Illinois Coal Reserve Assessment and Data Base Development: Final Report for Part 1

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ILLINOIS DEPARTMENT OF NATURAL RESOURCES

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EXECUTIVE SUMMARY

The new demonstrated reserve base estimate of coal for Illinois is 90 billion short tons.[1] This compares with 78 billion short tons in the Energy Information Administration's demonstrated reserve base of coal, as of January 1, 1994. 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 tons, as compared with the previous estimate of 181 billion tons.

The new estimates also incorporate the analyses of available sulfur, heat content, and rank group data appropriate for characterizing the remaining coal resources in Illinois. 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 resource quantities to ranges of sulfur, heat content, and rank group. The new allocations place almost 1% of the demonstrated reserve base of Illinois in the two lowest sulfur categories, as compared with none in the previous allocation used by the Energy Information Administration. These allocations also place 89% of the reserve base in the highest sulfur category, as opposed to the previous allocation's 69% in the highest category.

A comparison was made between depletion of reserves as calculated from maps of mined areas versus reported production and recovery rates. It demonstrated some potential pitfalls of estimating depletion based on reported production and the need for local knowledge of mine operations. Problems encountered included production data that reported on the basis of tipple location rather than point of extraction and depletion of surface-minable reserves by underground mines. Also, the destruction of reserves by preferential mining of lower seams could not be estimated from the statistics.

The accessible reserve base was estimated to be 62 billion short tons. The previous estimate of 56 billion tons excluded surface-minable coal under prime farm land, an exclusion that is no longer valid. The new estimate excludes reserves under towns, interstate highways, and public land; underground-minable reserves less than 4 feet thick; reserves in small, irregular blocks between mines; and an allowance for coal left for barriers and small blocks in future mines. The Illinois State Geological Survey (ISGS) is currently involved in a multiyear study supported by the U.S. Geological Survey (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.

Recoverable reserves, estimated to be 34 billion short tons, were calculated using recoverability factors of 50% for underground-minable reserves and 70% to 85% (depending upon location and thickness) for surface-minable reserves. These rates were selected after examining data on the depletion of reserves and mine production from January 1979 to January 1994. The recovery rates account for coal that will be lost in cleaning and handling or left as pillars or barriers in mines.

ACKNOWLEDGMENTS

The Illinois State Geological Survey entered into Cooperative Agreement DE-FC01-94EI24855 with the Energy Information Administration of the U.S. Department of Energy (USDOE) to update coal reserve estimates for Illinois.

The assistance of several people was critical to the completion of this report. Richard Harvey (ISGS) spent much of his career compiling and editing the data base of coal analyses that provided the basis for our coal quality allocations. Heinz Damberger (ISGS) provided extensive advice and consultation on the use, interpretation, and mapping of coal quality data and wrote the section on quality of coal shipped by mines, compared with that of channel samples. Jennifer Hines (ISGS) supervised the entry of production and stratigraphic data used to calculate cumulative production and to revise resource maps. Richard Bonskowski (U.S. Department of Energy) provided quality, production, and recovery data and helped to develop and refine the methodology for this project.

This project would not have been possible without the coal resource data base developed for many years by ISGS staff with the financial and technical support of the Coal Branch of the U.S. Geological Survey. In particular, the National Coal Resources Data System and Coal Availability Studies have been invaluable in advancing our knowledge of resources and reserves in Illinois.

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[1] All tonnages reported are short tons.

INTRODUCTION

The objective of the Coal Reserves Data Base (CRDB) program, sponsored by the Energy Information Administration (EIA), is to involve authorities from regions with major coal resources in EIA's effort to update coal reserve data for the nation. This report describes the results of the first year of a 2-year study in Illinois. It is the fifth study in the program to update state-level reserve estimates in cooperation with a state geological survey.

The first year of the planned 2-year project began on July 5, 1994, and ended on September 5, 1995. This project used funds furnished by the EIA and ISGS.

The CRDB uses an updated set of criteria designed to be consistent nationally but flexible locally to accommodate variations in geology and mining practices. This program is needed because the traditional source of EIA coal reserve estimates (the DRB or demonstrated reserve base of coal) was adapted from older published studies from various contributors, many of whom followed somewhat different criteria than those preferred for the DRB.

Purpose of Coal Reserves Data Base Studies

The CRDB data are intended for analyses of coal supply and to support analyses of policy and legislative issues. They will be available to both government and nongovernment analysts. The data also will be part of the information used to supply U.S. energy data for international data bases and to answer inquiries from private industry and the public.

The EIA recognizes that coal resource area maps, drilling records, historical mine boundaries, and site-specific analytical and geologic data are critical for reliable calculations of coal resource quantities. These types of information have been used to various extents in the current study. In accordance with the terms of the CRDB program, the supporting data files and detailed documentation will remain at the ISGS, where they will serve as the basis for future updates and revisions, amplification with new data, or modification for other ISGS objectives. The EIA will maintain copies of the detailed county/coalbed-level data base and selected source files.

The information in this report was compiled under guidelines that emphasize utilization of previously unexploited coal resource and coal analytical data that are immediately available and can be assimilated during a short-term project. The second year of this project will focus on revising seams with potential reserves of low to medium sulfur content or areas currently lacking reliable reserve estimates.

Geology and Mining Practices of the Illinois Coal Field

Illinois has the largest DRB of bituminous coal and the second largest DRB of any state (EIA 1995). The Illinois coal field in the Interior Region of the country consists of the western two-thirds of the Illinois Basin, which covers most of Illinois as well as western portions of Indiana and Kentucky (fig. 1).

Minable coal is found in the Pennsylvanian-age strata of the basin. The rank of these coals is high volatile bituminous, ranging from the A rank group

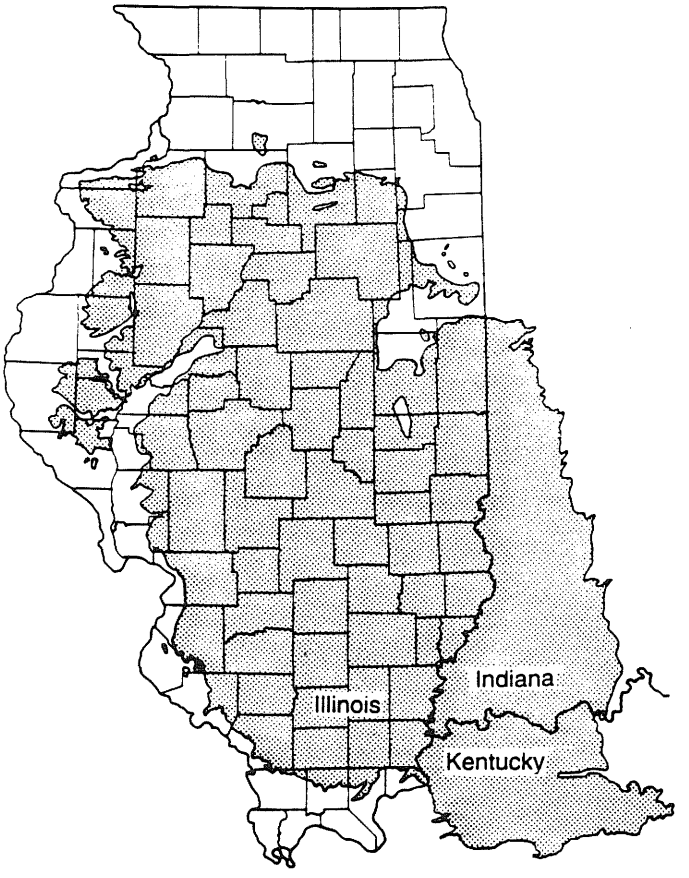

Figure 1 Illinois Basin or Eastern Interior Coal Field.

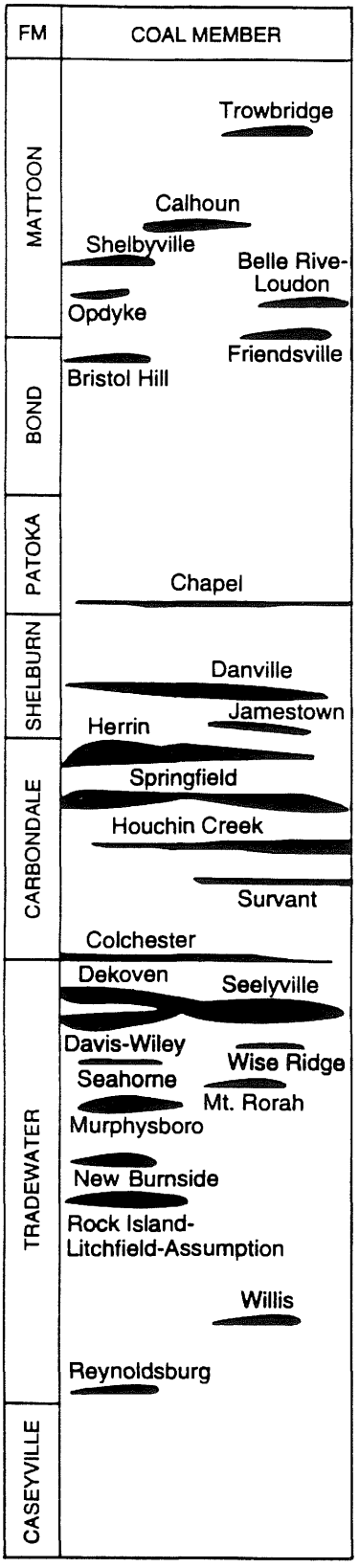

Figure 2 Stratigraphic position of coals mined or mapped as resources in Illinois.

at the extreme southern margin of the basin to rank groups B and C in the southern, central, and northern portions of the basin. The major coal seams crop out along the margins of the basin and dip gently to depths of more than 1,000 feet at the center of the basin in southeastern Illinois. Although the state has more than 60 named coal seams, resources reported in this study are for 27 seams; 97% of the resources are concentrated in seven seams: the Danville (No. 7), Herrin (No. 6), Springfield (No. 5), Colchester (No. 2), Seelyville, Dekoven, and Davis Coals (fig. 2). A few other coals have been mined locally by small operations, but no resources have been mapped because of their limited extent.

Since the development of modern surface mining equipment, coals up to about 150 feet deep have been commonly 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.

Surface mine production reached its peak in Illinois in 1969 at almost 35 million tons (IDMM 1994). Since that time, production has declined almost steadily to 9 million tons in 1994. Although stricter reclamation requirements and weak demand for high-sulfur coal have contributed to this decline, the major factor is believed to be depletion of low-cost reserves.

Shafts and slopes are the most common means of access to underground mines; but in a few cases, underground mines use a drift entrance constructed at an abandoned surface mine highwall or a box cut. 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% from longwall operations. Annual production from underground mines rose from the 30- to 40-million-ton range in the 1970s and 1980s to a peak of 47 million tons in 1992. This production rate is expected to drop sharply during the next few years as markets are lost as a result of Phase I restrictions of the 1990 Amendment to the Clean Air Act and increasing price competition from western coals.

Previous Investigations of Coal Resources and Reserves in Illinois

A report in 1913 (Campbell) estimated the coal resources of Illinois to be 200 billion tons. Although this estimate was based on very limited information and does not conform to current DRB criteria, the 200-billion figure remains a reasonable estimate for the total coal resources that may be present in the state.

In the early 1950s, Jack Simon and other members of the ISGS Coal Section staff under the general supervision of Gilbert Cady completed the first comprehensive survey of coal resources in the state (Cady 1952). This landmark report provided a framework and format generally followed in subsequent resource assessments. In particular, the report

Table 1 Reliability classifications for coal resources (modified from Cady 1952).

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.

established reliability categories adapted to reflect the lateral continuity of most coals found in Illinois (table 1). This 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.

