plateau.[55] In the meantime, EIA will continue to maintain the DRB and estimated recoverable reserves. Even if the NCRA is completed on schedule, the transition to an alternative national database would require extensive reengineering of applications and may not fill every need.

Reserve-Based Estimates

The term "reserve-based estimates" is used to describe estimates *of* coal reserves that are compiled *from* coal reserves data. The most extensive reserve-based estimate is EIA's recoverable reserves at active mines. It is compiled from estimates of the in situ coal that can be recovered from the active mines reporting each year on Form EIA-7A. Although extensive, this estimate holds no data on reserves controlled by parties who are not presently mining or not permitted to mine those reserves. Coal mining companies are not subject to legally binding reporting requirements, as in the oil and natural gas industries. In 1994, estimated reserves were actually reported by or estimated for only 70 percent of resource mapping projects, the Fire Clay coal resource mapping projects, the Fire Clay coal resource of the coal industry in regard to economic data, the two data elements actually reported are nominal, defined as[56]:

> (1). . . the coal tonnage representing that portion of coal reserves remaining at this mine at the end of the reporting year that you estimate can be recovered (mined) in the future, and

[55]Personal communication with Harold Gluskoter, U.S. Geological Survey, Reston, VA, April 1996.

[56]Energy Information Administration, "Coal Production Report," Form EIA-7A, data request terminology in "Recoverable Reserves" section of questionnaire (Washington, DC, December 1995) p. 2.

(2) . . . the recovery percentage used in estimating recoverable reserves in this mine.

A second species of reserve-based estimates with potential applicability to EIA recoverable reserve estimates was initiated by the U.S. Bureau of Mines (BOM) between 1989 and 1995, during its participation in the Coal Recoverability Studies (CRS) program. The CRS program was an outgrowth of BOM experience in coal mining cost studies done for the U.S. Department of Commerce and was designed to complement the results of USGS Coal Availability Studies with a methodology for reliable estimates of the economically recoverable coal in the CAS quadrangles studied.[57] The BOM methodology incorporated the coal resource and availability mapping from a completed CAS and refined those data by factoring in data on the volume and density of in-seam partings and data on coal mining economics and recovery rates in the study area. For analysis of mining economics and recovery, the BOM collected mine-level operational data under its strict, non-disclosure authority.

Data collection by the BOM entailed thorough investigations of actual mining and coal preparation economics and techniques in specific coal resource areas. The investigations included touring the quadrangle and adjacent areas to inventory all active mines, wash plants, railroads, haulage roads, streams and rivers, trends in terrain affecting mining and haulage, and other pertinent infrastructure. BOM mining engineers visited mines representative of all mining techniques in the study area and collected detailed operational data on machinery, efficiency, and operating costs, as well as information on mining restrictions, coal quality, and coal marketability. These data were supplemented with data on equipment costs and cost indexes, productivity, transportation costs, coal quality versus realization, taxation, and other factors from industry and government sources. As noted, the raw data from the mine and wash plant operators was restricted, but the BOM results and the software they developed are available and represent much-needed, up-to-date ground truth data.

The down side of this program is that the BOM completed CRS in only 15 quadrangles before the agency was virtually shut down at the end of 1995. The USGS plans to maintain the CRS program at a minimal level, subject to budget restrictions. Further, the CRS output data are only as good as the input information, which would need to be updated occasionally. The results depended on intensive data collection, with field observations and interviews by mining engineers with industry experience, working with mining-oriented computer specialists. It is not known how much support for additional CRS will be available or whether a scientifically validated program can be developed to extend the results to areas beyond the CRS quadrangles.

Finally, a third species of reserve-based data exists that has not been used by EIA. This is private assessments done by mining companies and reserve holders, including related proprietary studies by energy consulting companies. The private assessments generally are not available to the Federal Government or are not disclosable if they are available. Private assessments usually include resources and reserves. Reserves data may be developed only in selected, better-explored sections of the resource area, as mining companies have little incentive to do expensive drilling to prove up reserves that would not be needed for many years.

Proprietary studies by consulting companies are based on company resource and reserve data, collected under strict arrangements to protect identifiable data from disclosure. Access to these studies could be purchased by the Federal Government, but the results could not be disclosed in any way due to copyright protection. Cooperating coal companies benefit by getting access to regional coal resource estimates, which may improve their perspective on their own place in the region and aid them in planning. An example is the study of the low-sulfur coal resources of 14 counties in eastern Kentucky, southern West Virginia, and western Virginia done by Hill and Associates in the early 1990s.[58] The data were assembled by interviewing major resource holders and landowners, by tracing property ownership records for smaller parcels, by compiling all data on regional maps, and by screening and interpolating to derive estimates of remaining reserves in each county. This information was supplemented with data on coal quality, preparation, and markets, much of which is also confidential.

Coal Quality Applications

According to accepted USGS classification criteria, for resources usable in a DRB, coal rank and quality may be based on sampling within the resource body or may be inferred from other parts of the resource body or from

[57]U.S. Bureau of Mines, *Coal Resource Recoverability: A Methodology,* Information Circular 9638 (Washington, DC, 1993), pp. 5-17.

[58]Electric Power Research Institute, *Central Appalachia: Production Potential of Low-Sulfur Coal*, Volume I: Ten Counties in Core Low-Sulfur Region, prepared by Hill & Associates, Inc., Annapolis, MD (Palo Alto, CA, September 1991).

adjacent bodies. Because most coal resources in the United States occur in broad tabular beds or in fairly persistent zones of intermittent beds, the areal extents and volumes of coal can be estimated by mapping with relatively few measurement points. Coal rank does not change rapidly over distance in most geological environments, so data on the rank of coal sufficient for mapping large deposits can be drawn from one or two samples plus knowledge of the local geology. Some aspects of the quality of coal resources, however, may vary widely from one location to another or from one level in a bed to another level in the same coalbed. Among the common measures of quality that vary widely are heat value, ash content, and sulfur content.

In Federal Government coal resource assessments, samples collected and analyzed for coal quality factors are relatively sparse because coal quality sampling was not done at most coal measurement points. Coal quality is estimated largely after the fact, based on later sampling projects either at natural outcrops and exposed coal in mines, or from drilled cores, which are relatively expensive and therefore rare. Coal can also be sampled at the tipple, as it is loaded onto barges or trains. In nearly all cases there are too few reliable coal samples available to characterize the range of values that may occur within a coal deposit in the ground. In the CRS quadrangles, for example, the BOM found that the final step in its evaluations of economic recoverability was constrained by lack of quality data. Too few coal samples were available to determine reliably the variability among samples and within the resource quantities. The BOM used the available sample data and general background data on the local coal quality to assign calculated reserves to broad coal quality ranges.

For most of the DRB, Btu and sulfur ranges are allocated based on data in EIA files for coal mined in the same counties and purchased by the U.S. Government. Samples from the same bed are used, where available, and are supplemented with data from other nearby samples from the same bed (some in adjoining counties) or from adjacent coalbeds where more specific data are lacking. Thirty percent of the EIA samples used in allocations are weighted averages that represent multiple samples taken over an entire year. Any allocating of future reserves by quality factors is conjectural when based on data collected from other mines in the past. Such allocations at EIA have been tempered by judgment and data selectivity. EIA believes, however, that the use of samples that represent coal produced over a period of time is a reasonable means to estimate broad-range quality factors that would apply to future mining of analogous reserves over time. The critical judgment in this approach is in deciding which samples and reserves are analogous.

For reassessments of coal resources, however, as in EIA's Coal Reserves Data Base program, quality factors can be allocated with the benefit of field data and the local experience of State geological staff and their contacts at mines and undeveloped properties. State data may include drill hole samples in resources not yet being mined. Also, because the field data can be plotted and correlated with the coal resource mapping, trends in coal can be discovered and resource quantities directly allocated by coal quality trends. That type of allocation was used in the CRDB studies in New Mexico and Illinois and, in modified form, in eastern Kentucky (see Chapter 2). In other cases, circumstances and professional judgment have led to other appropriate allocation methods.

In the Ohio CRDB project, completed in 1991, the State geological staff used both BOM and State field data, but geodetic coordinates were only partially available and the resource mapping was not automated. In that case it was preferable to use a weighted statistical distribution of all valid samples, based on EIA's methods, to characterize coal quality. In the Wyoming CRDB study, completed at the end of 1991, the new resource data were allocated by correlation of mapped areas with available samples. There were not enough field samples to determine coal quality trends in some areas, so sample points were used as control points and were supplemented by hundreds of quality analyses from specific mines over a number of months or years. These data came from Federal Energy Regulatory Commission Form 423 (FERC-423), for fuel deliveries to electric power plants. The coals from this source were sampled at the power plants, where they were delivered in essentially “as mined” condition.

In Chapter 4 of this report, recoverable coal reserves at active mines are reported for the first time by coal ranks and sulfur ranges. As described there more fully, data on coal quality are not reported for the reserves on Form EIA-7A. Since no quality data can be collected for recoverable reserves at active mines, EIA has turned to the Btu and sulfur content data reported for coal distributed to electric utilities, independent power producers, industrial consumers, and coke plants. These deliveries originate at many of the mines reporting reserves on Form EIA-7A. EIA uses these data as reasonable indicators of the quality of the reserves at the active mines. The quality produced at a mine may vary from week to week, or from year to year, but in composite, the quality of coal reported on Form 423 is remarkably consistent from supply area to supply area over time. We accept this as indicative that reserves of similar quality will be available in the near term from the currently active mines. We also note that, in many coal supply regions, the quality of coal reported on Form 423 is the quality that can be *produced*, taking advantage of coal washing and of blending of coal from several mines. These coal quality data represent reserves of salable coal, although in situ they may be found mostly in less pure forms, in a wider range of pre-blending qualities.

Status of EIA's Coal Reserves Data Base

The CRDB program is EIA's vehicle for future revisions of the DRB and estimated recoverable reserves with coal quality allocations. The CRDB data are improved by new coal resource data, using coal quality analyses sampled in and selected for their applicability to the coal resources. On the other hand, for the coal supply areas for which CRDB projects are not currently feasible, the EIA continues periodic adjustments of the existing data to account for resource depletion. This is done to maintain a unified national database of the remaining DRB and estimated recoverable reserves adjusted to the latest common effective date.

A "base year" (Table A1) is the effective date of the detailed resource assessment for a DRB resource area, including adjustments for all known coal mined out and/or lost to mining (as of the base year). The source studies on which the DRB was based may be much older and, in many cases, were done at various times over a range of years. A latest common effective date is used to maintain database compatibility. It is the date to which data of varying base years, are adjusted to account for subsequent production and coal lost in mining.

Although major updates are being made in the CRDB, many important coal supply areas are still based on 1971 base year DRB data and on allocations performed in the 1980s for the EIA's Resource Allocation and Mine Costing (RAMC) model (Table A1). The DRB covers all States for which there are sufficient coal resource data to compute a reserve base. Beginning with the 1992 update year, coal quality allocations were extended to all DRB data, including those not used in RAMC, for which allocations had not previously been done.

Specialized Resource and Reserve Terminology

Understanding the specialized terminology of coal resources and reserves and the contexts in which the terms have become established at EIA, the USGS, or the BOM is critical for clear comprehension of the information presented in this report. These specialized terms are related either to EIA's DRB or Coal Reserves Data Base (CRDB), or to USGS CAS or BOM CRS, especially in those topics pertinent to EIA in updating U.S. coal reserves data. Specialized terms are *italicized* on initial use in a topical discussion and can be found in definition form in the Glossary of Selected Coal Classification Terms following Chapter 4 of this report.

EIA Terminology

EIA uses coal resources data as a starting point for projections of coal supplies covering periods of the future that reasonably can be modeled—usually not more than about 30 years. Speculative and hypothetical resource estimates are not relevant for those projections: there is not enough hard data behind the estimates to define the thicknesses, quantities, coal characteristics, and mining conditions that would apply. EIA focuses on resources such as in the DRB, with physical parameters similar to coal that is presently being mined, or could be mined at a profit in the foreseeable future, under reasonable assumptions regarding prices, market conditions, and extraction systems.

Because reserves are the amount of in situ coal resources that could be recovered by economical mining at the time of determination, they can in the strictest sense be defined only for a specified selling price and at a specified point in time. For coal, such reserve estimates might be done for mine planning. Still, many mines do not develop them, and those that do normally do not disclose them to the Federal Government. Therefore, EIA's broad *estimated recoverable reserves* are based on the DRB, consistent with its definition as that portion of identified resources from which reserves are calculated.

Underlying the original concept of a DRB was a reasonable assumption that reserves should be calculated only from measured and indicated resources because the quantities and characteristics of those resources are based on adequate data and are geologically well assured. In 1975, the resources in the earliest DRB (January 1, 1974) probably encompassed most areas of active mining and many virgin resource areas. Today, especially where the DRB is based on the same sources used in 1975, mining may extend into reserves that are beyond the scope of the DRB sources. Disparities may be related to the areas studied, specific coalbeds studied, reassessment of older areas using additional data, and/or the thoroughness of the old resource data (for example, some sources offer no basis for distinguishing surface- from underground-minable resources, and yet both types of mining may occur). EIA has drawn selectively on the inferred reserve base to document additional reserves in some such

Table A1. Summary of 1992 Status of Database Updates for Energy Information Administration (EIA) Coal Resource and Reserve Data

Update Year	Base Year	Lead Agency	State or Producing Area	Source Comments
1996	1993	Kentucky Geological Survey	Eastern Kentucky field	1983 coal resource data, State coal analyses, USGS availability data, EIA recovery and accessibility data.
1995	1994	Illinois State Geological Survey	Illinois	State coal mapping system, coal analyses, USGS availability data, State and EIA recovery data and accessibility standards.
1994	1993	New Mexico Bureau of Mines and Mineral Resources	New Mexico portion of San Juan Basin and its southern extensions	State mapping system and coal quality data, company data, BLM land use data, State and EIA depletion and recovery data.
1995	1991	EIA	New Mexico portion of Raton Basin	Resource data from published report, accessibility estimated, EIA recovery data.
1992	1981	EIA	Pennsylvania (anthracite)	Resource data and accessibility from published study, EIA recovery estimates.
1992	1991	Geological Survey of Wyoming	Wyoming, surface-minable DRB of major coalfields	State coal resource files and published studies, State coal analyses and FERC data, USGS maps for land use, State and EIA production and active-mines reserve data.
1991	1991	Ohio Geological Survey	Major coal-bearing counties of Ohio	Resources from new State data points, State coal analyses, except: published study for non-priority counties; accessibility from State estimates and EIA analysis of National Forest and roadway restrictions.
1991	1979 (based on 1946-1980 studies)	EIA	Arkansas, Colorado, New Mexico, and Virginia (anthracite fields), Alaska (northern), Georgia, Idaho, Michigan, North Carolina, Oregon	DRBs allocated to Btu/sulfur ranges using EIA coal quality data and published coal analyses.
1980-1986	1971, (based on 1907-1971 data and 1972-1985 updates)	EIA (core Resource Allocation and Mine Costing Model file)	Alabama, Alaska (southern), Arizona, Arkansas, Colorado, Indiana, Iowa, Kansas, Kentucky (western), Louisiana, Maryland, Missouri, Montana, North Dakota, Oklahoma, Pennsylvania (bituminous), South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wyoming (underground)	Basic Btu/sulfur allocations done in 1980 and 1986, based on 1971 DRB and extended to various updated DRB estimates from small post-1971 studies.

regions, where the mining industry is soundly established (based on evidence such as infrastructure, current production levels, recoverable reserves at active mines, and long-term contracts) and actual mine development has outpaced publicly available resource data for the DRB.

The reserves data that EIA develops from the DRB are its *estimated recoverable reserves*. The estimated recoverable reserves published in this report (Table B2) include only data derived from the DRB; any EIA recoverable reserve estimates that may be based on inferred data are exceptional, for use in data-intensive modeling situations. In previous reports of these data, EIA has used the term "recoverable reserves." We have added "estimated" to emphasize that they are extracted from the DRB using estimated regional factors to simulate expected accessibility and coal recoverability. The use of the modifier "recoverable" with reserves is technically redundant, but has long been preferred by EIA to emphasize that the part of the DRB that may be recoverable is being estimated. The estimated recoverable reserves are derived (not compiled from mine-level data) and are based on regional aggregations of resource data.

Estimated recoverable reserves are developed by adjusting the DRB by *accessibility factors* and *recovery factors*. An *accessible reserve base* is coal resource data derived by adjusting the DRB by accessibility factors only, and is a subset of *accessible resources. Accessibility* of resources is based primarily on *land use restrictions* that influence whether land areas and underlying coal resources may legally be available for mining. A secondary basis for accessibility is the *technological restrictions* that may affect economic minability of specific coal resources in a locality at the time of the evaluation. *Technological restrictions* include constraints on the economic or safe mining of the coal with contemporary technologies, which constraints are related to the nature of the coalbeds or local geology; for example, specific coalbed thickness or overburden characteristics known to deter economic mining of coal meeting broad regional DRB criteria, localized geologic structural problems, or unsafe or illegal proximity to another mine. Recovery factors used by EIA to estimate recoverable reserves are based on actual *recovery rates* reported by mines operating in the same regions, applied only to DRB coalbed depth and bed thickness categories that broadly define technologically minable conditions.

In addition, EIA uses traditional regional *recovery factors* to update the DRB for the effects of *depletion*. The traditional recovery factors—50 percent for underground and 80 percent for most surface mining—may appear conservative but were meant as reasonable estimates of net recovery of resources in the ground over a region, considering the fact that reported production ignores unmeasured amounts of coal that are left in place. This is not done just to support the roof. Coal is left in place to provide solid barriers between adjacent mines, to maintain barriers and keep mines sealed in sections near outcrops, and to support surface installations such as holding ponds and *preparation plants*. It is also left in place for safety, or environmental protection in numerous other circumstances, such as weak floor materials, unstable roof, or fault zones, and to isolate oil and gas wells left in place. The traditional recovery factors will be used to update the DRB for annual depletion until such time as coordinated accessibility and recovery factors are available for all major areas and production periods of the DRB and can be

The term "demonstrated reserve base (DRB)," or "reserve base" in the standard USGS classification, has been widely misunderstood, probably since soon after it was introduced in 1975. It is not a database of <u>reserves</u>, as many assume. Rather, it is made up of *resources* in the ground and serves as a basis, or base, from which to calculate reserves. The concept was especially needed for regional estimates (i.e., covering large areas rather than mine areas), for which earlier assessments of quantities of coal in the ground varied broadly and were inconsistent, reporting as both reserves and resources. The U.S. Bureau of Mines coined the term "reserve base" to identify this subset of coal resources. Reasonable mining potential was intended to be the unifying principle. EIA inherited the DRB and has continued to update it. The DRB data are firmly established at this time and have consistently followed a defined set of criteria for all updates from 1975 to 1995.

It is often suggested that "resource base" would be a more appropriate name. The term has become widely used but appears to be undefined. In most usages it seems to be analogous to the USGS term "total resources," but may improperly imply technological or scientific legitimacy (perhaps reminiscent of the idealized term, "knowledge base"). We believe that the proper role for this term is already filled by the terms "total resources" and, in some cases, "identified resources." Further, it would not be preferable to "reserve base" because "resource base" seems more broadly inclusive than the criteria for the DRB.

applied to revise historic depletion, to maintain yearly depletion, and to project forward depletion.

Land use restrictions make up a major part of EIA's accessibility adjustments. They include all legal or cultural impediments to mining that withhold the actual land area and / or its underlying coal resources from coal recovery activities. Land use restrictions may be "environmental restrictions" (such as endangered species habitat or some public lands) or "societal restrictions" (such as cemeteries, historic sites, reservoirs, or highways)—modifiers that emphasize the environmental or societal values motivating the land use restrictions.

EIA does not classify as environmental restrictions the environmental regulations that an operator may believe render a coal uneconomic to mine because of the costs of compliance, or environmental combustion standards that may make a coal less desirable and valuable in the marketplace, or similar environmental regulations that may affect mining costs or coal selling prices. These can be serious impediments to the economic mining of specific coal deposits at certain times, under contemporary mining and combustion technologies, but they are not related to land use and cannot readily be estimated from land use mapping. The costs that environmental regulations add to mining and the effects of environmental standards on coal values, however, are factors that EIA attempts to account for in the mine costing and demand variables for future coal supply projections.

EIA collects data from mine operators on their estimated *recoverable reserves at active mines*. These reserves are based on estimated recovery rates of coal in place, as reported by mine operators. In EIA's coal supply models, recoverable reserves at active mines are also referred to as *committed reserves*. "Committed reserves" is used to identify the quantity of reserves known to exist at currently active mines—the recovery of which is already committed due to investments at those mines—and to distinguish those reserves from the much larger quantity of estimated recoverable reserves. The quantity of reserves that are not committed at any existing mines (identified in EIA models as *available reserves* for new mine development) is the difference between estimated recoverable reserves and the committed reserves for a *coal supply region*. Strictly speaking, the difference between estimated recoverable reserves and committed reserves is not a measure of reserves that are available to supply new mines, and it can serve only as a guideline. This is because the estimated recoverable reserves and the recoverable reserves at active mines are derived by two different procedures and the data for either source (usually the recoverable reserves at active mines) may be much more current and comprehensive.

Data on coal production and recoverable reserves at active mines are collected by EIA for *salable coal*. Depending on the *quality* of the coal mined, the intended use of the coal, and local mining practice and infrastructure, the salable coal, or product, may be shipped raw as *run-of-mine* coal (either crushed and screened or unprepared), or it may be treated in a *preparation plant* to further remove impurities before shipping. Neither EIA nor any other public agency is authorized to collect data on the quantities and quality of mined coal before and after any processing. Therefore, actual data on quality of coal produced are not available, nor are actual data to calculate differences in coal quality and quantity of reserves versus coal shipped to customers.

USGS Terminology

Specialized terms developed by the USGS in the course of conducting Coal Availability Studies (CAS) and by the BOM in its Coal Recoverability Studies (CRS) may all be referenced in the rest of this report as "USGS terminology" because the USGS has taken over a limited CRS program from the BOM. The USGS terminology and the CAS and CRS programs are inherently important to EIA coal reserves data. The key USGS term is *available resources*. The USGS definition of available resources reflects a mapping methodology appropriate to integrated, three-dimensional mapping systems like the National Coal Resources Data System (NCRDS)—mapping systems that include planimetric, topographic, geologic, land use, and some environmental data. Using these systems, available-resource criteria can be adjusted to take in local variances in mining practices and land use policies, or can readily be revised if conditions change.

Thus, USGS available resources make use of mapped data in a defined study area to withdraw mined-out areas[59] directly from the resource areas. Regardless of how they are estimated in CAS, mined-out resources and restricted resources are treated as not available. The original resources are the basis for all ratios or percentages of *availability*. In other words, if the resources in a CAS were totally unencumbered by any physical or societal restrictions, but 30 percent of the resources were mined out, the CAS would classify the coal of the area as 30 percent mined out and only 70 percent available.

[59]Mined-out areas include coal that has been recovered as well as coal left in pillars or otherwise lost in the mining process. CAS can be conducted only if comprehensive mapping of past mining is available.

Much of EIA's DRB, on the other hand, previously depended on mapping of *original resources* to define primary resource quantities. (Only in recent updates, based on computerized mapping systems, are remaining resources mapped directly by subtracting mapped areas of past mining.) Original resources (or DRB) are converted to estimated remaining resources (or DRB) using historic production records and regional depletion factors. Regardless of derivation method, the remaining DRB data are readjusted periodically for further depletion (production tonnage plus estimated coal lost in mining). These data on remaining DRB, and not the original resources or DRB, become the basis for estimates of accessibility. In the example in the previous paragraph, the DRB would report the estimated remaining resources, adjusted for the 30-percent depleted on the basis of recorded production, but would classify the coal as 100 percent accessible. This is one difference between USGS availability and EIA accessibility.

The CAS define the basic physical parameters of coalbeds as *technological restrictions*. These parameters—coal bed thickness and depth from the surface—happen to be two of the fundamental criteria EIA has always used to include resources of greater mining potential in the DRB. Available resources, like the DRB, exclude quantities of coal in beds thinner than a specific threshold value. In USGS terminology, these thin-bedded restricted resources are considered not available for mining but are still considered part of the original resource basis. In the earlier example, if 30 percent of the resources are mined out and, say, 40 percent are designated as restricted due to bed thickness, only 30 percent of the original resources are available. By contrast, in the DRB the thin-bedded resources are catalogued as part of the identified resource but, because of the bed thickness criterion, have never been included in the DRB. Therefore, there would be no further adjustment to DRB accessibility because of bed thickness: the remaining DRB (adjusted for depletion as of a stated date) would still be considered 100 percent accessible.

USGS adjustments for bed thickness restrictions and depletion due to mining can generate drastic differences between coal resource availability and coal resource accessibility, but the differences grow out of the definitions of the terms and the methods for calculating the resources. The available resources and the accessible DRB for an area could be identical even though the reported percentage available and the accessibility factors are very different.

One further difference is in scope: The CAS report available resources are reported for measured, indicated, and inferred resources whereas the accessible DRB includes measured and indicated only. The potential impact of this difference is directly related to the density and distribution of data points throughout a study area—if the density is greater and the distribution of data points in a defined area is more even, the measured and indicated resources will predominate and resources relegated to the inferred category will decline. In practice, this difference has not had a direct effect on any regional resource estimates because CAS have not been conducted in broad areas, comparable to DRB areas. CAS have been performed only in selected quadrangles. No method to translate their results to entire coal supply regions has yet been accepted, but any eventual extrapolation must be able to distinguish the effects of lower data density in inferred resource areas from factors such as difficult topography.

The CAS identify *geologic considerations*, such as geologic structure problems or vertical proximity of coalbeds to each other in deep deposits, as restrictions to availability. Traditional DRB derivations, on the other hand, often took stock of geologic structural problems and deleted affected areas from the original resource or DRB compilations. For the DRB, the judgment of the principal investigator may be documented; however, the physical work maps on which the calculations were based may be lost or in files of the original field personnel or BOM field offices, and are usually not available nor readily updatable.

The proximity of coalbeds one above another is considered in CAS studies. For underground mines, mining a coalbed that is separated by, say, less than 40 feet of rock from the next coalbed above or below, can render the unmined coalbed unrecoverable because of fracturing or collapse of overlying strata and transmission of stress in zones above and below a mined bed. The thickness of rock between coalbeds that may be affected varies and can greatly exceed 40 feet in some geologic conditions. Without computerized, three-dimensional mapping, proximity of coalbeds has not been practical in most traditional coal resource studies, including most sources of the DRB. Coalbed proximity restrictions have been noted in most CAS, but regional extrapolations based on proximity restrictions have not been developed. Nonetheless, geologic considerations are designated as restrictions to availability in the USGS terminology whereas geologic considerations in the DRB—if enough geologic information was available—were applied by excluding the affected resources prior to DRB compilation.