Although the DRB did not exist at the time of Cady's report, the criteria used in the study are compatible with current DRB definitions and indicated a DRB of 61 billion tons. Additional mapping since 1950 raised the DRB to 78 billion tons (EIA 1995).

EIA's current DRB estimate for Illinois is based on a compilation of coal resources as of January 1, 1979 (Treworgy and Bargh 1982). Subsequent resource studies incorporated into this update are Jacobson (1983), Jacobson (1985), Jacobson (1993) and Treworgy (1995). Additional areas will be updated in the second year of this study.

METHODOLOGY AND ASSUMPTIONS

The primary focus of this project was to use existing data to update the DRB including allocation of coal reserves by depth and quality of the resource.

Coal Resource Quantities

Coal resource quantity data were compiled from published and unpublished maps developed by ISGS geologists from several sources: drilling logs, core descriptions, and geophysical logs obtained from companies as well as descriptions of mine and outcrop exposures made by ISGS geologists. Appendix 1 describes the sources of information used for resources for each seam in each county.

Mapping Procedures Past ISGS studies have demonstrated the utility of computers and digital databases for reserve assessments (e.g., Treworgy and Bargh 1982). 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 calculation of 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 some digital format. All data were combined into a common digital map database designed to facilitate processing for this study as well as to provide a suitable foundation for future updates and revisions. All remaining paper maps were digitized into this common database.

When this digital database was created, a number of changes that were made to the data resulted in some variations from the original paper maps. All tonnages differ from the previously

published figures, even in cases for which no mining or new mapping has taken place; for example, the base maps used for the digital database were digitized from USGS 7.5-minute topographic quadrangle maps. Most of the coal resource maps created or published before the 1980s were based on USGS 15-minute topographic maps, which are less accurate. Because the area and shape of each county is represented slightly differently by the two base maps, the conversion from one base to another inevitably results in a small increase or reduction in area and therefore in coal tonnage.

Adjustments were commonly necessary where two studies met or overlapped. A number of studies either mapped surface-minable or underground-minable coal separating surface from underground-minable coal at a depth of 150 feet. The 150-foot-depth line that formed the boundary between studies was similar, but never exactly the same in adjoining studies. The 150-foot-depth line had to be modified to combine the results from each study and create a seamless digital database. In most cases, the 150-foot-depth line from the surface-minable resource studies was more detailed and considered more accurate. This line was retained and data from the adjoining study of deeper coal were modified.

Mining Categories Resources and reserves are divided into categories based on the type of mining method most likely to be used to extract the coal. The two categories used for this study are surface minable and underground minable. A few companies use augering to extract coal beyond the last cut of a surface mine, and at least one company has used augering in an underground mine. Because augering is not widely practiced in Illinois, however, and its use is largely dependent upon circumstances at individual mines (e.g., the location of their lease boundary relative to the last practical highwall position), no separate category of resources could be defined for this mining method.

The surface-minable category consists of coals most likely to be mined by removing the overburden to expose and mine the coal. In Illinois, this is commonly done by some combination of draglines, shovels, bucket wheel excavators, trucks, and scrapers. The underground-minable category consists of resources that will be extracted by underground methods such as room-and-pillar or longwall mining. Access to the seam may be by drift, highwall exposure, box cut, slope, or shaft.

The factors that determine the method used to mine a particular deposit are economic rather than technical. The main factors are thickness of the coal, average stripping ratio of the mine block, nature of the overburden material (e.g., amount of blasting required or competency as a mine roof), 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, although imperfect delimiter between surface-minable and underground-minable resources. A few surface mines have mined small areas of deeper coal. More commonly, underground mines have mined shallower areas. In most cases, these underground mines are located where the greater portion of the reserve block is deeper than 150 feet, where surface land use or ownership makes surface mining impractical, or where existence of an abandoned highwall provides inexpensive access to a small, otherwise inaccessible, block of coal. These exceptions are determined by local conditions, land ownership, company policy, and other circumstances that cannot be considered in regional assessments such as this study.

Surface-minable resources are defined by ISGS convention to have a minimum thickness of 18 inches. Underground-minable resources are defined to have a minimum thickness of 28 inches. These minimum thicknesses have been used by the ISGS since the 1950s and 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 have been 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.

No maximum depth was established for underground-minable reserves. The deepest mapped 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 of the coal.

Table 2 Categories of coal seam thickness.

Average thickness	
inches	*feet*
18 – 28	2 *
28 – 42	3
42 – 54	4
54 – 66	5
66 – 78	6
78 – 90	7
90 – 102	8
102 – 114	9
>114	10

* Surface-minable coal only.

Table 3 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

Categories of Coal Thickness In Illinois, coal resources are mapped and reported in categories of 1-foot increments of seam thickness (table 2). The two thinnest categories, 18–28 and 28–42 inches, deviate from the 1-foot increment in order to correlate with national reporting categories used by the U.S. Department of Energy (USDOE) and USGS. In practice at the ISGS, consistent 12-inch increments (18–30 and 30–42 inches) have been used for most mapping of surface-minable coal and all recent mapping of underground-minable coal. For conformity with national reporting categories, these tonnages are reported as the 18–28 and 28–42-inch categories. The consistent increments are preferred by the ISGS because their evenness facilitates the use of computers to map resources. The use of these increments has no significant effect on the tonnages reported.

Some surface-minable resources and resources from older studies of underground-minable coal are mapped using categories of average thickness that do not correspond to the standard 1-foot increments; for example, an area of resources may be classified as "averages 20 inches." The original thickness categories mapped have been retained in the digital database produced for this study.

Depth of Coal Coal resources in Illinois have been mapped to depths of more than 1,500 feet. Surface-minable coals are found throughout the state (fig. 3). The major seams such as the Herrin Coal crop out and remain at shallow depths at the margins of the basin and dip toward the center of the basin in southeastern Illinois (fig. 4). Surface-minable resources are classified into three categories with 50-foot increments of overburden (0–50, 50–100, 100–150 ft). Coal deeper than 150 feet is classified into even 100-foot increments, except for the shallowest category of 150–200 feet. For reporting purposes, these have been aggregated into the broader categories shown in table 3. The digital data supplied to EIA retain the more detailed depth categories.

The surface-minable depth categories, which were digitized from previous studies, are more accurate than the categories deeper than 150 feet. The shallow categories were mapped manually by overlaying a structure map of the coal seam with a topographic map of the land surface. They reflect relatively detailed variations in surface topography and are suitable for calculating stripping ratios.

The categories deeper than 150 feet were mapped by contouring coal depths from point-source data. This procedure delineates broad, regional trends in depth, but ignores changes in depth caused by abrupt, localized changes in topography or coal structure (e.g., a deeply cut river valley or a fault). In Illinois, local changes in depth of seams due to topography and structure are relatively minor and do not need to be considered from the regional perspective of this study.

The point-source data were extracted from the ISGS stratigraphic database, a collection of logs obtained from companies and correlated by the Survey's geologists. The existing data are believed to be adequate for the precision needed for this study and no new data were compiled for this purpose (table 4). Contours were constructed using software from a commercial vendor and validated by geologic inspection. A grid consisting of 5,000x5,000-foot cells was used for contouring all seams. The grids were contoured at a "scale" of 1:50,000. Although no paper maps

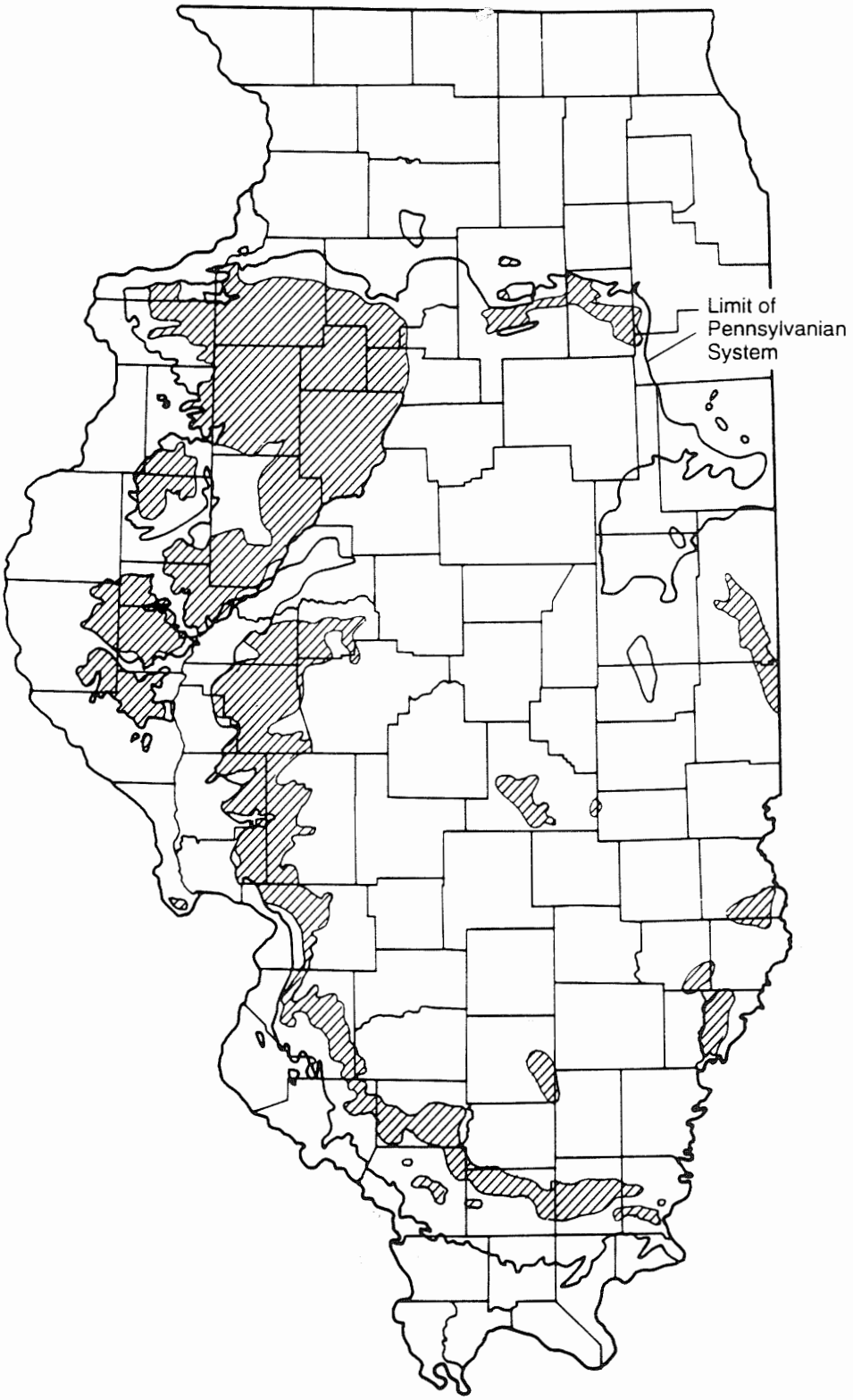

Figure 3 Areas with surface-minable coal resources (from IDENR 1982).

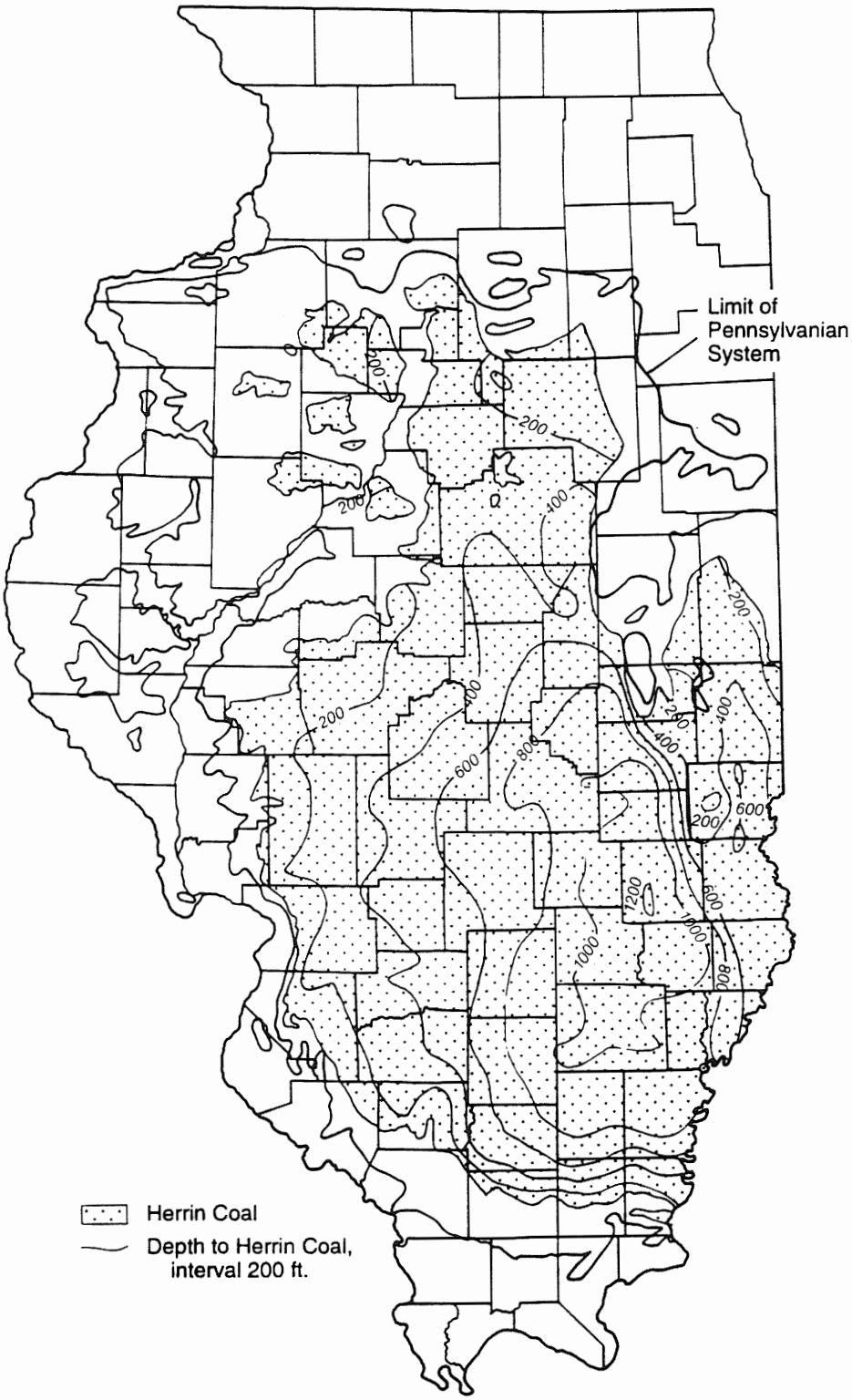

Figure 4 Depth of the Herrin Coal (from Smith and Stall 1975).

Table 4 Construction of depth maps for underground-minable reserves.

Coal	No. of points used	Data points per square mile	Additional control
Danville	9,185	0.4	Not allowed to be deeper than Herrin
Jamestown			Assigned same depth as Herrin
Herrin	17,371	0.7	
Springfield	10,106	0.4	Minimum 20 feet below Herrin
Houchin Creek			Depth assigned based on Herrin
Survant			Depth assigned based on Springfield
Colchester	6,794	0.3	Minimum 100 feet below Springfield
Seelyville	1,510	0.4	
Davis	2,659	1.2	Not allowed to be shallower than Colchester
Assumption			Not gridded; depth for this area estimated from three drill holes
Murphysboro	112	0.2	

were produced at this scale, the digital contour lines have a smooth appearance at this scale. Localized details that were not justifiable, given the data and assumptions used to create the final work maps, were eliminated by deleting contours enclosing areas less than 250 million square feet (about 9 square miles).

Additional control for some coals was provided by utilizing information about the depth of overlying or underlying beds. For example, the number and distribution of data points for the Herrin Coal were adequate to delineate the major structural features of the bed. Fewer control points were available for the underlying Houchin Creek Coal, so the depth of the Houchin Creek resources was commonly classified by adjusting the contours of the Herrin Coal by the approximate thickness of the stratigraphic interval between the two coals. The Jamestown Coal is commonly 5 to 20 feet above the Herrin Coal, so its resources were assigned the same depth as the Herrin Coal.

Reliability Categories The ISGS categories of reliability used for this study (table 1) are comparable to those defined by the USGS. Because of the considerable lateral continuity of most Illinois coals, however, the radius of influence assigned to each datum point is larger than that 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. These categories were originally defined by Cady (1952); they were modified by Treworgy and Bargh (1982) to include oil test geophysical logs as accepted data points for Class II-A.

The definitions are further modified by this study to include, at the geologist's discretion, coal test geophysical logs as accepted data points for Class I-A. The suite of logs run for coal exploration commonly include single point resistivity, gamma, density, and caliper. The logs are typically plotted at a scale of 1 inch equals 20 feet and with expanded sections of 1 inch equals 1 foot for major coals.

Calculation of Coal Tonnages Coal tonnages are 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 is used for this calculation. For example, the area between the 5.5-foot and 6.5-foot isopachs is assumed to have an average thickness of 6 feet.

As noted, changes in the base maps cause the tonnage of coal calculated for a seam in an area to differ from that in previous reports, even if no mining or new mapping has taken place. Tonnage also varies because of changes in the procedure for calculating areas. Prior to the late 1970s, all areas were measured by planimeter or a point-counting method. The 1979 update of underground-minable resources used geographic information system software (GIS) to compute areas and volumes (Treworgy and Bargh 1982). The GIS software, developed in-house, used 10-acre grid cells (660x660 ft) to represent areas, thus limiting resolution of features to 660 feet.

The present study used a commercial GIS package that represents features as vectors or polygons. Areas are calculated using a proprietary algorithm. Because of the differences in the way features are represented and the algorithms are used to compute areas, the areas (and

consequently volumes) calculated by the two methods differ by a few percent. The vector representation used for the current study is inherently more precise than the grid representation used by earlier software.

Revisions of Coal Resource Maps The ISGS continually receives new data on coal thickness from coal companies, consultants, other government agencies, and other sources. Revisions of resource estimates are needed in counties where significant new data have become available since the latest coal resources maps were compiled. Appendix 1 indicates those seams and counties for which new data are available. For the second year of this study, priority will be given to revising resources of low- and medium-sulfur coal for areas where significant additions to the DRB were expected.

Depletion Adjustments

Information on mined areas and production was compiled to update the DRB to January 1, 1994, and to provide EIA with some comparative statistics on reported production and depletion of reserves.

Mined Areas The ISGS maintains a digital database of mined areas (fig. 5); it currently contains outlines of more than 2,100 underground and 400 surface mines. The database also contains point locations for an additional 2,500 mines for which no outline is available. The mines lacking outlines are believed to be mostly small, short-lived operations that affected very small areas.

Outlines of mines are obtained from maps provided by mining companies or secondary sources, such as the private compilations made for banks or insurance companies. In the few cases for which no maps are available, the mined areas have been estimated from reported production. Prior to 1984, the exterior boundaries of mined areas were compiled on 1:62,500-scale base maps and then digitized. Since 1984, mine boundaries and large interior areas of unmined coal have been digitized directly from the original mine maps or obtained in a digital format directly from the mining company. In most cases, the newer outlines are at a scale of 1:12,000 or larger.

For this study, the database was updated using paper or digital maps that were obtained from mining companies and indicated areas mined to January 1, 1994. In addition, the boundaries of numerous abandoned mines were revised to incorporate corrections or additional detail.

Some coal left around abandoned mines has been excluded from resources because of mining laws or practical considerations. Illinois law requires that a barrier pillar at least 200 feet wide be left between mines. In many cases, larger blocks of unmined coal have been left because of geologic conditions, ownership issues, or the geometric layout required for face or pit operations. Although wider than 200 feet, these unmined blocks are often too small or convoluted to be extracted by an adjacent mine.

These blocks of unminable coal between mines were excluded from resource tabulations in the 1979 estimate; however, barrier pillars created between mines since 1979 were included in the estimate of resources or DRB—a measure taken to conform with the the USGS and USDOE definitions of resources and reserves. This tonnage has been excluded from the accessible reserve base (see section on Coal Accessibility Adjustments).

Production Data Data on annual coal production were obtained from annual reports published by the Illinois Department of Mines and Minerals (IDMM). (Prior to 1917, these reports were published as the Biennial Report of the Bureau of Labor Statistics and the Annual Coal Report of Illinois of the State Mining Board.) In the reports are lists of the annual production of each mine in the state, including the location and type of mine, and the name and average thickness and depth of the seam mined.

Three problems were encountered in using the production data: (1) Production is commonly reported for the county where the mine tipple is located, not the county where the coal is mined. (2) Production is commonly reported by mine, not seam. If a mine operates in more than one seam, assumptions must be made as to how to allocate the production to each seam. (3) Some underground mines recover coal classified as surface minable. Also the production data do not provide information on reserves destroyed or rendered unminable by mining of underlying or overlying seams.

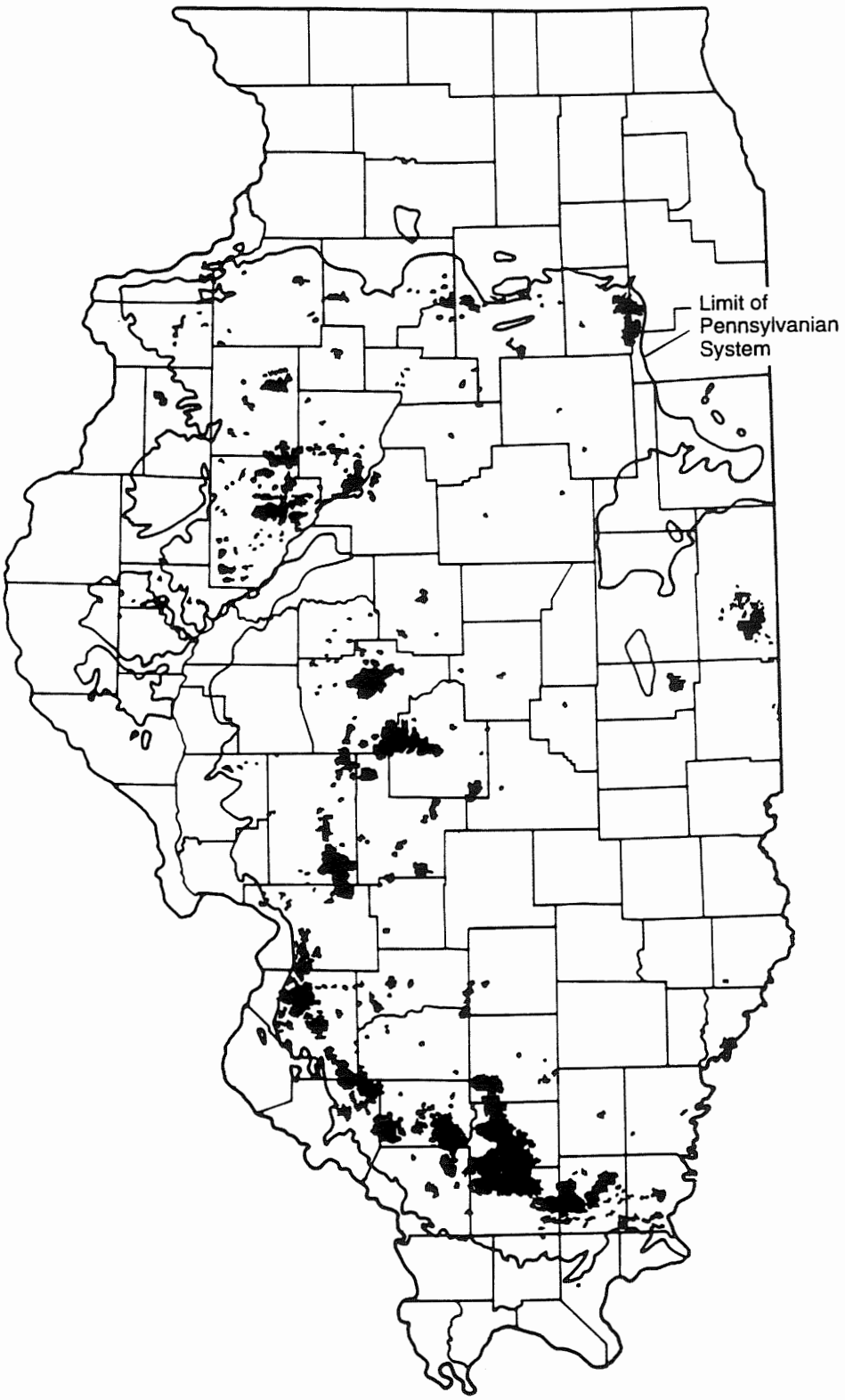

Figure 5 Mined-out areas in Illinois.