Regardless of differences in scope and scale, the results of the CAS are very relevant for updating DRB accessibility rates related to land use. *Land use restrictions* are identifiable and separable in CAS data. Accordingly, CAS have been used to update those factors that the studies share in common with DRB accessibility and represent a significant new source of information. Any additional impacts on accessibility due to *technological restrictions* are usually based on the experience and observations of field investigators and information supplied by operators.

In summary, USGS available resources are compatible with EIA accessible resource or accessible DRB estimates even though differences exist both in the sequencing of adjustments and in the nomenclature. The concept of accessibility is appropriate for the DRB, in which resources are separately adjusted for bed thickness and depth and to account for depletion. The concept of availability is appropriate in the CAS, in which computerized, updatable mapping systems are used to exclude bed thicknesses, depths, and depleted resources by graphical methods that are also used to analyze other restrictions, including technological and land use.

In regard to the DRB, it would not be appropriate to substitute the term “available” for “accessible” because EIA already uses that term in other contexts related to coal supplies. “Available coal reserves” is a logical descriptor used for the reserves for future mines in EIA coal supply projections that are determined by subtracting the committed reserves at active mines from the estimated recoverable reserves for a coal supply region. Also, the coal stockpiles at mines and at the facilities of major coal consumers, such as coal-fired electric power plants, are referred to as “available” coal supplies in contexts such as labor strikes or transportation disruptions due to natural forces.

Appendix B

Detailed Estimates of Demonstrated Reserve Base, Estimated Recoverable Reserves, and Recoverable Reserves at Active Mines, for U.S. Coal by Heat and Sulfur Content

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Alabama - Surface							
< 15	0.0	0.0	0.0	1,083.0	0.0	0.0	1,083.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	162.9	239.9	607.1	192.2	0.0	1,202.1
26+	0.0	195.1	138.0	655.0	0.0	0.0	988.0
Total	**0.0**	**358.0**	**377.9**	**2,345.1**	**192.2**	**0.0**	**3,273.1**
Alabama - Underground							
< 15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	146.2	208.8	288.0	113.8	0.0	756.7
26+	0.0	167.2	0.0	438.0	0.0	0.0	605.2
Total	**0.0**	**313.4**	**208.8**	**726.0**	**113.8**	**0.0**	**1,361.9**
Alabama - Total							
<15	0.0	0.0	0.0	1,083.0	0.0	0.0	1,083.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	309.1	448.7	895.1	305.9	0.0	1,958.8
26+	0.0	362.3	138.0	1,093.0	0.0	0.0	1,593.2
Total	**0.0**	**671.3**	**586.6**	**3,071.1**	**305.9**	**0.0**	**4,635.0**
Alaska, South - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	487.8	52.0	0.0	0.0	0.0	0.0	539.8
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**487.8**	**52.0**	**0.0**	**0.0**	**0.0**	**0.0**	**539.8**
Alaska, South - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	4,083.2	87.2	0.0	0.0	0.0	0.0	4,170.4
20-22.99	0.0	17.6	0.0	0.0	0.0	0.0	17.6
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**4,083.2**	**104.8**	**0.0**	**0.0**	**0.0**	**0.0**	**4,188.0**
Alaska, South - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	4,571.0	139.2	0.0	0.0	0.0	0.0	4,710.2
20-22.99	0.0	17.6	0.0	0.0	0.0	0.0	17.6
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**4,571.0**	**156.7**	**0.0**	**0.0**	**0.0**	**0.0**	**4,727.7**
Alaska, North - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	17.4	4.9	3.9	2.4	0.0	0.0	28.5
20-22.99	77.3	39.1	0.0	0.0	0.0	0.0	116.3
23-25.99	16.7	5.7	0.0	0.0	0.0	0.0	22.4
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**111.3**	**49.6**	**3.9**	**2.4**	**0.0**	**0.0**	**167.2**
Alaska, North - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	129.4	36.1	28.3	17.9	0.0	0.0	211.7
20-22.99	569.4	286.5	0.0	0.0	0.0	0.0	855.9
23-25.99	125.6	41.9	0.0	0.0	0.0	0.0	167.5
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**824.3**	**364.4**	**28.3**	**17.9**	**0.0**	**0.0**	**1,235.0**
Alaska, North - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	146.7	40.9	32.2	20.3	0.0	0.0	240.1
20-22.99	646.7	325.5	0.0	0.0	0.0	0.0	972.2
23-25.99	142.2	47.6	0.0	0.0	0.0	0.0	189.9
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**935.6**	**414.1**	**32.2**	**20.3**	**0.0**	**0.0**	**1,402.2**

See notes at end of table.

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Arizona - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	87.3	0.0	0.0	0.0	0.0	87.3
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**87.3**	**0.0**	**0.0**	**0.0**	**0.0**	**87.3**
Arizona - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	101.6	0.0	0.0	0.0	0.0	101.6
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**101.6**	**0.0**	**0.0**	**0.0**	**0.0**	**101.6**
Arizona - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	188.8	0.0	0.0	0.0	0.0	188.8
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**188.8**	**0.0**	**0.0**	**0.0**	**0.0**	**188.8**
Arkansas - Surface							
<15	0.0	0.0	0.0	25.3	0.0	0.0	25.3
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.5	0.5
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	2.2	104.2	9.2	1.5	1.5	118.7
Total	**0.0**	**2.2**	**104.2**	**34.5**	**1.5**	**2.0**	**144.5**
Arkansas - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	1.9	1.9
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	14.2	192.7	43.5	10.1	10.1	270.6
Total	**0.0**	**14.2**	**192.7**	**43.5**	**10.1**	**12.0**	**272.5**
Arkansas - Total							
<15	0.0	0.0	0.0	25.3	0.0	0.0	25.3
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	2.4	2.4
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	16.3	296.9	52.8	11.7	11.7	389.3
Total	**0.0**	**16.3**	**296.9**	**78.0**	**11.7**	**14.0**	**417.0**
Colorado - Surface							
<15	0.0	0.0	4,189.9	0.0	0.0	0.0	4,189.9
15-19.99	11.4	4.6	0.4	0.0	0.0	0.0	16.3
20-22.99	144.3	0.0	10.5	12.4	0.0	0.0	167.2
23-25.99	191.9	143.7	25.2	39.2	17.6	0.0	417.7
26+	0.0	3.6	0.0	0.0	0.0	0.0	3.6
Total	**347.6**	**151.9**	**4,225.9**	**51.7**	**17.6**	**0.0**	**4,794.7**
Colorado - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	2,670.3	1,100.7	64.5	0.0	0.0	0.0	3,835.5
20-22.99	1,430.0	1,576.8	241.2	152.9	0.0	0.0	3,400.9
23-25.99	2,176.2	1,223.7	313.6	308.7	156.3	0.0	4,178.5
26+	202.6	283.7	65.7	82.2	0.0	0.0	634.2
Total	**6,479.1**	**4,184.9**	**684.9**	**543.9**	**156.3**	**0.0**	**12,049.0**
Colorado - Total							
<15	0.0	0.0	4,189.9	0.0	0.0	0.0	4,189.9
15-19.99	2,681.7	1,105.3	64.9	0.0	0.0	0.0	3,851.8
20-22.99	1,574.3	1,576.8	251.6	165.4	0.0	0.0	3,568.1
23-25.99	2,368.1	1,367.5	338.8	348.0	173.9	0.0	4,596.1
26+	202.6	287.3	65.7	82.2	0.0	0.0	637.8
Total	**6,826.6**	**4,336.8**	**4,910.8**	**595.5**	**173.9**	**0.0**	**16,843.7**

See notes at end of table.

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Georgia - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.1	0.0	0.2	0.0	0.0	0.2
26+	0.3	0.5	0.5	0.0	0.1	0.1	1.5
Total	**0.3**	**0.6**	**0.5**	**0.2**	**0.1**	**0.1**	**1.7**
Georgia - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.1	0.0	0.1	0.0	0.0	0.2
26+	0.8	0.3	0.2	0.1	0.2	0.2	1.7
Total	**0.8**	**0.4**	**0.2**	**0.2**	**0.2**	**0.2**	**1.9**
Georgia - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.2	0.0	0.3	0.0	0.0	0.4
26+	1.1	0.8	0.6	0.1	0.3	0.3	3.2
Total	**1.1**	**1.0**	**0.6**	**0.4**	**0.3**	**0.3**	**3.6**
Idaho - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Idaho - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.3	2.1	1.0	1.0	0.0	0.0	4.4
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.3**	**2.1**	**1.0**	**1.0**	**0.0**	**0.0**	**4.4**
Idaho - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.3	2.1	1.0	1.0	0.0	0.0	4.4
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.3**	**2.1**	**1.0**	**1.0**	**0.0**	**0.0**	**4.4**
Illinois - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	8.8	121.9	130.7
20-22.99	0.0	0.0	0.0	22.0	421.4	14,009.8	14,453.1
23-25.99	0.0	0.0	1.4	46.5	80.8	1,462.2	1,590.9
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**1.4**	**68.5**	**511.0**	**15,593.9**	**16,174.7**
Illinois - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	72.6	497.5	804.6	2,422.8	2,167.3	43,656.7	49,621.4
23-25.99	0.0	16.9	245.0	1,592.2	1,488.6	20,807.7	24,150.4
26+	0.0	0.0	0.0	0.0	0.0	9.4	9.4
Total	**72.7**	**514.4**	**1,049.5**	**4,015.0**	**3,655.9**	**64,473.8**	**73,781.3**
Illinois - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	8.8	121.9	130.7
20-22.99	72.6	497.5	804.6	2,444.7	2,588.7	57,666.4	64,074.6
23-25.99	0.0	16.9	246.3	1,638.7	1,569.4	22,270.0	25,741.3
26+	0.0	0.0	0.0	0.0	0.0	9.4	9.4
Total	**72.7**	**514.4**	**1,050.9**	**4,083.4**	**4,166.9**	**80,067.7**	**89,956.0**

See notes at end of table.

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Indiana - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	71.5	36.8	152.9	0.0	277.8	538.9
23-25.99	0.0	37.0	9.8	30.6	255.2	246.7	579.3
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**108.5**	**46.5**	**183.5**	**255.2**	**524.4**	**1,118.1**
Indiana - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	336.0	263.6	745.7	1,274.5	2,356.7	4,976.5
23-25.99	0.0	263.0	116.7	622.5	1,081.8	1,812.3	3,896.3
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**599.1**	**380.3**	**1,368.2**	**2,356.4**	**4,168.9**	**8,872.8**
Indiana - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	407.5	300.4	898.6	1,274.5	2,634.4	5,515.4
23-25.99	0.0	300.1	126.5	653.1	1,337.0	2,058.9	4,475.6
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**707.6**	**426.9**	**1,551.7**	**2,611.5**	**4,693.4**	**9,991.0**
Iowa - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	457.0	0.0	457.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**457.0**	**0.0**	**457.0**
Iowa - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	187.3	1,545.2	1,732.5
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**187.3**	**1,545.2**	**1,732.5**
Iowa - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	644.3	1,545.2	2,189.5
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**644.3**	**1,545.2**	**2,189.5**
Kansas - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	76.0	433.0	509.0
23-25.99	0.0	0.0	0.0	0.0	246.4	151.8	398.2
26+	0.0	0.0	0.0	0.0	0.0	68.5	68.5
Total	**0.0**	**0.0**	**0.0**	**0.0**	**322.3**	**653.3**	**975.6**
Kansas - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Kansas - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	76.0	433.0	509.0
23-25.99	0.0	0.0	0.0	0.0	246.4	151.8	398.2
26+	0.0	0.0	0.0	0.0	0.0	68.5	68.5
Total	**0.0**	**0.0**	**0.0**	**0.0**	**322.3**	**653.3**	**975.6**

See notes at end of table.