Cumulative Mined-Out Underground-Minable Resources Cumulative mined-out underground resources consist of the tonnage originally present in areas mined between 1979 and 1994. These resources have either been extracted by mining or left as pillars within the mines. The tonnage was calculated by combining maps of mines and resources as of 1979 and 1994 and calculating the tonnage of coal in the area mined since 1979 (fig. 6). Large blocks of unmined coal within mines, coal in barrier pillars between mines, or coal within 200 feet of mine boundaries have not been included in the cumulative mined-out resources. These areas are considered unminable and excluded from the accessible reserve base.

The calculation of cumulative mined-out underground resources is based entirely on the corrected digital map data base compiled for this study; and for the most part, it is not influenced by the base map or software precision limitations of the 1979 study. The precision of the calculation is affected to a small extent by the accuracy of the 1979 mine boundaries, which were not drafted or digitized as precisely as the 1994 boundaries. Many boundaries, the east boundary of the mine shown in figure 6 for example, are slightly offset. The effect of this offset on the calculation is negligible.

Cumulative Production from Surface Mines The base year for mapping of surface-minable resources varies from county to county (fig. 7): mapping of surface-minable resources in Saline County (southern Illinois) included mining to January 1956; mapping of surface-minable resources in northern Illinois counties included mining to July 1 1959; and resources for all other counties were mapped as of January 1 of the year listed. Production from the base year of mapping through 1971 was available from a compilation made by the ISGS in 1973 (DeMaris, unpublished notes). Production of surface coal mines from 1972 through 1993 was compiled from the annual *Reports of the Illinois Department of Mines and Minerals*. These two sources were combined to arrive at cumulative production from surface mines in each seam and county from the base year of mapping to 1994. For Saline County, for example, cumulative surface-mine production will be reported for each seam from the base year of 1956 to January 1, 1994.

Some mines have operated pits in two or more counties and processed the coal at a central tipple. In most cases, the mine's production is listed in the annual coal report under the county where the tipple is located. Records that report production according to the county where the coal was mined are not readily available. The continuous production of large, multicounty operations distorts the apparent cumulative production of certain counties. No attempt was made in this study to reallocate production to the county in which it was mined.

Several mines produce from more than one seam, sometimes as many as five seams. In most of these cases, the published production is not reported by seam. Allocating production to individual seams requires knowledge of the individual mining operation, including thickness and continuity of the seams, location of pits, and operating goals of the company. A seam may be the main target of a mining operation or merely part of the interburden mined in portions of the mine property. Consequently, allocation of production to individual seams has been based on our best knowledge of each situation. The assumptions used to allocate the production prior to 1971 are documented by DeMaris (unpublished notes, 1973). The assumptions used by this study to allocate production from 1972 to 1994 are listed in appendix 2.

Depleted Surface-Minable Resources The boundaries of mined areas as of January 1, 1994, were merged with the surface-minable resource maps to calculate remaining resources. Cumulative depletion was calculated as the difference between the resources at the date of original mapping (referred to as the base year) and the new (January 1994) resource estimate. For example, cumulative depletion of surface-minable resources for Saline County is the difference between resources reported for the base year 1956 and those reported January 1, 1994.

As explained in a previous section, the changes in base maps and technology used (computer vs. planimeter) to calculate areas between the base year and the current study cause reported tonnages (and therefore cumulative depletion) to increase or decrease by a few percent. This effect is most noticeable in counties with limited or no production from surface mines. The apparent depletion in these counties is largely due to these procedural factors rather than to actual mining.

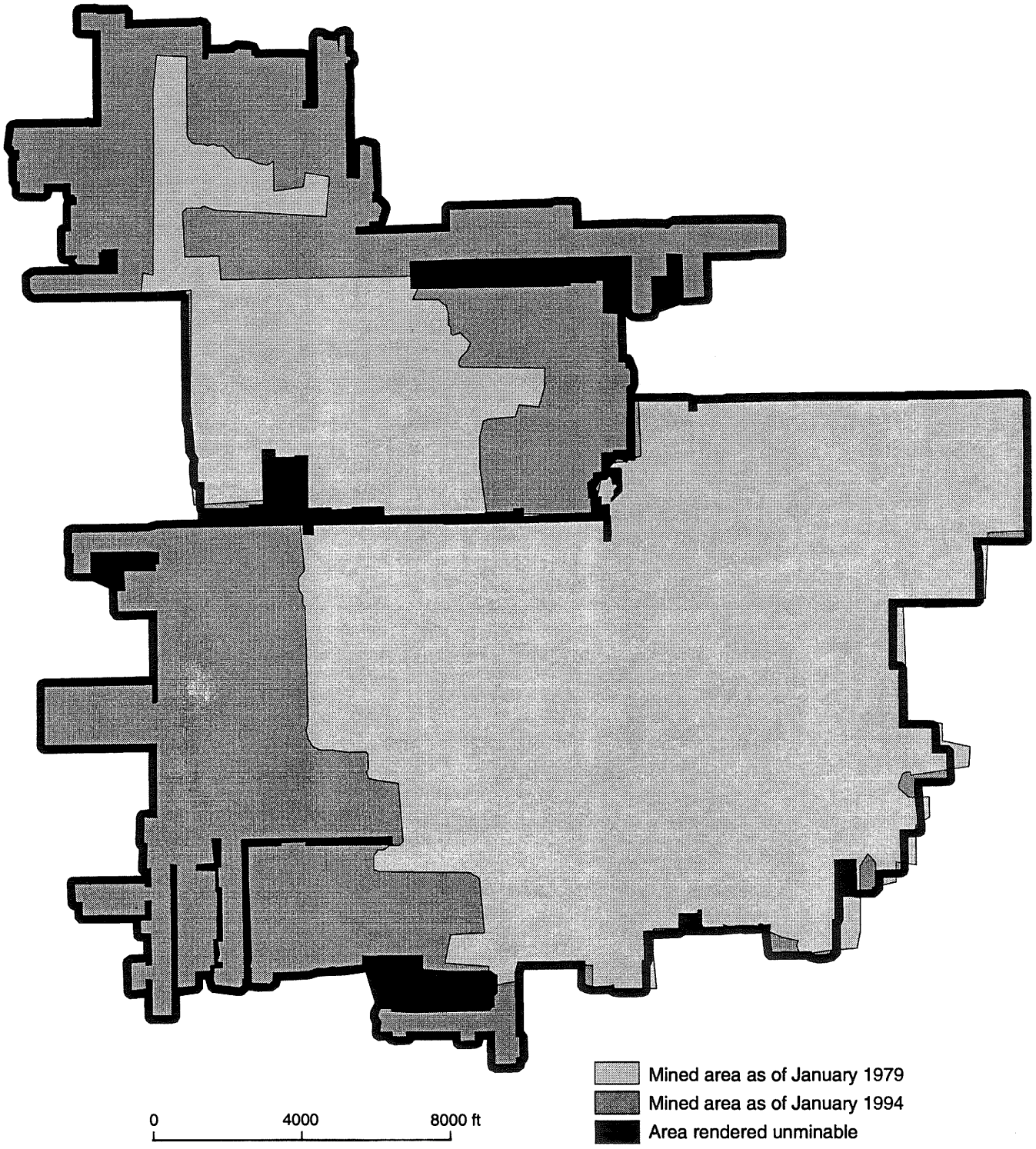

Figure 6 Changes in mined areas around two mines, January 1979 to January 1994.

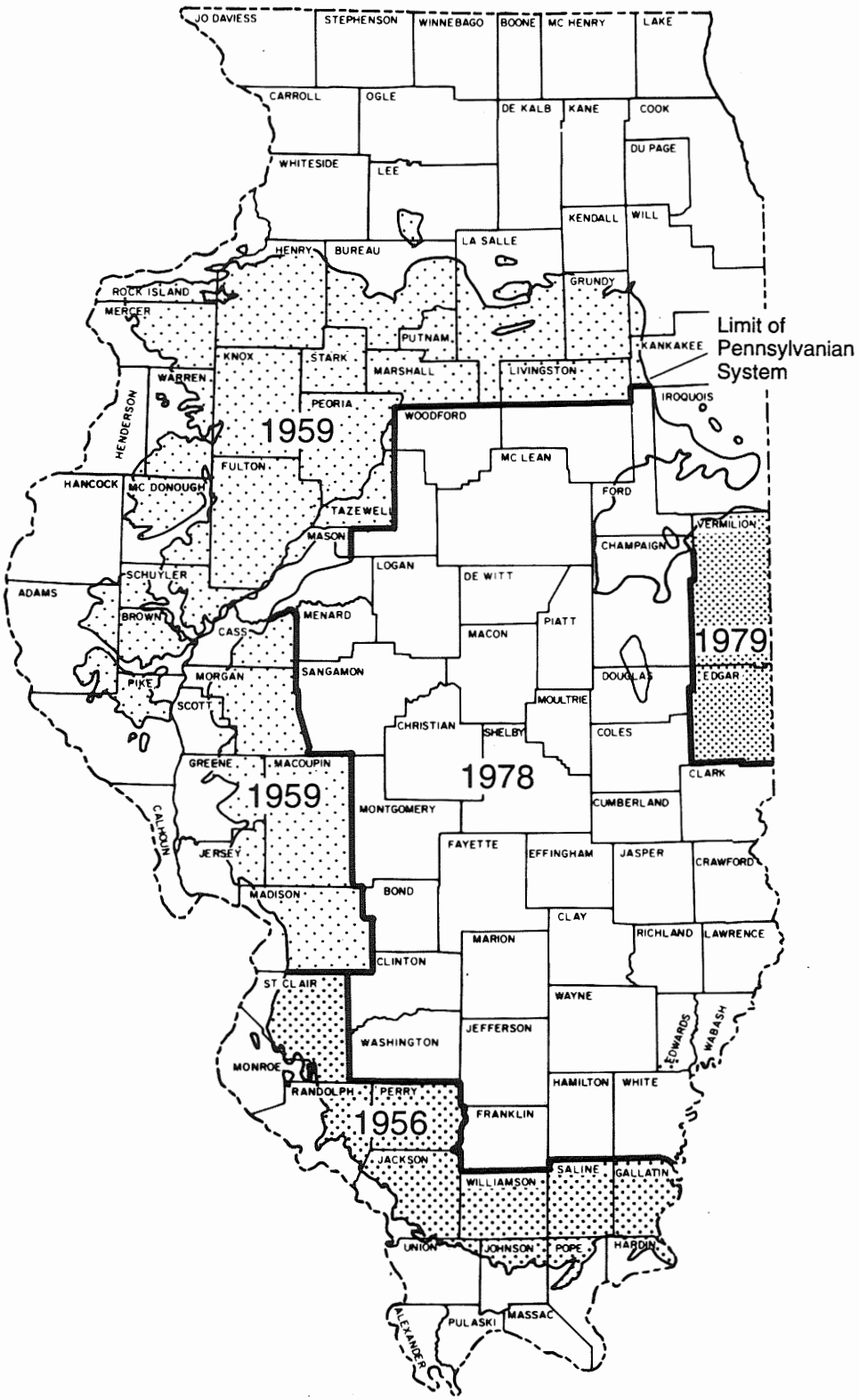

Figure 7 Base year of mapping of surface-minable coal resources.

Coal Quality Characterizations

Reserves were allocated to coal quality categories for sulfur, rank, and calorific value as specified by EIA's Procedural Guidelines.

Sources of Data The ISGS has a file of 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 (table 5) were used in this study.

Table 5 Types of analyses used to assess heating value, rank, and sulfur.

Sample type	Number of analyses
Face channel	2,252
Composite face channel	384
Column	90
Composite column	7
Composite bench	11
Drill core	948
Composite drill core	5

Standard face channel samples exclude partings greater than 3/8 inches, whereas column and drill core samples generally do not exclude any material. As a result, face channel samples will have lower ash contents and higher heating values than drill core or column samples taken in the same area. For example, the mean ash content of the Herrin Coal face channel samples was 11.2%, whereas the mean ash content from drill core samples was more than 15%.This inconsistency was taken into consideration in contouring the data (see following sections on sulfur, rank, and caloric value).

The EIA provided copies of data collected by the Federal Energy Regulatory Commission on quality of coal shipped to electric power producers (FERC Form No. 423). These data were used to verify the sulfur contents mapped based on the ISGS analyses.

Quality of Coal Shipped by Mines Compared with That of Face Channel Samples Nearly all the coal shipped by Illinois mines has been cleaned. The original concept of the face channel sampling technique (Holmes 1911), in particular the exclusion of mineral partings more than 3/8 inches, was intended to simulate the unsophisticated cleaning that prevailed at that time. Modern coal cleaning plants will remove more than just the prominent, visible mineral partings; therefore, in theory, channel samples may not provide a representative picture of the quality of the coal that will be produced from the resources in the ground.

The ISGS conducted a study in the early 1970s (Helfinstine et al. 1971 and 1974) to determine how representative channel samples are of cleaned Illinois coal. It was found that channel samples are generally a good indicator of shipped coal quality. On the average, in terms of their ash and sulfur contents, channel samples are equivalent to a recovery rate between 70% and 100% (averaging about 88%) of the combustibles. Generally, this would be considered an acceptable recovery rate of combustibles during cleaning. It was further found that, compared with column samples (channel samples without exclusion of mineral partings) from the same sites, a 90% recovery rate of combustibles corresponds to a 70% to 86% (averaging 80%) overall recovery from the full seam. The mining process may add 5% out-of-seam dilution, which suggests that cleaning plants have an overall recovery from raw coal of about 65% to 81%, averaging 75%.

In 1993, by comparison, Illinois mines averaged 69% clean coal recovery from raw coal; recovery ranged between 51% and 84% for mines producing more than 0.3 million tons per year IDMM 1993). This lower percentage is not surprising because selection of sites for collecting channel and column samples generally avoids any anomalous seam, roof, or floor conditions that tend to raise the reject. Also, the assumed 90% recovery of combustibles probably is on the high side for the average of all mines in Illinois. However, for currently active mines for which we have data, the average ash and sulfur contents of shipped coal and of channel samples are nearly identical; face channel samples average only 3% to 5% (relative) higher ash and sulfur contents than the corresponding shipped coal. Overall, face channel samples still constitute an acceptable representation of the quality of cleaned coal that can be produced from a resource.

Sulfur Content Sulfur content was mapped as pounds of sulfur per million Btu. The sample basis (as-received, dry, or ash-free) is inconsequential as long as the same basis is used for both sulfur and Btu. Conceptually, the drill cores and column samples could have higher sulfur contents than face channel samples because thick pyrite bands or concretions would be excluded from a face channel; however, this situation is expected to occur mostly in high-sulfur coals (greater than 2.5 pounds sulfur per million Btu). In areas of low to medium sulfur content (the areas contoured for this study), thick pyrite bands are not commonly present. Therefore, the use of drill hole and column samples is not believed to have materially altered the allocation of coal within the categories used for this study.

Sulfur content of Illinois coals is related to the environment of deposition and geologic burial associated with the coals. An understanding of the geologic features associated with lower sulfur coal and a knowledge of their distribution is an aid to mapping these deposits. The approximate extent of areas of low- to medium-sulfur coal for the Danville, Herrin, Springfield, Colchester, and Murphysboro Coals in Illinois have been mapped on the basis of these geological models (Gluskoter and Simon 1968, Hopkins 1968, Gluskoter and Hopkins 1970, Jacobson 1983, Treworgy and Jacobson 1986). Lower sulfur deposits of the Danville and Colchester Coals are associated with a silty to sandy facies in the overlying strata. Lower sulfur deposits of the Herrin, Springfield, and Murphysboro Coals also correspond to areas where the marine black shale and limestone units that normally overlie the coals are displaced by silty to sandy units.

Mapping the sulfur content for each seam began with plotting the sulfur values from analyses along with the geologic boundaries (if any) of sediments normally associated with low-sulfur coals. Contours, hand-drawn by geologists, were based on the plotted analyses and supplemented by the geologic interpretation. Contour intervals are those specified in EIA's Procedural Guidelines (table 6). For areas of limited data, it was necessary to confer with coal companies that had explored the areas to learn the general range and pattern of the coal's sulfur content. Coals or areas of coals for which no sulfur data were available were classified as high sulfur (greater than 2.5 pounds of sulfur per million Btu).

Data available for the Assumption Coal were not adequate to contour the sulfur content, but indicated a range from 1.7 to 3.2 pounds of sulfur per million Btu. Two-thirds of the tonnage was assigned, on the basis of the number and distribution of data points, to the category of less than 2.5 pounds of sulfur per million Btu; and the remaining one-third was assigned to the category of greater than 2.5 pounds of sulfur per million Btu.

Rank All Illinois coals are high-volatile bituminous A, B, or C. Coal rank changes systematically with distribution and depth of the deposit in the coal field (Damberger 1971). Rank was determined by calculating the heating value of samples on a moist, mineral-matter-free basis, according to formulas of ASTM Standard D388 (ASTM 1990). Because this calculation excludes mineral matter, all sample types provide equivalent results.

The Herrin Coal had the broadest distribution of analyses of all seams (fig. 8). Analyses of the Herrin served as the primary control for mapping trends in rank. Rank group isolines were drawn based on the analyses for each coal as well as on the general trend of the Herrin Coal. In areas of good data control, rank isolines were found to parallel certain geologic structures: the Shawneetown and Cottage Grove Fault Systems, the DuQuoin Monocline, the La Salle Anticlinal Belt, and the Marshall-Sidell Syncline (figs. 9 and 10). These structures were used to continue the trend of rank isolines across areas of limited control.

Rank of the other seams was mapped based on the analyses available and the regional rank pattern indicated by the Herrin Coal. Coals that are 100 feet above or below the Herrin Coal (e.g., the Danville, Jamestown, and Springfield Coals) will have a calorific value approximately 100 to 200 Btu per pound lower or higher than the Herrin, respectively (Damberger 1971). The data for the Danville and Jamestown Coals were sparse and insufficient to justify a significant shift from the Herrin Coal, so the same rank lines were used for all three coals. The data for the Springfield Coal suggest a B/C rank group boundary that corresponds to the Herrin Coal along the east and west sides of the basin, but extends farther northward in the central part of the basin (fig. 10). The rank of the Seelyville (for which there are considerable resources, but very limited analyses) is based on analyses of the overlying Colchester Coal and a calculated increase in Btu per pound, based on depth of the Seelyville below the Herrin. Other coals were limited in extent and assigned rank based on available analyses.

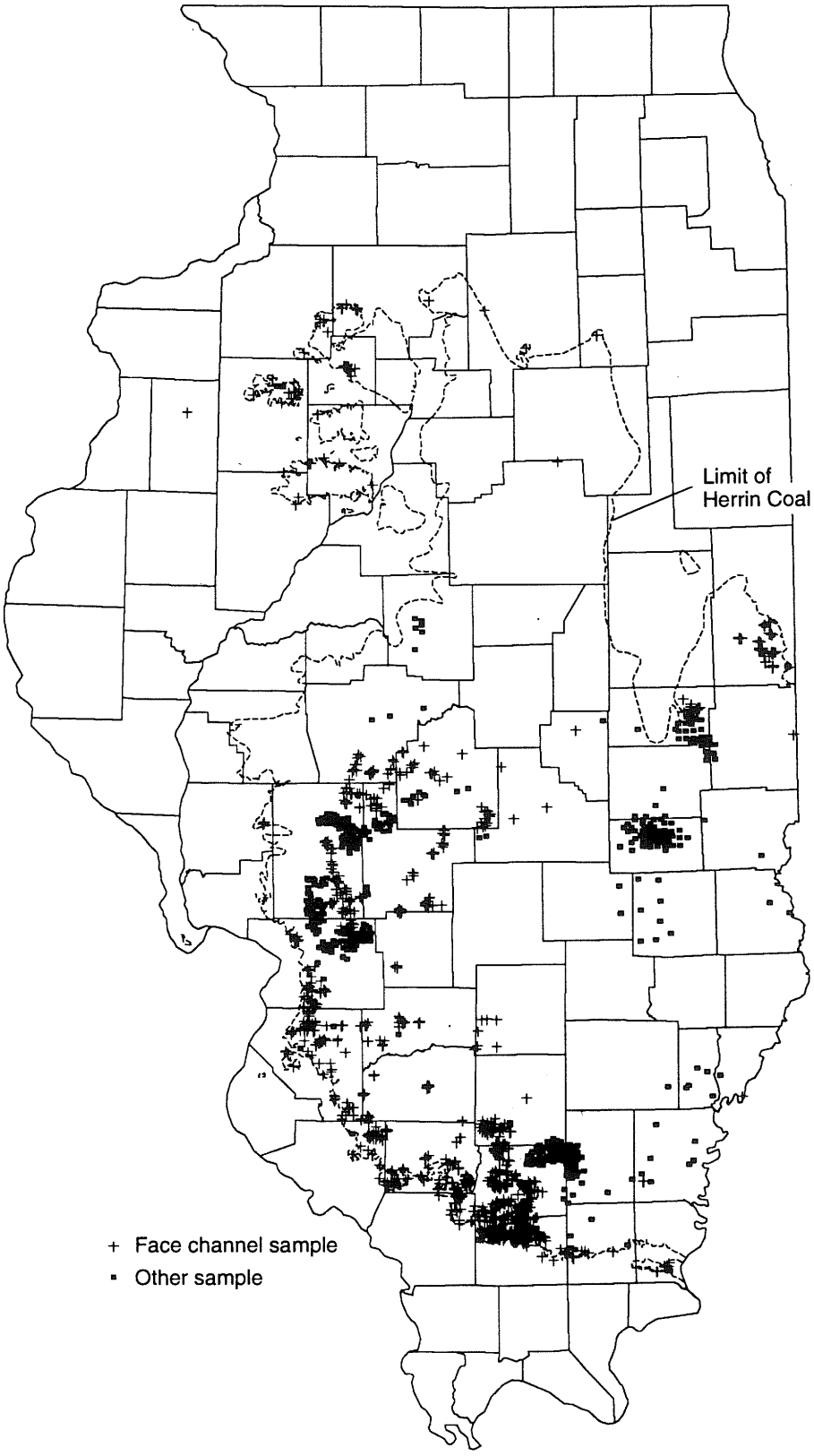

Figure 8 Locations of Herrin Coal samples analyzed to determine rank, sulfur content, and Btu.