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)

(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Kentucky, Eastern - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	20.0	50.0	159.8	40.0	139.9	409.6
20-22.99	0.0	199.8	119.9	199.8	209.8	209.8	939.1
23-25.99	10.0	559.4	739.3	769.2	379.6	359.6	2,817.1
26+	239.8	2,187.8	1,138.8	1,398.6	599.4	229.8	5,794.1
Total	**249.8**	**2,967.0**	**2,047.9**	**2,527.4**	**1,228.8**	**939.1**	**9,959.9**
Kentucky, Eastern - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	5.1	12.7	40.5	10.1	35.5	103.8
20-22.99	0.0	50.7	30.4	50.7	53.2	53.2	238.1
23-25.99	2.5	141.8	187.4	195.0	96.2	91.2	714.2
26+	60.8	554.6	288.7	354.6	152.0	58.3	1,468.9
Total	**63.3**	**752.2**	**519.2**	**640.7**	**311.5**	**238.1**	**2,525.0**
Kentucky, Eastern - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	25.0	62.6	200.4	50.1	175.3	513.4
20-22.99	0.0	250.5	150.3	250.5	263.0	263.0	1,177.1
23-25.99	12.5	701.3	926.7	964.2	475.9	450.8	3,531.3
26+	300.5	2,742.4	1,427.6	1,753.1	751.3	288.0	7,263.0
Total	**313.1**	**3,719.2**	**2,567.1**	**3,168.2**	**1,540.3**	**1,177.1**	**12,484.8**
Kentucky, Western - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	59.4	701.1	671.3	1,431.7
23-25.99	0.0	0.0	0.0	140.1	749.6	1,363.9	2,253.5
26+	0.0	0.0	0.0	0.0	29.6	5.1	34.7
Total	**0.0**	**0.0**	**0.0**	**199.5**	**1,480.3**	**2,040.3**	**3,720.0**
Kentucky, Western - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	13.9	1,891.7	2,671.9	4,577.5
23-25.99	0.0	0.0	0.0	60.2	1,859.3	9,176.1	11,095.6
26+	0.0	0.0	0.0	0.0	474.9	211.9	686.7
Total	**0.0**	**0.0**	**0.0**	**74.1**	**4,225.9**	**12,059.9**	**16,359.9**
Kentucky, Western - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	73.2	2,592.8	3,343.2	6,009.3
23-25.99	0.0	0.0	0.0	200.3	2,608.9	10,539.9	13,349.1
26+	0.0	0.0	0.0	0.0	504.5	217.0	721.5
Total	**0.0**	**0.0**	**0.0**	**273.5**	**5,706.2**	**14,100.1**	**20,079.8**
Louisiana - Surface							
<15	0.0	0.0	0.0	471.3	0.0	0.0	471.3
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**471.3**	**0.0**	**0.0**	**471.3**
Louisiana - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Louisiana - Total							
<15	0.0	0.0	0.0	471.3	0.0	0.0	471.3
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**471.3**	**0.0**	**0.0**	**471.3**

See notes at end of table.

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Maryland - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	24.0	0.0	24.0
26+	0.0	4.0	11.8	18.9	23.5	0.0	58.2
Total	**0.0**	**4.0**	**11.8**	**18.9**	**47.5**	**0.0**	**82.2**
Maryland - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	197.7	0.0	197.7
26+	0.0	51.9	90.3	191.8	117.4	0.0	451.4
Total	**0.0**	**51.9**	**90.3**	**191.8**	**315.1**	**0.0**	**649.2**
Maryland - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	221.8	0.0	221.8
26+	0.0	55.8	102.2	210.8	140.8	0.0	509.6
Total	**0.0**	**55.8**	**102.2**	**210.8**	**362.6**	**0.0**	**731.4**
Michigan - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.1	0.0	0.1
20-22.99	0.0	0.0	0.2	0.6	0.1	0.1	0.9
23-25.99	0.0	0.0	0.5	1.9	0.5	0.3	3.2
26+	0.0	0.0	0.0	0.2	0.1	0.0	0.4
Total	**0.0**	**0.0**	**0.7**	**2.7**	**0.8**	**0.4**	**4.6**
Michigan - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.8	0.0	0.8
20-22.99	0.0	0.0	6.6	10.3	6.8	6.5	30.2
23-25.99	0.0	0.0	10.6	32.1	21.7	17.4	81.8
26+	0.0	0.0	0.0	4.8	5.6	0.0	10.4
Total	**0.0**	**0.0**	**17.2**	**47.2**	**34.8**	**23.9**	**123.1**
Michigan - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.9	0.0	0.9
20-22.99	0.0	0.0	6.8	10.8	6.9	6.6	31.1
23-25.99	0.0	0.0	11.1	34.1	22.2	17.6	85.0
26+	0.0	0.0	0.0	5.0	5.7	0.0	10.7
Total	**0.0**	**0.0**	**17.9**	**49.9**	**35.6**	**24.2**	**127.7**
Missouri - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	77.9	2,823.7	2,901.5
23-25.99	0.0	0.0	0.0	0.0	136.8	1,438.2	1,575.0
26+	0.0	0.0	0.0	0.0	0.0	40.0	40.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**214.6**	**4,301.9**	**4,516.5**
Missouri - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	6.2	1,181.9	1,188.1
23-25.99	0.0	0.0	0.0	0.0	35.8	239.7	275.5
26+	0.0	0.0	0.0	0.0	0.0	15.5	15.5
Total	**0.0**	**0.0**	**0.0**	**0.0**	**42.0**	**1,437.1**	**1,479.1**
Missouri - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	84.1	4,005.6	4,089.7
23-25.99	0.0	0.0	0.0	0.0	172.6	1,677.9	1,850.5
26+	0.0	0.0	0.0	0.0	0.0	55.5	55.5
Total	**0.0**	**0.0**	**0.0**	**0.0**	**256.6**	**5,739.1**	**5,995.7**

See notes at end of table.

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Montana - Surface							
<15	1,860.4	3,720.7	5,842.6	1,546.2	1,860.4	930.2	15,760.5
15-19.99	20,183.6	4,971.9	5,997.2	1,501.7	184.6	215.1	33,054.1
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**22,043.9**	**8,692.6**	**11,839.8**	**3,048.0**	**2,045.0**	**1,145.3**	**48,814.6**
Montana - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	30,392.4	19,001.0	14,304.0	4,472.8	676.9	726.3	69,573.3
20-22.99	349.6	422.9	70.5	211.0	137.8	193.5	1,385.4
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**30,742.0**	**19,423.9**	**14,374.5**	**4,683.8**	**814.7**	**919.8**	**70,958.7**
Montana - Total							
<15	1,860.4	3,720.7	5,842.6	1,546.2	1,860.4	930.2	15,760.5
15-19.99	50,575.9	23,972.9	20,301.2	5,974.5	861.5	941.4	102,627.4
20-22.99	349.6	422.9	70.5	211.0	137.8	193.5	1,385.4
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**52,785.9**	**28,116.5**	**26,214.3**	**7,731.8**	**2,859.7**	**2,065.1**	**119,773.3**
New Mexico - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	1,052.1	1,222.9	2,208.9	0.0	0.0	4,483.9
20-22.99	0.0	488.7	402.0	901.1	0.0	0.0	1,791.8
23-25.99	0.0	9.7	0.0	7.4	0.0	0.0	17.1
26+	46.7	1.9	0.0	0.0	0.0	0.0	48.6
Total	**46.7**	**1,552.4**	**1,624.9**	**3,117.4**	**0.0**	**0.0**	**6,341.4**
New Mexico - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	1,225.6	516.4	1,423.2	0.0	0.0	3,165.2
20-22.99	0.0	843.4	598.9	654.6	0.0	0.0	2,096.8
23-25.99	0.0	564.5	0.3	31.8	0.0	0.0	596.7
26+	48.7	297.1	0.9	0.0	0.0	0.0	346.7
Total	**48.7**	**2,930.6**	**1,116.5**	**2,109.6**	**0.0**	**0.0**	**6,205.4**
New Mexico - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	2,277.7	1,739.3	3,632.1	0.0	0.0	7,649.1
20-22.99	0.0	1,332.0	1,000.9	1,555.7	0.0	0.0	3,888.6
23-25.99	0.0	574.2	0.3	39.2	0.0	0.0	613.7
26+	95.4	299.0	0.9	0.0	0.0	0.0	395.3
Total	**95.4**	**4,483.0**	**2,741.4**	**5,227.0**	**0.0**	**0.0**	**12,546.8**
North Carolina - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
North Carolina - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.7	2.9	3.6
26+	0.0	0.0	0.7	3.6	2.9	0.0	7.1
Total	**0.0**	**0.0**	**0.7**	**3.6**	**3.6**	**2.9**	**10.7**
North Carolina - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.7	2.9	3.6
26+	0.0	0.0	0.7	3.6	2.9	0.0	7.1
Total	**0.0**	**0.0**	**0.7**	**3.6**	**3.6**	**2.9**	**10.7**

See notes at end of table.

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
North Dakota - Surface							
<15	571.1	983.3	1,802.4	4,506.1	1,123.3	483.7	9,470.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**571.1**	**983.3**	**1,802.4**	**4,506.1**	**1,123.3**	**483.7**	**9,470.0**
North Dakota - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
North Dakota - Total							
<15	571.1	983.3	1,802.4	4,506.1	1,123.3	483.7	9,470.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**571.1**	**983.3**	**1,802.4**	**4,506.1**	**1,123.3**	**483.7**	**9,470.0**
Ohio - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	18.2	34.0	93.0	282.1	636.5	1,063.8
23-25.99	30.7	85.1	135.1	441.4	948.2	2,597.8	4,238.2
26+	0.0	40.9	82.8	106.5	106.9	268.2	605.3
Total	**30.7**	**144.2**	**251.9**	**640.9**	**1,337.2**	**3,502.5**	**5,907.3**
Ohio - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	9.1	10.5	156.5	641.5	1,482.4	2,300.1
23-25.99	140.0	112.1	289.7	1,025.2	2,565.2	8,248.4	12,380.6
26+	0.0	42.1	78.8	286.9	811.8	1,946.4	3,165.9
Total	**140.0**	**163.3**	**379.0**	**1,468.6**	**4,018.6**	**11,677.2**	**17,846.7**
Ohio - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	27.3	44.5	249.6	923.6	2,118.9	3,363.9
23-25.99	170.6	197.1	424.8	1,466.6	3,513.5	10,846.2	16,618.8
26+	0.0	83.0	161.6	393.4	918.7	2,214.6	3,771.3
Total	**170.6**	**307.5**	**630.9**	**2,109.5**	**5,355.7**	**15,179.8**	**23,754.0**
Oklahoma - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	26.7	26.7
23-25.99	0.0	29.0	5.0	9.0	14.3	89.6	146.9
26+	0.0	65.4	30.5	39.3	33.4	0.0	168.6
Total	**0.0**	**94.4**	**35.5**	**48.3**	**47.7**	**116.4**	**342.2**
Oklahoma - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	64.9	64.9
23-25.99	0.0	61.2	83.4	75.4	55.7	148.9	424.5
26+	0.0	269.7	126.9	234.7	116.6	0.0	748.0
Total	**0.0**	**330.9**	**210.4**	**310.1**	**172.3**	**213.8**	**1,237.4**
Oklahoma - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	91.6	91.6
23-25.99	0.0	90.1	88.4	84.3	70.0	238.5	571.4
26+	0.0	335.2	157.4	274.1	150.0	0.0	916.6
Total	**0.0**	**425.3**	**245.9**	**358.4**	**220.0**	**330.1**	**1,579.6**

See notes at end of table.

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Oregon - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.8	0.4	0.6	0.0	0.2	0.2	2.3
20-22.99	0.4	0.0	0.2	0.0	0.0	0.0	0.6
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**1.3**	**0.4**	**0.8**	**0.0**	**0.2**	**0.2**	**2.9**
Oregon - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	4.2	2.1	3.1	0.0	1.0	1.0	11.4
20-22.99	2.1	0.0	1.0	0.0	0.0	0.0	3.1
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**6.2**	**2.1**	**4.2**	**0.0**	**1.0**	**1.0**	**14.5**
Oregon - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	5.0	2.5	3.7	0.0	1.3	1.3	13.7
20-22.99	2.5	0.0	1.3	0.0	0.0	0.0	3.7
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**7.5**	**2.5**	**5.0**	**0.0**	**1.3**	**1.3**	**17.4**
Pennsylvania, Anthracite - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	10.9	2.0	3.9	0.0	0.0	16.8
23-25.99	427.2	1,689.5	431.3	75.2	11.1	4.1	2,638.4
26+	97.6	494.6	108.3	18.9	0.2	0.0	719.6
Total	**524.8**	**2,195.0**	**541.7**	**98.0**	**11.3**	**4.1**	**3,374.8**
Pennsylvania, Anthracite - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	13.2	0.0	3.9	0.0	0.0	17.1
23-25.99	864.2	1,906.0	251.7	30.5	4.3	0.0	3,056.8
26+	197.0	415.2	135.2	26.6	2.5	0.0	776.4
Total	**1,061.2**	**2,334.5**	**386.9**	**61.0**	**6.8**	**0.0**	**3,850.4**
Pennsylvania, Anthracite - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	24.1	2.0	7.8	0.0	0.0	33.9
23-25.99	1,291.4	3,595.6	683.1	105.7	15.4	4.1	5,695.2
26+	294.6	909.8	243.5	45.5	2.7	0.0	1,496.1
Total	**1,586.0**	**4,529.5**	**928.6**	**159.0**	**18.1**	**4.1**	**7,225.2**
Pennsylvania, Bituminous - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	40.2	18.6	58.8
23-25.99	0.0	6.8	28.6	153.1	148.9	129.8	467.2
26+	0.0	25.3	63.6	287.0	137.2	45.7	558.7
Total	**0.0**	**32.1**	**92.2**	**440.1**	**326.2**	**194.1**	**1,084.7**
Pennsylvania, Bituminous - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	95.9	246.5	226.9	569.4
23-25.99	0.0	95.7	241.1	2,147.6	2,861.1	1,672.3	7,017.8
26+	0.0	390.5	1,146.1	6,528.6	4,223.5	682.0	12,970.7
Total	**0.0**	**486.2**	**1,387.2**	**8,772.1**	**7,331.2**	**2,581.2**	**20,557.9**
Pennsylvania, Bituminous - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	95.9	286.7	245.6	628.2
23-25.99	0.0	102.5	269.7	2,300.7	3,010.0	1,802.1	7,485.0
26+	0.0	415.8	1,209.7	6,815.5	4,360.7	727.7	13,529.4
Total	**0.0**	**518.3**	**1,479.4**	**9,212.1**	**7,657.4**	**2,775.3**	**21,642.6**

See notes at end of table.