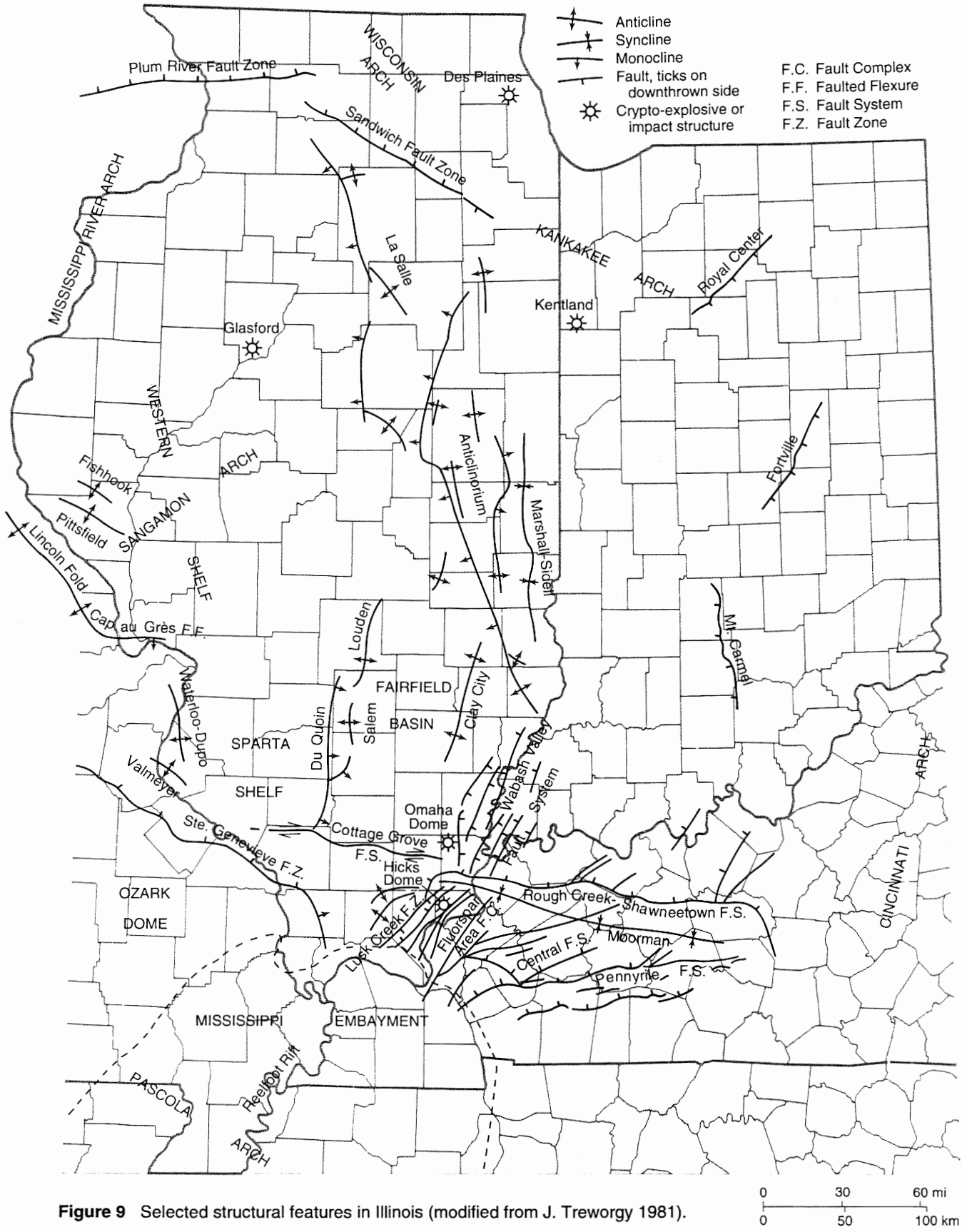

Figure 9 Selected structural features in Illinois (modified from J. Treworgy 1981).

Table 6 Categories of sulfur content (lbs sulfur/million Btu).

0.40 or less
0.41 – 0.60
0.61 – 0.83
0.84 – 1.24
1.25 – 1.67
1.68 – 2.5
>2.5

Table 7 Categories of heating value (million Btu/short ton).

26 or higher
25 – 25.99
23 – 24.99
20 – 22.99
15 – 19.99

Calorific Value The analyses of coal were used to map million Btu per ton on an as-received basis, according to the categories specified in EIA's procedural guidelines (table 7). Because ash content affects the heating value, an adjustment is needed to compensate for the higher ash values of drill holes.

The mean ash content for all face channels of Herrin Coal (1,436 samples) is 11.2%, with a standard deviation of 2%. Aside from increases in ash content near contemporaneous channels, no pattern of ash distribution has been observed. The mean ash value was used to compute a normalized heating value for the drill core analyses. At this mean ash value, the 23- and 25-million-Btu-per-ton contours correspond closely to the B/C and A/B rank isolines, respectively. Given the distribution of available data, the same isolines were judged for purposes of this study to be suitable boundaries for both rank and heating value per ton.

Coal Accessibility Adjustments

The accessible reserve base has been defined by EIA (Richard Bonskowski, personal communication, September 1995) as the portion of the DRB that can be mined at present, when local or regional mining practice and technologies, physical or geologic conditions, and societal constraints are taken into account. Factors restricting accessibility, determined on a state-by-state basis, may include land use restrictions (towns, cemeteries, highways, railroads, oil and gas wells) and technological, geological, and regulatory constraints (coal bed depth and thickness, geologic conditions, proximity to another coal bed or mine, or barrier coal left between mines), all of which may change with time.

EIA has expanded its concept of accessibility to include, for new resource studies and revisions, the limiting effects of certain technological and geologic conditions. In the past, such adjustments were made in the resource data base, by the field investigator, or within the DRB derivation and were difficult to reassess. EIA is taking advantage of the more detailed assessment capabilities of computerized resource mapping systems and enhancing the comparability of coal accessibility and the USGS concept of coal availability (as presented below). The expanded definition has been incorporated into the Illinois study.

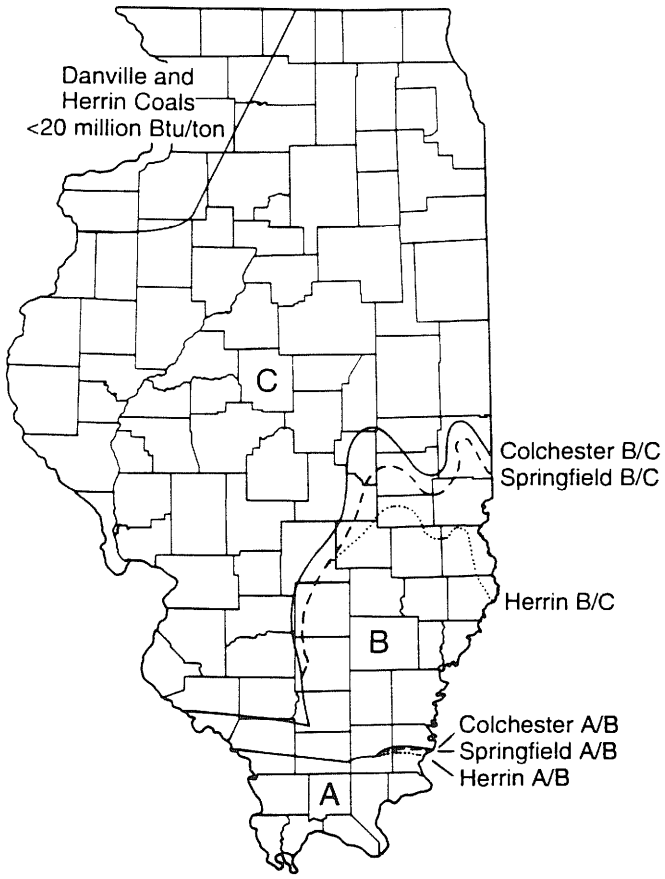

Figure 10 Rank of selected coals in Illinois.

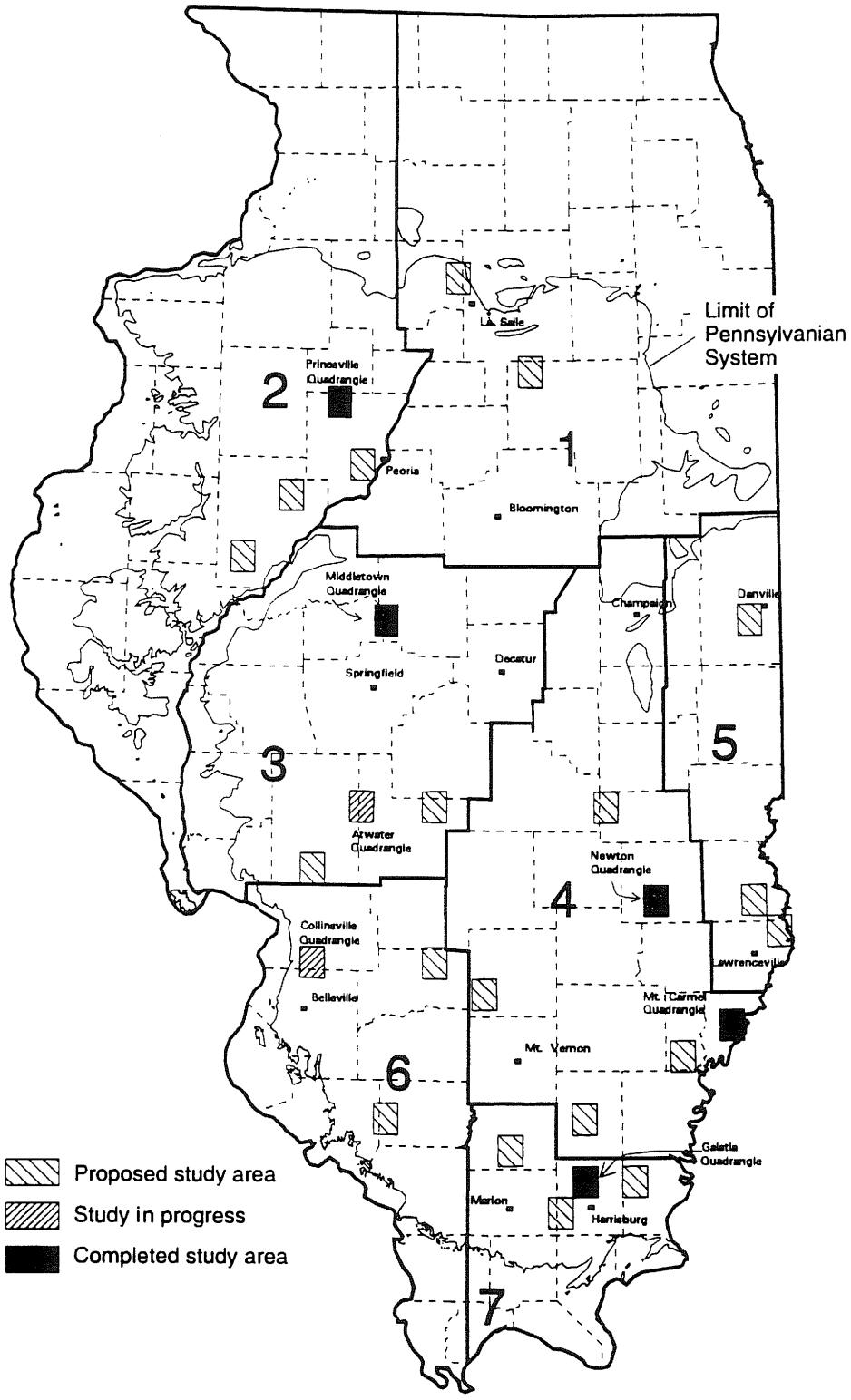

Figure 11 Quadrangles selected for coal availability studies.

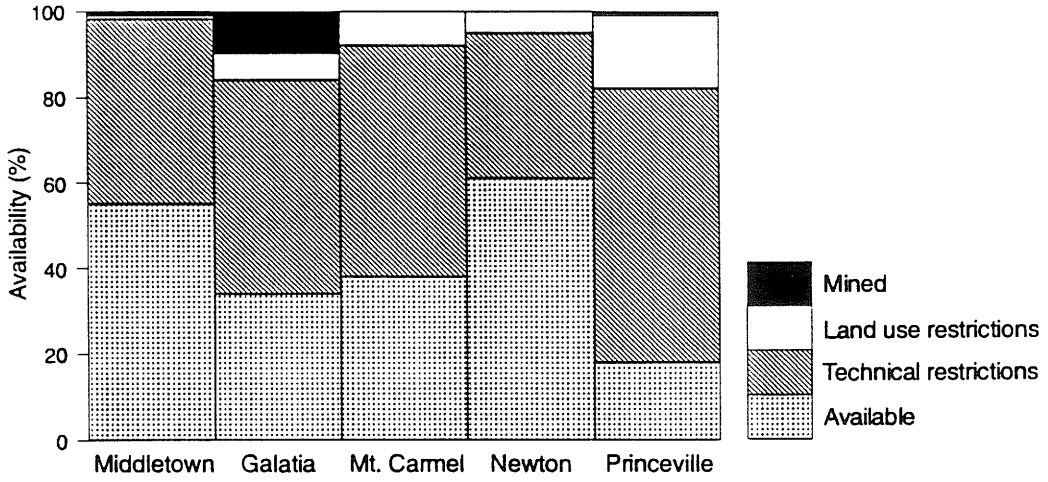

Figure 12 Availability of coal resources in five quadrangles in Illinois.

The USGS is supporting state geological surveys in their detailed investigations of relatively small but representative sample areas (7.5-minute quadrangles); the objective is to identify and quantify factors that limit the availability of coal for future development (Eggleston et al. 1990). These coal availability studies define resources not restricted by land use, geologic, or technological parameters as "available." Although available resources, as defined by the USGS, are currently too limited a sampling to support a national data base, they do constitute an important source of information for EIA coal supply projections. While maintaining the integrity of the DRB as a nationally consistent data base, EIA is working to minimize the differences between the concepts of available and accessible resources. The accessible reserve base includes essentially the portion of available resources that would meet DRB criteria. For new resource updates, EIA is coordinating data on coal accessibility and coal availability to the extent feasible.

The ISGS is in the third year of a multiyear study supported by the USGS to assess the availability of coal for mining (Treworgy et al. 1994; Treworgy, Chenoweth, and Bargh 1995; Jacobson et al. in prep; Treworgy, Chenoweth, and Jacobson 1995). At this point in the project, five quadrangles have been evaluated, about 20% of the number needed to reliably assess availability of resources in the state (fig. 11).

The amount of coal available for mining in the sample areas has ranged from 18% to 61% of the original resources (fig. 12). 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% to 16% of the resources in the quadrangles studied.

Although it is too early to apply most of the initial findings of this study, some preliminary observations have been incorporated into this estimate of accessible reserves. It is anticipated that the final findings of this study will significantly alter the accessible reserve base. The factors considered for estimating the accessible reserve base are listed in table 8.

Prime Farm land Almost 60% of the 36 million acres of land in Illinois are classified as prime farm land. The percentage of surface-minable resources underlying prime farm land is not available; however, in 1978 the ISGS identified 6 billion tons of surface-minable reserves with the highest potential for development. Using the percentage of prime farm land in each county, the Illinois Department of Mines and Minerals estimated that 58% of these reserves underlie prime farm land and that this represents 2.5% of the prime farm land in the state (IDMM 1993).

EIA's current estimate of accessible coal in Illinois excludes surface-minable reserves in areas of prime farm land. Illinois' surface mine regulations do not preclude the mining of prime farm land, and there is no indication from the coal availability studies that operators consider areas of prime farm land to be unminable. Currently, surface mines in the state are mining and successfully reclaiming areas of prime farm land. In recent interviews with four surface-mine operators conducted for a coal availability study involving prime farm land, none of the operators

Table 8 Factors considered and applied to the DRB to estimate the accessible reserve base.

Factor considered	Applied?	Remarks
Technical		
Prime farm land	No	There is no evidence that prime farm land 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% of reserves otherwise accessible.
Thin coal	Yes	Underground-minable reserves <48 inches thick excluded.
Land Use		The tonnage of underground-minable reserves restricted by all land use categories was estimated from previous mapping; 6% of all surface-minable reserves was assumed to be inaccessible because of land use.
Interstate highways	Yes	
Towns	Yes	
Cemeteries	Yes	
Public lands	Yes	

considered prime farm land to be a factor that limited accessibility of the reserves. For these reasons, prime farm land was not used as a factor in estimating the accessible reserve base.

Areas Densely Drilled for Oil Since Cady (1952), the ISGS has excluded areas densely drilled for oil from its calculation of reserves. Coal mining experts interviewed by Treworgy and Bargh (1982) confirmed this restriction, and the amount of coal excluded (9.6 billion tons) was documented for the first time. The theory was that safety considerations prevented mining coal in such areas. In our recent coal availability studies, it was found that mining companies no longer regard closely spaced oil wells as an absolute barrier to mining. Although regulations of the Mine Safety and Health Administration (MSHA) 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 for the mining company to plug the well to MSHA specifications and 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.

Underground-Minable Coal less than 48 Inches Thick The five quadrangles studied for coal availability in Illinois to date contain about 2% of the underground-minable resources in the state and include all the major seams. In assessing the availability of these resources, six of the eight companies operating major underground mines in the state have been interviewed. All six companies identified coal less than 48 inches thick as too thin to economically mine by underground methods. Because the state lacks natural outcrops, most underground mines require extensive exploratory and development drilling to obtain data for mine planning and permitting and the construction of slopes and shafts for the movement of air, men, materials, and coal. To justify these expensive and time-consuming premining investments, 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 48 inches thick have been excluded from the accessible reserve base.

Coal Rendered Inaccessible by Mining A significant portion of inaccessible reserves consists of blocks of coal left as barrier pillars (the law requires 200 feet between mines) or simply left out of the mining plan 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 (fig. 13). The buffer areas for each seam were examined and adjusted to include additional areas of coal considered to be unminable because of the small size

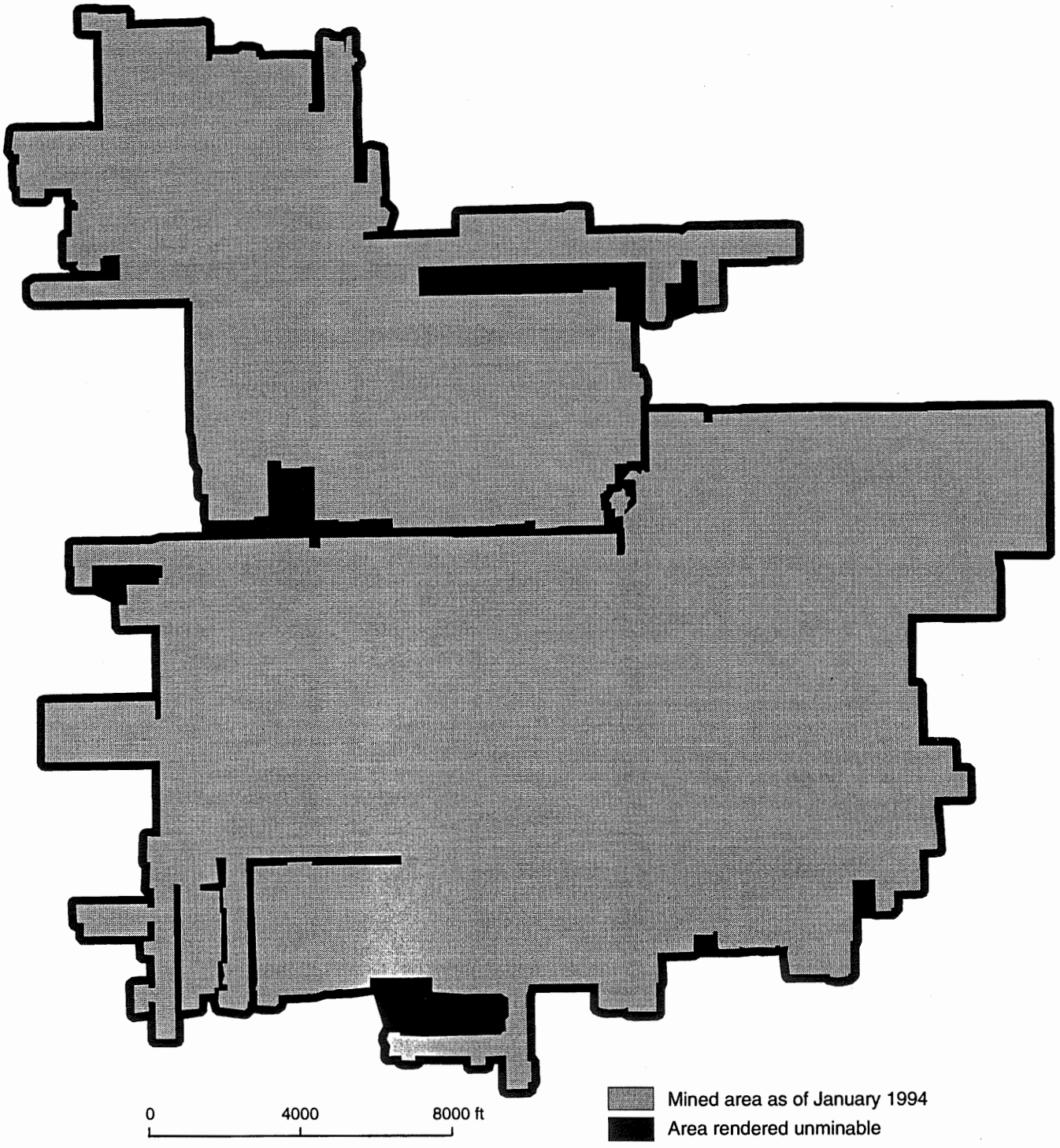

Figure 13 Typical area of unminable coal adjacent to two mines.

of the 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 amount of coal rendered inaccessible depends upon many variables. Studies conducted by the U.S. Bureau of Mines in selected quadrangles of West Virginia, Kentucky, and Illinois found that, even with optimal mine layouts, from 2% to 12% of the original resources will be left as pillars (USBM 1995). In reality, an optimal mine layout never occurs. Geologic conditions, availability of land and mineral rights, market conditions, and the desire of companies to maximize profits result in less than optimal placement of mines. This study found that, on a county-by-county basis, the amount of inaccessible coal ranged from 6% to more than 40% of the original resources in mined areas. On a statewide basis, the amount of inaccessible coal was roughly 20% of the original resources in mined areas. Some of this coal may have been left because of surface features, which are accounted for separately; thus it was assumed that 15% of the coal otherwise qualfied for the accessible reserve base will be rendered inaccessible by future mining.

Other Technical Factors Other technical 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. These factors are not understood well enough at this time to use them to adjust the accessible reserve base. At the completion of Illinois' coal availability assessment, the accessible reserve base should be adjusted to include as many of these factors as practical.