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
South Dakota - Surface							
<15	0.0	0.0	137.0	1.0	228.1	0.0	366.1
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**137.0**	**1.0**	**228.1**	**0.0**	**366.1**
South Dakota - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
South Dakota - Total							
<15	0.0	0.0	137.0	1.0	228.1	0.0	366.1
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**137.0**	**1.0**	**228.1**	**0.0**	**366.1**
Tennessee - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	108.6	0.0	0.0	108.6
26+	0.0	57.2	34.6	28.7	59.1	0.0	179.6
Total	**0.0**	**57.2**	**34.6**	**137.3**	**59.1**	**0.0**	**288.2**
Tennessee - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	179.7	0.0	0.0	179.7
26+	0.0	123.0	69.6	59.5	107.1	0.0	359.3
Total	**0.0**	**123.0**	**69.6**	**239.2**	**107.1**	**0.0**	**539.0**
Tennessee - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	288.3	0.0	0.0	288.3
26+	0.0	180.2	104.2	88.2	166.3	0.0	538.9
Total	**0.0**	**180.2**	**104.2**	**376.5**	**166.3**	**0.0**	**827.1**
Texas - Surface							
<15	0.0	0.0	767.0	7,379.8	4,429.2	488.9	13,064.8
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**767.0**	**7,379.8**	**4,429.2**	**488.9**	**13,064.8**
Texas - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Texas - Total							
<15	0.0	0.0	767.0	7,379.8	4,429.2	488.9	13,064.8
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**767.0**	**7,379.8**	**4,429.2**	**488.9**	**13,064.8**

See notes at end of table.

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Utah - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	34.7	21.9	106.8	44.0	42.6	250.0
23-25.99	9.0	4.9	1.8	0.0	0.0	0.0	15.7
26+	1.3	0.9	0.0	0.0	0.0	0.0	2.2
Total	**10.3**	**40.5**	**23.7**	**106.8**	**44.0**	**42.6**	**267.9**
Utah - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.6	0.6	0.0	0.0	0.0	1.1
20-22.99	0.0	785.1	939.4	1,590.5	386.8	545.1	4,247.0
23-25.99	617.9	349.0	151.7	0.0	0.0	0.0	1,118.6
26+	137.4	183.8	0.0	0.0	0.0	0.0	321.2
Total	**755.2**	**1,318.5**	**1,091.7**	**1,590.5**	**386.8**	**545.1**	**5,687.8**
Utah - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.6	0.6	0.0	0.0	0.0	1.1
20-22.99	0.0	819.8	961.3	1,697.3	430.8	587.7	4,497.0
23-25.99	626.9	353.9	153.5	0.0	0.0	0.0	1,134.3
26+	138.7	184.7	0.0	0.0	0.0	0.0	323.4
Total	**765.5**	**1,359.0**	**1,115.4**	**1,697.3**	**430.8**	**587.7**	**5,955.7**
Virginia - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	3.4	13.2	110.0	0.0	0.0	0.0	126.6
26+	64.0	294.2	141.4	71.0	0.0	0.0	570.6
Total	**67.4**	**307.4**	**251.5**	**71.0**	**0.0**	**0.0**	**697.3**
Virginia - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	13.4	9.1	13.3	0.0	0.0	0.0	35.7
23-25.99	69.6	144.4	130.0	8.2	0.0	0.0	352.1
26+	187.2	621.2	286.7	147.1	0.0	0.0	1,242.2
Total	**270.1**	**774.8**	**430.0**	**155.2**	**0.0**	**0.0**	**1,630.0**
Virginia - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	13.4	9.1	13.3	0.0	0.0	0.0	35.7
23-25.99	73.0	157.6	240.0	8.2	0.0	0.0	478.8
26+	251.2	915.4	428.1	218.1	0.0	0.0	1,812.8
Total	**337.5**	**1,082.2**	**681.4**	**226.3**	**0.0**	**0.0**	**2,327.3**
Washington - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	68.7	0.0	0.0	68.7
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**68.7**	**0.0**	**0.0**	**68.7**
Washington - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	83.4	169.0	776.1	0.0	0.0	1,028.5
20-22.99	124.8	0.0	0.0	81.4	0.0	0.0	206.2
23-25.99	0.0	97.6	0.0	0.0	0.0	0.0	97.6
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**124.8**	**181.0**	**169.0**	**857.5**	**0.0**	**0.0**	**1,332.3**
Washington - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	83.4	169.0	844.7	0.0	0.0	1,097.1
20-22.99	124.8	0.0	0.0	81.4	0.0	0.0	206.2
23-25.99	0.0	97.6	0.0	0.0	0.0	0.0	97.6
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**124.8**	**181.0**	**169.0**	**926.2**	**0.0**	**0.0**	**1,400.9**

See notes at end of table.

Table B1. Estimates of the Demonstrated Reserve Base of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)

(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining	Sulfur Content (Pounds of Sulfur per Million Btu)						
Heat Content (Million Btu per Short Ton)	≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
West Virginia - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	23.0	23.0
23-25.99	0.0	439.9	391.0	267.1	9.9	71.9	1,179.8
26+	180.3	1,847.8	506.4	451.9	290.6	83.7	3,360.8
Total	**180.3**	**2,287.6**	**897.4**	**719.0**	**300.6**	**178.7**	**4,563.6**
West Virginia - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	187.9	211.4	71.7	471.0
23-25.99	0.0	785.3	815.8	2,063.6	973.6	3,517.6	8,155.9
26+	1,006.6	8,646.0	3,247.2	4,473.9	3,193.0	2,225.9	22,792.7
Total	**1,006.6**	**9,431.3**	**4,062.9**	**6,725.5**	**4,378.0**	**5,815.2**	**31,419.5**
West Virginia - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	187.9	211.4	94.7	494.0
23-25.99	0.0	1,225.1	1,206.8	2,330.7	983.5	3,589.5	9,335.6
26+	1,186.9	10,493.8	3,753.6	4,925.9	3,483.7	2,309.7	26,153.5
Total	**1,186.9**	**11,718.9**	**4,960.3**	**7,444.5**	**4,678.5**	**5,993.9**	**35,983.1**
Wyoming - Surface							
<15	0.0	0.0	0.0	1,127.4	210.0	1,646.3	2,983.7
15-19.99	5,020.3	9,965.5	4,525.6	1,597.9	429.0	956.3	22,494.6
20-22.99	36.1	162.7	216.8	55.1	21.7	0.0	492.4
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**5,056.3**	**10,128.2**	**4,742.4**	**2,780.4**	**660.7**	**2,602.6**	**25,970.7**
Wyoming - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	3,781.4	15,223.0	9,691.9	8,780.7	1,186.1	0.0	38,663.1
20-22.99	491.2	502.2	683.9	365.3	0.0	60.8	2,103.3
23-25.99	82.3	504.2	830.8	341.4	0.0	0.0	1,758.7
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**4,354.9**	**16,229.4**	**11,206.6**	**9,487.3**	**1,186.1**	**60.8**	**42,525.1**
Wyoming - Total							
<15	0.0	0.0	0.0	1,127.4	210.0	1,646.3	2,983.7
15-19.99	8,801.7	25,188.5	14,217.5	10,378.6	1,615.1	956.3	61,157.7
20-22.99	527.3	664.8	900.8	420.4	21.7	60.8	2,595.7
23-25.99	82.3	504.2	830.8	341.4	0.0	0.0	1,758.7
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**9,411.2**	**26,357.6**	**15,949.1**	**12,267.7**	**1,846.8**	**2,663.4**	**68,495.8**
United States - Surface							
<15	2,431.5	4,704.0	12,738.8	16,140.2	7,850.9	3,549.1	47,414.6
15-19.99	25,721.2	16,071.3	11,800.6	5,539.4	662.7	1,433.4	61,228.6
20-22.99	258.0	1,112.7	844.3	1,606.9	2,331.1	19,173.3	25,326.4
23-25.99	688.8	3,186.8	2,118.9	2,696.6	3,214.9	7,916.0	19,821.9
26+	630.0	5,221.4	2,360.9	3,085.3	1,281.6	742.7	13,321.8
Total	**29,729.5**	**30,296.3**	**29,863.4**	**29,068.5**	**15,341.2**	**32,814.4**	**167,113.3**
United States - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	41,060.8	36,764.6	24,790.4	15,511.2	1,874.9	762.8	120,764.7
20-22.99	3,053.1	5,451.6	3,663.9	6,743.1	7,211.1	54,119.3	80,242.1
23-25.99	4,078.5	6,455.7	3,877.6	9,003.2	11,511.9	45,734.4	80,661.3
26+	1,841.0	12,060.5	5,729.6	12,875.9	9,217.5	5,159.7	46,884.2
Total	**50,033.4**	**60,732.4**	**38,061.6**	**44,133.5**	**29,815.4**	**105,776.1**	**328,552.3**
United States - Total							
<15	2,431.5	4,704.0	12,738.8	16,140.2	7,850.9	3,549.1	47,414.6
15-19.99	66,782.0	52,835.9	36,591.0	21,050.7	2,537.6	2,196.2	181,993.3
20-22.99	3,311.1	6,564.3	4,508.2	8,350.1	9,542.2	73,292.6	105,568.4
23-25.99	4,767.3	9,642.6	5,996.5	11,699.8	14,726.8	53,650.3	100,483.3
26+	2,471.0	17,281.8	8,090.5	15,961.2	10,499.2	5,902.3	60,206.0
Total	**79,762.9**	**91,028.7**	**67,925.0**	**73,201.9**	**45,156.6**	**138,590.5**	**495,665.6**

Note: Totals may not equal sum of components because of independent rounding. Heat and sulfur content categories of coal resources and reserves are limited to two decimal places. Conversion of heat and sulfur contents to millions of Btu per short ton and pounds of sulfur per million Btu, respectively, produces values with multiple decimal places. These are rounded to two places prior to category allocations, as an appropriate expression of accuracy for estimates extended to in-place coal resources and reserves.

Source: Energy Information Administration.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Alabama - Surface							
<15	0.0	0.0	0.0	771.4	0.0	0.0	771.4
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	116.1	170.9	432.5	136.9	0.0	856.3
26+	0.0	138.9	98.3	466.6	0.0	0.0	703.8
Total	**0.0**	**255.0**	**269.2**	**1,670.4**	**136.9**	**0.0**	**2,331.5**
Alabama - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	73.7	105.2	145.2	57.3	0.0	381.4
26+	0.0	84.3	0.0	220.8	0.0	0.0	305.0
Total	**0.0**	**157.9**	**105.2**	**365.9**	**57.3**	**0.0**	**686.4**
Alabama - Total							
<15	0.0	0.0	0.0	771.4	0.0	0.0	771.4
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	189.7	276.1	577.6	194.2	0.0	1,237.6
26+	0.0	223.2	98.3	687.3	0.0	0.0	1,008.8
Total	**0.0**	**412.9**	**374.4**	**2,036.4**	**194.2**	**0.0**	**3,017.9**
Alaska, South - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	386.2	41.2	0.0	0.0	0.0	0.0	427.4
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**386.2**	**41.2**	**0.0**	**0.0**	**0.0**	**0.0**	**427.4**
Alaska, South - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	2,067.1	44.1	0.0	0.0	0.0	0.0	2,111.3
20-22.99	0.0	8.9	0.0	0.0	0.0	0.0	8.9
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**2,067.1**	**53.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2,120.2**
Alaska, South - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	2,453.3	85.3	0.0	0.0	0.0	0.0	2,538.6
20-22.99	0.0	8.9	0.0	0.0	0.0	0.0	8.9
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**2,453.3**	**94.2**	**0.0**	**0.0**	**0.0**	**0.0**	**2,547.5**
Alaska, North - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Alaska, North - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Alaska, North - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

See notes at end of table.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)

(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Arizona - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	69.1	0.0	0.0	0.0	0.0	69.1
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**69.1**	**0.0**	**0.0**	**0.0**	**0.0**	**69.1**
Arizona - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	51.4	0.0	0.0	0.0	0.0	51.4
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**51.4**	**0.0**	**0.0**	**0.0**	**0.0**	**51.4**
Arizona - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	120.5	0.0	0.0	0.0	0.0	120.5
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**120.5**	**0.0**	**0.0**	**0.0**	**0.0**	**120.5**
Arkansas - Surface							
<15	0.0	0.0	0.0	17.7	0.0	0.0	17.7
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.4	0.4
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	1.5	73.0	6.5	1.1	1.1	83.1
Total	**0.0**	**1.5**	**73.0**	**24.2**	**1.1**	**1.4**	**101.2**
Arkansas - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.9	0.9
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	6.6	89.8	20.3	4.7	4.7	126.1
Total	**0.0**	**6.6**	**89.8**	**20.3**	**4.7**	**5.6**	**127.0**
Arkansas - Total							
<15	0.0	0.0	0.0	17.7	0.0	0.0	17.7
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	1.2	1.2
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	8.1	162.7	26.8	5.8	5.8	209.2
Total	**0.0**	**8.1**	**162.7**	**44.4**	**5.8**	**7.0**	**228.1**
Colorado - Surface							
<15	0.0	0.0	3,296.4	0.0	0.0	0.0	3,296.4
15-19.99	9.0	3.6	0.3	0.0	0.0	0.0	12.8
20-22.99	113.5	0.0	8.2	9.8	0.0	0.0	131.6
23-25.99	151.0	113.1	19.9	30.9	13.9	0.0	328.6
26+	0.0	2.9	0.0	0.0	0.0	0.0	2.9
Total	**273.4**	**119.5**	**3,324.8**	**40.6**	**13.9**	**0.0**	**3,772.2**
Colorado - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	1,401.3	577.6	33.9	0.0	0.0	0.0	2,012.8
20-22.99	750.5	827.5	126.6	80.3	0.0	0.0	1,784.8
23-25.99	1,142.1	642.2	164.6	162.0	82.0	0.0	2,192.8
26+	106.3	148.9	34.5	43.2	0.0	0.0	332.8
Total	**3,400.2**	**2,196.2**	**359.4**	**285.4**	**82.0**	**0.0**	**6,323.3**
Colorado - Total							
<15	0.0	0.0	3,296.4	0.0	0.0	0.0	3,296.4
15-19.99	1,410.3	581.2	34.1	0.0	0.0	0.0	2,025.7
20-22.99	864.0	827.5	134.8	90.0	0.0	0.0	1,916.3
23-25.99	1,293.0	755.3	184.4	192.9	95.9	0.0	2,521.4
26+	106.3	151.7	34.5	43.2	0.0	0.0	335.7
Total	**3,673.6**	**2,315.7**	**3,684.2**	**326.1**	**95.9**	**0.0**	**10,095.5**

See notes at end of table.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining	Sulfur Content (Pounds of Sulfur per Million Btu)						
Heat Content (Million Btu per Short Ton)	≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Georgia - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.1	0.0	0.0	0.2
26+	0.2	0.4	0.3	0.0	0.1	0.1	1.0
Total	**0.2**	**0.4**	**0.3**	**0.1**	**0.1**	**0.1**	**1.2**
Georgia - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.1
26+	0.3	0.1	0.1	0.0	0.1	0.1	0.8
Total	**0.3**	**0.2**	**0.1**	**0.1**	**0.1**	**0.1**	**0.8**
Georgia - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.1	0.0	0.2	0.0	0.0	0.2
26+	0.6	0.5	0.4	0.0	0.2	0.2	1.8
Total	**0.6**	**0.6**	**0.4**	**0.2**	**0.2**	**0.2**	**2.0**
Idaho - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Idaho - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.1	0.9	0.5	0.5	0.0	0.0	2.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.1**	**0.9**	**0.5**	**0.5**	**0.0**	**0.0**	**2.0**
Idaho - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.1	0.9	0.5	0.5	0.0	0.0	2.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.1**	**0.9**	**0.5**	**0.5**	**0.0**	**0.0**	**2.0**
Illinois - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	4.9	68.2	73.1
20-22.99	0.0	0.0	0.0	11.3	233.3	8,032.4	8,277.1
23-25.99	0.0	0.0	0.9	31.6	52.7	930.6	1,015.8
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.9**	**42.9**	**290.9**	**9,031.2**	**9,366.0**
Illinois - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	5.3	108.8	274.1	788.6	688.2	14,346.9	16,211.8
23-25.99	0.0	4.4	75.3	624.7	588.0	7,096.7	8,389.1
26+	0.0	0.0	0.0	0.0	0.0	1.9	1.9
Total	**5.3**	**113.1**	**349.4**	**1,413.3**	**1,276.2**	**21,445.4**	**24,602.7**
Illinois - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	4.9	68.2	73.1
20-22.99	5.3	108.8	274.1	799.9	921.5	22,379.3	24,488.8
23-25.99	0.0	4.4	76.2	656.3	640.7	8,027.3	9,404.9
26+	0.0	0.0	0.0	0.0	0.0	1.9	1.9
Total	**5.3**	**113.1**	**350.4**	**1,456.2**	**1,567.1**	**30,476.6**	**33,968.7**

See notes at end of table.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining	Sulfur Content (Pounds of Sulfur per Million Btu)						
Heat Content (Million Btu per Short Ton)	≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Indiana - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	41.8	21.5	89.4	0.0	162.4	315.1
23-25.99	0.0	21.7	5.7	17.9	149.2	144.3	338.7
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**63.4**	**27.2**	**107.3**	**149.2**	**306.7**	**653.8**
Indiana - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	139.2	109.2	308.8	527.9	976.0	2,061.1
23-25.99	0.0	108.9	48.3	257.8	448.1	750.6	1,613.7
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**248.1**	**157.5**	**566.7**	**975.9**	**1,726.6**	**3,674.8**
Indiana - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	181.0	130.7	398.2	527.9	1,138.5	2,376.2
23-25.99	0.0	130.6	54.1	275.7	597.3	894.8	1,952.4
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**311.5**	**184.7**	**674.0**	**1,125.1**	**2,033.3**	**4,328.6**
Iowa - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	319.9	0.0	319.9
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**319.9**	**0.0**	**319.9**
Iowa - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	87.3	720.0	807.2
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**87.3**	**720.0**	**807.2**
Iowa - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	407.2	720.0	1,127.1
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**407.2**	**720.0**	**1,127.1**
Kansas - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	53.2	303.1	356.3
23-25.99	0.0	0.0	0.0	0.0	172.5	106.3	278.7
26+	0.0	0.0	0.0	0.0	0.0	47.9	47.9
Total	**0.0**	**0.0**	**0.0**	**0.0**	**225.6**	**457.4**	**683.0**
Kansas - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Kansas - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	53.2	303.1	356.3
23-25.99	0.0	0.0	0.0	0.0	172.5	106.3	278.7
26+	0.0	0.0	0.0	0.0	0.0	47.9	47.9
Total	**0.0**	**0.0**	**0.0**	**0.0**	**225.6**	**457.4**	**683.0**

See notes at end of table.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Kentucky, Eastern - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	11.2	27.9	89.3	22.3	78.1	228.8
20-22.99	0.0	111.6	67.0	111.6	117.2	117.2	524.5
23-25.99	5.6	312.4	412.9	429.6	212.0	200.9	1,573.3
26+	133.9	1,221.9	636.0	781.1	334.8	128.3	3,235.9
Total	**139.5**	**1,657.0**	**1,143.7**	**1,411.5**	**686.2**	**524.5**	**5,562.5**
Kentucky, Eastern - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	2.8	7.1	22.6	5.7	19.8	58.0
20-22.99	0.0	28.3	17.0	28.3	29.7	29.7	133.0
23-25.99	1.4	79.2	104.7	108.9	53.7	50.9	398.8
26+	33.9	309.7	161.2	198.0	84.9	32.5	820.3
Total	**35.4**	**420.1**	**289.9**	**357.8**	**174.0**	**133.0**	**1,410.1**
Kentucky, Eastern - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	14.0	35.0	111.9	28.0	97.9	286.7
20-22.99	0.0	139.9	83.9	139.9	146.9	146.9	657.4
23-25.99	7.0	391.6	517.5	538.5	265.8	251.8	1,972.2
26+	167.8	1,531.6	797.3	979.1	419.6	160.9	4,056.2
Total	**174.8**	**2,077.1**	**1,433.7**	**1,769.4**	**860.2**	**657.4**	**6,972.5**
Kentucky, Western - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	37.1	438.5	419.9	895.5
23-25.99	0.0	0.0	0.0	87.6	468.8	853.0	1,409.4
26+	0.0	0.0	0.0	0.0	18.5	3.2	21.7
Total	**0.0**	**0.0**	**0.0**	**124.7**	**925.8**	**1,276.0**	**2,326.6**
Kentucky, Western - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	5.9	804.7	1,136.5	1,947.1
23-25.99	0.0	0.0	0.0	25.6	790.9	3,903.1	4,719.6
26+	0.0	0.0	0.0	0.0	202.0	90.1	292.1
Total	**0.0**	**0.0**	**0.0**	**31.5**	**1,797.5**	**5,129.8**	**6,958.8**
Kentucky, Western - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	43.0	1,243.1	1,556.4	2,842.5
23-25.99	0.0	0.0	0.0	113.2	1,259.7	4,756.1	6,129.0
26+	0.0	0.0	0.0	0.0	220.5	93.3	313.8
Total	**0.0**	**0.0**	**0.0**	**156.3**	**2,723.3**	**6,405.8**	**9,285.4**
Louisiana - Surface							
<15	0.0	0.0	0.0	349.4	0.0	0.0	349.4
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**349.4**	**0.0**	**0.0**	**349.4**
Louisiana - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Louisiana - Total							
<15	0.0	0.0	0.0	349.4	0.0	0.0	349.4
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**349.4**	**0.0**	**0.0**	**349.4**

See notes at end of table.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Maryland - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	16.3	0.0	16.3
26+	0.0	2.7	8.0	12.8	15.9	0.0	39.4
Total	**0.0**	**2.7**	**8.0**	**12.8**	**32.2**	**0.0**	**55.7**
Maryland - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	108.4	0.0	108.4
26+	0.0	28.4	49.5	105.1	64.3	0.0	247.4
Total	**0.0**	**28.4**	**49.5**	**105.1**	**172.7**	**0.0**	**355.8**
Maryland - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	124.7	0.0	124.7
26+	0.0	31.1	57.5	118.0	80.2	0.0	286.8
Total	**0.0**	**31.1**	**57.5**	**118.0**	**204.9**	**0.0**	**411.5**
Michigan - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.1	0.0	0.1
20-22.99	0.0	0.0	0.1	0.4	0.1	0.1	0.6
23-25.99	0.0	0.0	0.3	1.3	0.3	0.2	2.2
26+	0.0	0.0	0.0	0.1	0.1	0.0	0.2
Total	**0.0**	**0.0**	**0.5**	**1.8**	**0.5**	**0.3**	**3.1**
Michigan - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.3	0.0	0.3
20-22.99	0.0	0.0	3.0	4.6	3.1	2.9	13.6
23-25.99	0.0	0.0	4.8	14.5	9.8	7.8	36.8
26+	0.0	0.0	0.0	2.2	2.5	0.0	4.7
Total	**0.0**	**0.0**	**7.8**	**21.3**	**15.7**	**10.7**	**55.4**
Michigan - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.4	0.0	0.4
20-22.99	0.0	0.0	3.1	5.0	3.1	3.0	14.2
23-25.99	0.0	0.0	5.1	15.8	10.1	8.0	39.0
26+	0.0	0.0	0.0	2.3	2.6	0.0	4.9
Total	**0.0**	**0.0**	**8.2**	**23.1**	**16.2**	**11.0**	**58.5**
Missouri - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	54.5	1,976.7	2,031.2
23-25.99	0.0	0.0	0.0	0.0	95.7	1,006.9	1,102.6
26+	0.0	0.0	0.0	0.0	0.0	28.0	28.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**150.2**	**3,011.6**	**3,161.8**
Missouri - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	2.9	550.7	553.6
23-25.99	0.0	0.0	0.0	0.0	16.7	111.7	128.4
26+	0.0	0.0	0.0	0.0	0.0	7.2	7.2
Total	**0.0**	**0.0**	**0.0**	**0.0**	**19.6**	**669.6**	**689.2**
Missouri - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	57.4	2,527.4	2,584.8
23-25.99	0.0	0.0	0.0	0.0	112.4	1,118.5	1,231.0
26+	0.0	0.0	0.0	0.0	0.0	35.2	35.2
Total	**0.0**	**0.0**	**0.0**	**0.0**	**169.8**	**3,681.2**	**3,851.0**

See notes at end of table.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Montana - Surface							
<15	1,458.2	2,916.3	4,579.4	1,212.0	1,458.2	729.1	12,353.1
15-19.99	16,555.8	4,078.3	4,919.3	1,231.8	151.4	176.4	27,113.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**18,013.9**	**6,994.6**	**9,498.7**	**2,443.8**	**1,609.6**	**905.5**	**39,466.1**
Montana - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	15,386.1	9,619.2	7,241.4	2,264.4	342.7	367.7	35,221.5
20-22.99	177.0	214.1	35.7	106.8	69.8	98.0	701.4
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**15,563.1**	**9,833.4**	**7,277.1**	**2,371.2**	**412.5**	**465.7**	**35,922.8**
Montana - Total							
<15	1,458.2	2,916.3	4,579.4	1,212.0	1,458.2	729.1	12,353.1
15-19.99	31,941.9	13,697.5	12,160.7	3,496.2	494.1	544.1	62,334.5
20-22.99	177.0	214.1	35.7	106.8	69.8	98.0	701.4
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**33,577.1**	**16,827.9**	**16,775.8**	**4,815.0**	**2,022.0**	**1,371.2**	**75,389.0**
New Mexico - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	824.0	1,029.8	1,860.8	0.0	0.0	3,714.6
20-22.99	0.0	396.0	318.5	720.5	0.0	0.0	1,435.0
23-25.99	0.0	7.7	0.0	5.8	0.0	0.0	13.4
26+	37.0	1.5	0.0	0.0	0.0	0.0	38.5
Total	**37.0**	**1,229.2**	**1,348.3**	**2,587.1**	**0.0**	**0.0**	**5,201.5**
New Mexico - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	547.6	248.7	690.6	0.0	0.0	1,487.0
20-22.99	0.0	425.3	292.2	331.8	0.0	0.0	1,049.3
23-25.99	0.0	285.8	0.2	15.4	0.0	0.0	301.3
26+	24.7	150.4	0.4	0.0	0.0	0.0	175.5
Total	**24.7**	**1,409.1**	**541.5**	**1,037.8**	**0.0**	**0.0**	**3,013.0**
New Mexico - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	1,371.6	1,278.4	2,551.4	0.0	0.0	5,201.5
20-22.99	0.0	821.3	610.7	1,052.2	0.0	0.0	2,484.2
23-25.99	0.0	293.5	0.2	21.1	0.0	0.0	314.8
26+	61.6	151.9	0.4	0.0	0.0	0.0	214.0
Total	**61.6**	**2,638.3**	**1,889.7**	**3,624.8**	**0.0**	**0.0**	**8,214.5**
North Carolina - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
North Carolina - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.3	1.3	1.6
26+	0.0	0.0	0.3	1.6	1.3	0.0	3.2
Total	**0.0**	**0.0**	**0.3**	**1.6**	**1.6**	**1.3**	**4.8**
North Carolina - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.3	1.3	1.6
26+	0.0	0.0	0.3	1.6	1.3	0.0	3.2
Total	**0.0**	**0.0**	**0.3**	**1.6**	**1.6**	**1.3**	**4.8**

See notes at end of table.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)

(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
North Dakota - Surface							
<15	435.7	750.1	1,375.0	3,437.6	856.9	369.0	7,224.4
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**435.7**	**750.1**	**1,375.0**	**3,437.6**	**856.9**	**369.0**	**7,224.4**
North Dakota - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
North Dakota - Total							
<15	435.7	750.1	1,375.0	3,437.6	856.9	369.0	7,224.4
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**435.7**	**750.1**	**1,375.0**	**3,437.6**	**856.9**	**369.0**	**7,224.4**
Ohio - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	12.7	22.8	61.4	180.1	420.4	697.4
23-25.99	20.1	56.3	88.7	283.8	612.8	1,709.8	2,771.5
26+	0.0	27.3	56.2	70.4	70.2	173.8	398.0
Total	**20.1**	**96.4**	**167.7**	**415.6**	**863.1**	**2,303.9**	**3,866.8**
Ohio - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	4.1	4.8	68.5	282.2	652.1	1,011.6
23-25.99	61.6	50.1	127.8	438.7	1,131.0	3,640.0	5,449.2
26+	0.0	18.6	35.0	126.4	359.7	851.3	1,391.0
Total	**61.6**	**72.7**	**167.6**	**633.6**	**1,772.9**	**5,143.4**	**7,851.7**
Ohio - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	16.8	27.5	129.9	462.3	1,072.4	1,708.9
23-25.99	81.6	106.4	216.5	722.5	1,743.8	5,349.8	8,220.6
26+	0.0	45.9	91.2	196.9	429.9	1,025.1	1,788.9
Total	**81.6**	**169.0**	**335.3**	**1,049.2**	**2,636.0**	**7,447.3**	**11,718.4**
Oklahoma - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	18.7	18.7
23-25.99	0.0	20.3	3.5	6.3	10.0	62.8	102.8
26+	0.0	45.8	21.4	27.5	23.4	0.0	118.1
Total	**0.0**	**66.1**	**24.9**	**33.8**	**33.4**	**81.5**	**239.6**
Oklahoma - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	30.2	30.2
23-25.99	0.0	28.5	38.9	35.1	25.9	69.4	197.8
26+	0.0	125.7	59.1	109.4	54.3	0.0	348.5
Total	**0.0**	**154.2**	**98.0**	**144.5**	**80.3**	**99.6**	**576.5**
Oklahoma - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	48.9	48.9
23-25.99	0.0	48.8	42.4	41.4	36.0	132.1	300.6
26+	0.0	171.5	80.5	136.9	77.7	0.0	466.6
Total	**0.0**	**220.3**	**122.9**	**178.3**	**113.7**	**181.1**	**816.1**

See notes at end of table.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Oregon - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.6	0.3	0.5	0.0	0.2	0.2	1.7
20-22.99	0.3	0.0	0.2	0.0	0.0	0.0	0.5
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.9**	**0.3**	**0.6**	**0.0**	**0.2**	**0.2**	**2.1**
Oregon - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	1.9	0.9	1.4	0.0	0.5	0.5	5.1
20-22.99	0.9	0.0	0.5	0.0	0.0	0.0	1.4
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**2.8**	**0.9**	**1.9**	**0.0**	**0.5**	**0.5**	**6.5**
Oregon - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	2.5	1.2	1.9	0.0	0.6	0.6	6.8
20-22.99	1.2	0.0	0.6	0.0	0.0	0.0	1.9
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**3.7**	**1.2**	**2.5**	**0.0**	**0.6**	**0.6**	**8.6**
Pennsylvania, Anthracite - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	1.8	0.2	0.6	0.0	0.0	2.6
23-25.99	70.1	204.2	48.9	8.8	1.1	0.4	333.6
26+	15.3	56.4	12.3	2.0	0.0	0.0	86.1
Total	**85.4**	**262.5**	**61.5**	**11.4**	**1.2**	**0.4**	**422.3**
Pennsylvania, Anthracite - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	1.3	0.0	0.4	0.0	0.0	1.7
23-25.99	77.9	165.5	22.6	3.1	0.4	0.0	269.5
26+	16.9	38.2	11.9	2.3	0.2	0.0	69.6
Total	**94.9**	**205.0**	**34.5**	**5.7**	**0.6**	**0.0**	**340.7**
Pennsylvania, Anthracite - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	3.2	0.2	1.0	0.0	0.0	4.3
23-25.99	148.1	369.7	71.6	11.8	1.5	0.4	603.1
26+	32.2	94.6	24.2	4.3	0.2	0.0	155.6
Total	**180.3**	**467.5**	**96.0**	**17.1**	**1.8**	**0.4**	**763.0**
Pennsylvania, Bituminous - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	28.0	13.0	41.0
23-25.99	0.0	4.7	19.9	106.7	103.7	90.4	325.5
26+	0.0	17.6	44.3	199.9	95.6	31.8	389.2
Total	**0.0**	**22.4**	**64.2**	**306.6**	**227.3**	**135.2**	**755.7**
Pennsylvania, Bituminous - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	51.3	131.9	121.4	304.7
23-25.99	0.0	51.2	129.0	1,149.3	1,531.1	894.9	3,755.5
26+	0.0	209.0	613.3	3,493.7	2,260.2	365.0	6,941.1
Total	**0.0**	**260.2**	**742.4**	**4,694.3**	**3,923.2**	**1,381.3**	**11,001.3**
Pennsylvania, Bituminous - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	51.3	159.9	134.4	345.7
23-25.99	0.0	55.9	149.0	1,255.9	1,634.8	985.3	4,081.0
26+	0.0	226.6	657.6	3,693.6	2,355.7	396.8	7,330.4
Total	**0.0**	**282.5**	**806.6**	**5,000.9**	**4,150.5**	**1,516.5**	**11,757.0**

See notes at end of table.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining	Sulfur Content (Pounds of Sulfur per Million Btu)						
Heat Content (Million Btu per Short Ton)	≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
South Dakota - Surface							
<15	0.0	0.0	103.6	0.8	172.4	0.0	276.8
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**103.6**	**0.8**	**172.4**	**0.0**	**276.8**
South Dakota - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
South Dakota - Total							
<15	0.0	0.0	103.6	0.8	172.4	0.0	276.8
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**103.6**	**0.8**	**172.4**	**0.0**	**276.8**
Tennessee - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	73.6	0.0	0.0	73.6
26+	0.0	38.8	23.4	19.4	40.1	0.0	121.7
Total	**0.0**	**38.8**	**23.4**	**93.0**	**40.1**	**0.0**	**195.3**
Tennessee - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	98.5	0.0	0.0	98.5
26+	0.0	67.4	38.2	32.6	58.7	0.0	196.9
Total	**0.0**	**67.4**	**38.2**	**131.1**	**58.7**	**0.0**	**295.4**
Tennessee - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	172.1	0.0	0.0	172.1
26+	0.0	106.2	61.6	52.1	98.8	0.0	318.6
Total	**0.0**	**106.2**	**61.6**	**224.2**	**98.8**	**0.0**	**490.7**
Texas - Surface							
<15	0.0	0.0	590.4	5,680.8	3,409.4	376.3	10,056.9
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**590.4**	**5,680.8**	**3,409.4**	**376.3**	**10,056.9**
Texas - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Texas - Total							
<15	0.0	0.0	590.4	5,680.8	3,409.4	376.3	10,056.9
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**590.4**	**5,680.8**	**3,409.4**	**376.3**	**10,056.9**

See notes at end of table.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining / Heat Content (Million Btu per Short Ton)	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
Utah - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	27.5	17.3	84.6	34.8	33.7	197.9
23-25.99	7.1	3.9	1.4	0.0	0.0	0.0	12.4
26+	1.0	0.7	0.0	0.0	0.0	0.0	1.7
Total	**8.2**	**32.1**	**18.8**	**84.6**	**34.8**	**33.7**	**212.1**
Utah - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.3	0.3	0.0	0.0	0.0	0.5
20-22.99	0.0	384.9	460.5	779.7	189.6	267.2	2,082.0
23-25.99	302.9	171.1	74.4	0.0	0.0	0.0	548.4
26+	67.4	90.1	0.0	0.0	0.0	0.0	157.5
Total	**370.2**	**646.3**	**535.2**	**779.7**	**189.6**	**267.2**	**2,788.4**
Utah - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.3	0.3	0.0	0.0	0.0	0.5
20-22.99	0.0	412.3	477.9	864.3	224.5	301.0	2,279.9
23-25.99	310.0	175.0	75.8	0.0	0.0	0.0	560.8
26+	68.4	90.8	0.0	0.0	0.0	0.0	159.2
Total	**378.4**	**678.4**	**553.9**	**864.3**	**224.5**	**301.0**	**3,000.5**
Virginia - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	2.2	8.5	70.5	0.0	0.0	0.0	81.1
26+	41.0	188.5	90.6	45.5	0.0	0.0	365.5
Total	**43.2**	**196.9**	**161.1**	**45.5**	**0.0**	**0.0**	**446.6**
Virginia - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	7.5	5.1	7.4	0.0	0.0	0.0	20.1
23-25.99	39.1	81.1	73.0	4.6	0.0	0.0	197.7
26+	105.1	348.8	161.0	82.6	0.0	0.0	697.5
Total	**151.7**	**435.0**	**241.4**	**87.2**	**0.0**	**0.0**	**915.3**
Virginia - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	7.5	5.1	7.4	0.0	0.0	0.0	20.1
23-25.99	41.3	89.6	143.5	4.6	0.0	0.0	278.8
26+	146.1	537.3	251.6	128.1	0.0	0.0	1,063.0
Total	**194.8**	**631.9**	**402.5**	**132.7**	**0.0**	**0.0**	**1,361.9**
Washington - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	54.4	0.0	0.0	54.4
20-22.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**54.4**	**0.0**	**0.0**	**54.4**
Washington - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	42.2	85.6	392.9	0.0	0.0	520.6
20-22.99	63.2	0.0	0.0	41.2	0.0	0.0	104.4
23-25.99	0.0	49.4	0.0	0.0	0.0	0.0	49.4
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**63.2**	**91.6**	**85.6**	**434.1**	**0.0**	**0.0**	**674.7**
Washington - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	42.2	85.6	447.3	0.0	0.0	573.0
20-22.99	63.2	0.0	0.0	41.2	0.0	0.0	104.4
23-25.99	0.0	49.4	0.0	0.0	0.0	0.0	49.4
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**63.2**	**91.6**	**85.6**	**488.5**	**0.0**	**0.0**	**728.8**

See notes at end of table.

Table B2. Estimated Recoverable Reserves of Coal by Btu/Sulfur Range, State, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995)

State and Type of Mining	Sulfur Content (Pounds of Sulfur per Million Btu)						
Heat Content (Million Btu per Short Ton)	≤ 0.40	0.41-0.60	0.61-0.83	0.84-1.67	1.68-2.50	> 2.50	Total
West Virginia - Surface							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	0.0	0.0	14.9	14.9
23-25.99	0.0	281.4	245.4	164.5	6.4	42.9	740.6
26+	115.7	1,182.1	322.2	282.4	173.1	49.6	2,125.1
Total	**115.7**	**1,463.6**	**567.6**	**446.9**	**179.6**	**107.4**	**2,880.6**
West Virginia - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	100.3	112.8	38.3	251.4
23-25.99	0.0	419.1	435.4	1,101.3	519.6	1,877.4	4,352.8
26+	537.2	4,614.4	1,733.0	2,387.7	1,704.1	1,188.0	12,164.5
Total	**537.2**	**5,033.5**	**2,168.4**	**3,589.4**	**2,336.5**	**3,103.6**	**16,768.6**
West Virginia - Total							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-22.99	0.0	0.0	0.0	100.3	112.8	53.2	266.3
23-25.99	0.0	700.5	680.7	1,265.8	526.0	1,920.3	5,093.4
26+	652.9	5,796.5	2,055.2	2,670.1	1,877.3	1,237.6	14,289.6
Total	**652.9**	**6,497.1**	**2,735.9**	**4,036.2**	**2,516.1**	**3,211.0**	**19,649.2**
Wyoming - Surface							
<15	0.0	0.0	0.0	909.8	170.1	1,393.4	2,473.3
15-19.99	4,405.4	8,691.6	3,960.9	1,360.9	340.0	814.5	19,573.4
20-22.99	28.6	130.3	173.0	43.7	17.2	0.0	392.7
23-25.99	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**4,434.0**	**8,821.9**	**4,133.9**	**2,314.4**	**527.3**	**2,207.9**	**22,439.4**
Wyoming - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	2,042.0	8,220.4	5,233.6	4,741.6	640.5	0.0	20,878.1
20-22.99	265.3	271.2	369.3	197.2	0.0	32.8	1,135.8
23-25.99	44.4	272.3	448.6	184.3	0.0	0.0	949.7
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**2,351.6**	**8,763.9**	**6,051.6**	**5,123.2**	**640.5**	**32.8**	**22,963.6**
Wyoming - Total							
<15	0.0	0.0	0.0	909.8	170.1	1,393.4	2,473.3
15-19.99	6,447.4	16,912.1	9,194.6	6,102.5	980.5	814.5	40,451.5
20-22.99	293.8	401.5	542.3	240.9	17.2	32.8	1,528.5
23-25.99	44.4	272.3	448.6	184.3	0.0	0.0	949.7
26+	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**6,785.6**	**17,585.8**	**10,185.5**	**7,437.6**	**1,167.8**	**2,240.7**	**45,403.0**
United States - Surface							
<15	1,893.9	3,666.5	9,944.8	12,379.4	6,067.1	2,867.8	36,819.4
15-19.99	21,357.0	13,650.1	9,938.6	4,597.2	518.9	1,137.3	51,199.2
20-22.99	142.4	790.8	628.8	1,170.3	1,476.7	11,512.8	15,721.8
23-25.99	256.0	1,150.2	1,089.0	1,680.8	2,052.4	5,148.3	11,376.7
26+	344.1	2,927.0	1,386.0	1,914.3	772.8	463.8	7,807.9
Total	**23,993.3**	**22,184.6**	**22,987.2**	**21,741.9**	**10,887.8**	**21,130.1**	**122,924.9**
United States - Underground							
<15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19.99	20,898.4	19,055.3	12,851.8	8,112.0	989.6	388.0	62,295.2
20-22.99	1,269.6	2,469.9	1,700.3	2,893.7	2,929.9	19,003.6	30,267.0
23-25.99	1,669.5	2,483.4	1,853.1	4,369.4	5,363.2	18,403.8	34,142.4
26+	891.9	6,240.6	2,987.3	6,825.9	4,797.0	2,540.8	24,283.5
Total	**24,729.5**	**30,249.2**	**19,392.6**	**22,201.0**	**14,079.8**	**40,336.0**	**150,988.0**
United States - Total							
<15	1,893.9	3,666.5	9,944.8	12,379.4	6,067.1	2,867.8	36,819.4
15-19.99	42,255.4	32,705.4	22,790.5	12,709.3	1,508.5	1,525.3	113,494.3
20-22.99	1,412.0	3,260.7	2,329.0	4,064.0	4,406.7	30,516.4	45,988.7
23-25.99	1,925.6	3,633.6	2,942.1	6,050.2	7,415.6	23,552.1	45,519.0
26+	1,236.0	9,167.6	4,373.3	8,740.2	5,569.8	3,004.6	32,091.4
Total	**48,722.8**	**52,433.7**	**42,379.7**	**43,943.0**	**24,967.6**	**61,466.1**	**273,912.9**

Note: Totals may not equal sum of components because of independent rounding. Heat and sulfur content categories of coal resources and reserves are limited to two decimal places. Conversion of heat and sulfur contents to millions of Btu per short ton and pounds of sulfur per million Btu, respectively, produces values with multiple decimal places. These are rounded to two places prior to category allocations, as an appropriate expression of accuracy for estimates extended to in-place coal resources and reserves.

Source: Energy Information Administration.

Table B3. Estimates of Recoverable Reserves at Active Mines in 1994 by Coal Rank/Sulfur Range, Region, and Type of Mining
(Million Short Tons Remaining as of January 1, 1995; Reported as of December 31, 1994)

Region and Mining Method / Coal Rank	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.60	0.61-1.67	> 1.67	Total
Pennsylvania, Ohio – Surface				
Bituminous[a]	11.5	126.6	225.7	363.8
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**11.5**	**126.6**	**225.7**	**363.8**
Pennsylvania, Ohio – Underground				
Bituminous[a]	128.4	546.8	353.1	1,028.3
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**128.4**	**546.8**	**353.1**	**1,028.3**
Pennsylvania, Ohio – Total				
Bituminous[a]	139.9	673.4	578.8	1,392.1
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**139.9**	**673.4**	**578.8**	**1,392.1**
West Virginia (North) – Surface				
Bituminous	16.9	59.6	39.0	115.5
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**16.9**	**59.6**	**39.0**	**115.5**
West Virginia (North) – Underground				
Bituminous	58.5	289.8	397.2	745.5
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**58.5**	**289.8**	**397.2**	**745.5**
West Virginia (North) – Total				
Bituminous	75.4	349.4	436.2	861.0
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**75.4**	**349.4**	**436.2**	**861.0**
West Virginia (South) – Surface				
Bituminous	179.1	221.5	1.4	402.0
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**179.1**	**221.5**	**1.4**	**402.0**
West Virginia (South) – Underground				
Bituminous	446.9	119.5	0.2	566.6
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**446.9**	**119.5**	**0.2**	**566.6**
West Virginia (South) – Total				
Bituminous	626.0	341.0	1.6	968.6
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**626.0**	**341.0**	**1.6**	**968.6**

See footnotes at end of table.

Table B3. Estimates of Recoverable Reserves at Active Mines in 1994 by Coal Rank/Sulfur Range, Region, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995; Reported as of December 31, 1994)

Region and Mining Method / Coal Rank	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.60	0.61-1.67	> 1.67	Total
Kentucky (East) – Surface				
Bituminous	33.1	137.4	4.0	174.5
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**33.1**	**137.4**	**4.0**	**174.5**
Kentucky (East) – Underground				
Bituminous	191.7	439.8	2.9	634.4
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**191.7**	**439.8**	**2.9**	**634.4**
Kentucky (East) – Total				
Bituminous	224.8	577.2	6.9	808.9
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**224.8**	**577.2**	**6.9**	**808.9**
Virginia, Tennessee, Maryland – Surface				
Bituminous	4.6	25.2	0.2	29.9
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**4.6**	**25.2**	**0.2**	**29.9**
Virginia, Tennessee, Maryland – Underground				
Bituminous	192.2	143.0	2.1	337.4
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**192.2**	**143.0**	**2.1**	**337.4**
Virginia, Tennessee, Maryland – Total				
Bituminous	196.8	168.2	2.3	367.3
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**196.8**	**168.2**	**2.3**	**367.3**
Alabama – Surface				
Bituminous	7.2	29.6	3.8	40.7
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**7.2**	**29.6**	**3.8**	**40.7**
Alabama – Underground				
Bituminous	286.3	129.3	0.8	416.5
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**286.3**	**129.3**	**0.8**	**416.5**
Alabama – Total				
Bituminous	293.5	159.0	4.7	457.1
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**293.5**	**159.0**	**4.7**	**457.1**

See footnotes at end of table.

Table B3. Estimates of Recoverable Reserves at Active Mines in 1994 by Coal Rank/Sulfur Range, Region, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995; Reported as of December 31, 1994)

Region and Mining Method / Coal Rank	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.60	0.61-1.67	> 1.67	Total
Illinois, Indiana, Kentucky (West), Missouri, Oklahoma – Surface				
Bituminous	7.8	53.8	419.2	480.8
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**7.8**	**53.8**	**419.2**	**480.8**
Illinois, Indiana, Kentucky (West), Missouri, Oklahoma – Underground				
Bituminous	56.0	417.2	925.1	1,398.3
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**56.0**	**417.2**	**925.1**	**1,398.3**
Illinois, Indiana, Kentucky (West), Missouri, Oklahoma – Total				
Bituminous	63.8	471.0	1,344.3	1,879.1
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**63.8**	**471.0**	**1,344.3**	**1,879.1**
Texas – Surface				
Bituminous[b]	0.0	0.0	0.0	0.0
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	658.0	368.3	1,026.3
Total	**0.0**	**658.0**	**368.3**	**1,026.3**
Texas – Underground				
Bituminous	0.0	0.0	0.0	0.0
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**
Texas – Total				
Bituminous[b]	0.0	0.0	0.0	0.0
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	658.0	368.3	1,026.3
Total	**0.0**	**658.0**	**368.3**	**1,026.3**
Montana, North Dakota – Surface				
Bituminous	0.0	0.0	0.0	0.0
Subbituminous	656.4	600.1	0.0	1,256.5
Lignite	6.9	1,624.2	89.5	1,720.6
Total	**663.3**	**2,224.3**	**89.5**	**2,977.1**
Montana, North Dakota – Underground				
Bituminous	0.0	0.0	0.0	0.0
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**
Montana, North Dakota – Total				
Bituminous	0.0	0.0	0.0	0.0
Subbituminous	656.4	600.1	0.0	1,256.5
Lignite	6.9	1,624.2	89.5	1,720.6
Total	**663.3**	**2,224.3**	**89.5**	**2,977.1**

See footnotes at end of table.

Table B3. Estimates of Recoverable Reserves at Active Mines in 1994 by Coal Rank/Sulfur Range, Region, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995; Reported as of December 31, 1994)

Region and Mining Method / Coal Rank	Sulfur Content (Pounds of Sulfur per Million Btu) ≤ 0.60	0.61-1.67	> 1.67	Total
Wyoming (East) – Surface				
Bituminous	0.0	0.0	0.0	0.0
Subbituminous	6,326.5	205.4	0.0	6,531.9
Lignite	0.0	0.0	0.0	0.0
Total	**6,326.5**	**205.4**	**0.0**	**6,531.9**
Wyoming (East) – Underground				
Bituminous	0.0	0.0	0.0	0.0
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**0.0**	**0.0**	**0.0**	**0.0**
Wyoming (East) – Total				
Bituminous	0.0	0.0	0.0	0.0
Subbituminous	6,326.5	205.4	0.0	6,531.9
Lignite	0.0	0.0	0.0	0.0
Total	**6,326.5**	**205.4**	**0.0**	**6,531.9**
Wyoming (West), Arizona, Colorado, New Mexico, Utah, Washington, Alaska – Surface				
Bituminous	694.0	8.2	0.0	702.2
Subbituminous	561.2	1,449.4	0.0	2,010.6
Lignite	0.0	0.0	0.0	0.0
Total	**1,255.2**	**1,457.6**	**0.0**	**2,712.8**
Wyoming (West), Arizona, Colorado, New Mexico, Utah, Washington, Alaska – Underground				
Bituminous[c]	810.2	60.7	0.0	870.9
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	810.2	60.7	0.0	870.9
Wyoming (West), Arizona, Colorado, New Mexico, Utah, Washington, Alaska – Total				
Bituminous[c]	1,504.2	68.9	0.0	1,573.2
Subbituminous	561.2	1,449.4	0.0	2,010.6
Lignite	0.0	0.0	0.0	0.0
Total	**2,065.4**	**1,518.3**	**0.0**	**3,583.7**

See footnotes at end of table.

Table B3. Estimates of Recoverable Reserves at Active Mines in 1994 by Coal Rank/Sulfur Range, Region, and Type of Mining (Continued)
(Million Short Tons Remaining as of January 1, 1995; Reported as of December 31, 1994)

Region and Mining Method	Sulfur Content (Pounds of Sulfur per Million Btu)			
Coal Rank	≤ 0.60	0.61-1.67	> 1.67	Total
United States – Surface				
Bituminous	954.2	662.0	693.3	2,309.4
Subbituminous	7,544.1	2,255.0	0.0	9,799.0
Lignite	6.9	2,282.2	457.8	2,746.9
Total[d]	**8,505.1**	**5,199.1**	**1,151.1**	**14,855.3**
United States – Underground				
Bituminous	2,170.3	2,146.1	1,681.5	5,997.9
Subbituminous	0.0	0.0	0.0	0.0
Lignite	0.0	0.0	0.0	0.0
Total	**2,170.3**	**2,146.1**	**1,681.5**	**5,997.9**
United States – Total				
Bituminous	3,124.4	2,808.0	2,374.8	8,307.3
Subbituminous	7,544.1	2,255.0	0.0	9,799.0
Lignite	6.9	2,282.2	457.8	2,746.9
Total[d]	**10,675.4**	**7,345.2**	**2,832.6**	**20,853.2**

[a]Bituminous coal reserves for Pennsylvania and Ohio include a small amount of anthracite reserves.
[b]Lignite reserves for Texas include a small amount of bituminous coal reserves. These data were aggregated to avoid disclosure of individual company data.
[c]Bituminous reserves at underground mines in this region include a small amount of subbituminous coal reserves. These data were aggregated to avoid disclosure of individual company data.
[d]Data for Arkansas, Kansas, Iowa, and Louisiana were withheld to avoid disclosure of individual company data. In 1994, reserves at active mines in these States totaled 163.3 million tons.

Note: Data may not equal sum of components due to independent rounding. Heat and sulfur content categories of coal resources and reserves are limited to two decimal places. Conversion of heat and sulfur contents to millions of Btu per short ton and pounds of sulfur per million Btu, respectively, produces values with multiple decimal places. These are rounded to two places prior to category allocations, as an appropriate expression of accuracy for estimates extended to in-place coal resources and reserves.

Sources: **Coal Reserves Data**: Energy Information Administration, Form EIA-7A, “Coal Production Report”; **Coal Quality Data:** Form EIA-3A, “Annual Coal Quality Report–Manufacturing Plants”; Form EIA-5A, “Annual Coal Quality Report–Coke Plants”; Form EIA-6, “Coal Distribution Report”; Form EIA-867, “Annual Nonutility Power Producer Report”; and Federal Energy Regulatory Commission, Form-423, “Monthly Report of Cost and Quality of Fuels for Electric Plants.”