Land Use Earlier investigations have identified land uses such as interstate highways, railroads, cemeteries, towns, and public lands as factors that limit the accessibility of coal (Treworgy et al. 1978, Treworgy and Bargh 1982). Current coal availability studies indicate that some refinements are needed in how these factors are assessed. For example, early results indicate that surface mining can be conducted closer to towns in the southern part of the state than elsewhere. Also, county and township roads are serious obstacles to surface mining in some counties, but not in others. Additional quadrangle studies will help to define these factors and how they should be applied to the accessible reserve base.

The tonnage of underground-minable coal rendered inaccessible by surface features was mapped and calculated in the 1979 estimate of resources (Treworgy and Bargh 1982). The percentage of accessible coal varied from county to county; rural counties generally have 96% to 98% accessible, and counties with large urban areas have 78% to 92% accessible (appendix 3). The percentage of accessible coal for each seam in each county was applied to the underground-minable DRB (minus coal rendered inaccessible by mining) to obtain the underground-minable portion of the accessible reserve base.

Although the accessibility of surface-minable reserves has been considered in a previous study (Treworgy et al. 1978), changes in mining practice and findings from coal availability studies indicate that major changes are needed. For this preliminary assessment, a 94% rate of accessibility was applied in all counties to the new surface-minable DRB. This figure was chosen because it is the statewide average for the underground-minable reserves and it falls in the middle of the range measured for the surface-minable resources in the coal availability quadrangles studied to date. When more data are available, the accessibility rate is expected to vary widely from county to county.

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 IDMM reports).

Underground Mining 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% to 58% on a county and seam basis and averaged 48% for all seams and counties combined (table 9a). This agrees with EIA's data for 1991 through 1993, which show a weighted average

Table 9a Recovery rates, cumulative depletion, and production of underground-minable resources in selected counties from January 1, 1979, to January 1, 1994.

County	Coal	Depletion *million tons*	Production *million tons*	In-mine recovery %
Douglas	Herrin	42	18	43
Franklin	Herrin	179	100	56 *
Hamilton	Springfield	14	6	44
Jefferson	Herrin	121	59	49
Logan	Springfield	29	12	42
Macoupin	Herrin	127	54	43
Perry	Herrin	12	7	58
Washington	Herrin	42	20	47
White	Herrin	31	12	40
TOTAL		597	288	48

* A significant portion of the production during this period came from longwall mines, hence the higher recovery rate.

Table 9b Cumulative depletion and production of underground-minable resources in selected counties from January 1, 1979, to January 1, 1994.

County	Coal	Depletion *million tons*	Production *million tons*	Remarks
Christian	Herrin	52	36	Includes coal mined in Montgomery and Christian Counties
Clinton	Herrin	121	39	
Coles	Herrin	0	.01	Area mined too small to measure at scale of mapping
Gallatin	Springfield	40	23	Some production from surface-minable reserves
Montgomery	Herrin	39	8	Some production reported under Christian County
Randolph	Herrin	66	60	Some production from surface-minable reserves
St. Clair	Herrin	3	14	Most production from surface-minable reserves
Saline	Herrin	60	29	Some production from surface-minable reserves
Saline	Springfield	51	27	Some production from surface-minable reserves
Sangamon	Herrin	37	0	Production reported under Christian County
Sangamon	Springfield	3	0	Production reported under Logan County
Vermilion	Danville	0	0.2	Area mined too small to measure at scale of mapping
Vermilion	Herrin	0	0.3	All production from surface-minable reserves
Wabash	Springfield	56	41	About one-third of this production is from Indiana
Williamson	Herrin	28	9	Some production from surface-minable reserves and some tonnage reported under Franklin and Saline Counties
Williamson	Springfield	11	1	Some production from surface-minable reserves and some production reported under Saline County

Table 10a Cumulative surface-minable depletion, production, and validated recovery rates from base year to 1994 (all tonnages in millions).

County	Seam	Resources as of base year	Current resources	Inferred depletion	Reported surface-mine production	Recovery rate*
Fulton	Springfield	702.386	576.002	126.384	100.579	80
Fulton	Colchester	1104.785	1069.500	35.285	19.914	56
Knox	Herrin	257.066	215.567	41.499	28.284	68
Peoria	Herrin	1058.371	1031.348	27.023	19.210	71
Peoria	Colchester	107.779	100.783	6.996	6.651	95
Perry	Herrin	896.767	638.037	258.730	235.354	91(ug)
Perry	Springfield	209.274	108.718	107.184	88.513	88
Randolph	Herrin	279.139	182.765	96.374	67.904	70(ug)**
Randolph	Springfield	175.890	154.510	21.380	19.035	89
St. Clair	Herrin	1241.165	1092.084	148.081	116.845	79(ug)**
Schuyler	Springfield	113.394	104.969	8.425	4.239	50
Will	Colchester	21.623	13.855	7.768	6.081	78
TOTAL				885.119	712.609	81

* (ug) indicates that some surface-minable resources were depleted by underground mining.
** If depletion due to underground mining is exlcuded, the recovery rate rises to about 90%.

recovery rate of 50% for all underground mines. Based on these statistics, a factor of 50% was used to calculate remaining recoverable underground-minable reserves.

Some consideration was given to using a higher recovery rate in counties where longwall mining is being practiced; however, EIA's data did not show a consistent relation between mines operating longwalls and higher recovery rates. This is probably due to the influence of factors such 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 the reported production included production from outside the county, underground-minable reserves were depleted by surface mining, or production was too small to measure depletion at the scale of mapping (table 9b).

Surface Mining Data provided by EIA for individual surface mines for the years 1991 to 1993 showed recovery rates from 60% to 90%, with a weighted average of 75%. These figures compare favorably with recovery rates for selected counties, as calculated from cumulative depletion (from base year of mapping to January 1994) of surface-minable resources and reported cumulative production from surface mines (table 10). Both the EIA data and the ISGS cumulative depletion data from base year of mapping to 1994 suggest that recovery rates are lower for thinner seams (e.g., the Colchester Coal) or seams with many impurities (e.g., the Herrin Coal in Fulton and Peoria Counties). The Herrin Coal in the northwestern part of the state commonly contains impurities in the form of a widespread parting known as the "blue band" and prevalent occurrences of "white top" and clay dikes (Smith and Berggren 1963, Damberger 1970).

Based on these data, a recovery rate of 70% was used in this study to calculate recoverable surface-minable reserves of seams less than 48 inches thick or the Herrin Coal in northwestern Illinois. A recovery rate of 85% was used for all other surface-minable reserves.

RESULTS

Demonstrated Reserve Base

The new demonstrated reserve base (DRB) for Illinois as of January 1, 1994, is 90 billion short tons, which compares with 78 billion short tons in the previous estimate. The new estimate includes revised resource mapping in a number of counties as well as significant adjustments for depletion due to past mining. Areas of coal reserves densely drilled for oil or gas exploration, now that they have been included in the DRB estimate, account for about 3 billion tons of the increase.

Table 10b Cumulative surface-minable depletion and production from base year to 1994 (all tonnages in millions). Unless otherwise indicated under "remarks," production was statistically too small, relative to resources, to calculate a recovery rate.

County	Seam	Resources as of base year	Current resources	Inferred depletion	Reported surface-mine production	Remarks*
Adams	Colchester	619.275	616.332	2.943	0.292	
Brown	Colchester	385.689	383.410	2.279	0.016	Some production reported under Schuyler County
Bureau	Herrin	262.115	272.536		2.070	
Edgar	Danville	150.392	151.119		1.380	
Fulton	Danville	58.882	56.558	2.324	0	Destroyed by mining of lower seam
Fulton	Herrin	249.286	242.666	6.620	7.203	Some production probably from Knox County
Fulton	Rock Island	5.458	8.028		0.096	
Gallatin	Herrin	121.905	177.746		5.724	New mapping
Gallatin	Springfield	115.849	104.651	11.198	1.727	ug mining of sf resources
Greene	Colchester	500.648	502.965		0.072	
Grundy	Colchester	312.519	306.064	6.455	0.608	
Jackson	Herrin	149.318	79.287	70.031	33.314	Revised mapping
Jackson	Springfield	99.843	96.533	3.310	3.681	New mapping
Jackson	Murphysboro	130.278	134.524		0.871	New mapping
Jefferson	Opdyke	22.344	23.258		0.413	
Kankakee	Houchin Creek	15.515	14.892	.623	0.105	
Kankakee	Colchester	11.501	11.861		2.647	Some production from Will or Grundy County
Knox	Danville	2.523	1.170	1.353	0	Destroyed by mining of lower seam
Knox	Springfield	626.509	621.346	5.163	2.676	Incomplete reporting
La Salle	Colchester	209.712	265.053		0.009	New mapping
McDonough	Colchester	584.320	580.217	4.103	5.364	
Mercer	Rock Island	55.000	54.075		0.480	
Peoria	Danville	282.537	276.297	6.240	0	Destroyed by mining of lower seam
Peoria	Springfield	725.549	736.787		0.890	
Saline	Danville	78.422	69.075	9.347	0	Incomplete reporting; destroyed by mining
Saline	Herrin	284.572	217.234	67.338	35.344	ug mining of sf resources
Saline	Springfield	93.422	89.339	4.083	2.014	ug mining of sf resources
Saline	Dekoven	45.130	60.071		7.022	New mapping
Saline	Davis	43.864	71.077		8.855	Revised mapping
Schuyler	Colchester	606.150	600.911	5.239	5.591	
Stark	Herrin	442.467	438.940	3.327	8.341	New mapping
Vermilion	Danville	386.647	393.459		0.124	New mapping
Williamson	Danville	57.022	55.829		3.555	Some production from Saline County
Williamson	Herrin	290.718	236.971	53.747	69.938	Revised mapping
Williamson	Springfield	200.268	184.008	16.260	6.945	ug mining of sf resources
Williamson	Dekoven	40.826	51.331		7.862	New mapping
Williamson	Davis	26.331	46.703		10.786	New mapping

* ug = underground; sf = surface minable

The new estimates incorporate analyses of available sulfur, heating value, and rank group data appropriate for characterizing the remaining coal resources in Illinois. 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 resource quantities to ranges of sulfur content and heating value. The new allocations place almost 1% of the DRB of Illinois in the two lowest sulfur categories (588 million tons), as compared with none in the previous allocation used by the EIA. These new allocations also place 89% of the reserve base in the highest sulfur category, however, as opposed to 69% in the previous allocation.

Table 11a Summary of surface-minable Demonstrated Reserve Base in Illinois, as of January 1, 1994 (million short tons).

Heat content million Btu/ short ton)	Coal rank / Sulfur content (lbs sulfur/million Btu) <0.40	0.41–0.60	0.61–0.83	0.84–1.24	1.25–1.67	1.68–2.50	>2.50	Total all sulfur categories
		Bituminous						
<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

Table 11b Summary of underground-minable Demonstrated Reserve Base in Illinois, as of January 1, 1994 (million short tons).

Heat content million Btu/ short ton)	Coal rank / Sulfur content (lbs sulfur/million Btu) <0.40	0.41–0.60	0.61–0.83	0.84–1.24	1.25–1.67	1.68–2.50	>2.50	Total all sulfur categories
		Bituminous						
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	19,657.37	23,004.01
25 – 25.99	–	–	–	–	–	–	1,170.13	1,170.13
> 25.99	–	–	–	–	–	–	14.09	14.09
TOTAL	72.73	515.01	1,050.76	2,212.38	1,807.29	3,660.21	64,549.48	73,867.88

Table 11c Summary of total Demonstrated Reserve Base in Illinois, as of January 1, 1994 (million short tons).

Heat content million Btu/ short ton)	Coal rank / Sulfur content (lbs sulfur/million Btu) <0.40	0.41–0.60	0.61–0.83	0.84–1.24	1.25–1.67	1.68–2.50	>2.50	Total all sulfur categories
		Bituminous						
<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	20,746.81	24,222.16
25 – 25.99	–	–	–	–	–	–	1,544.01	1,544.01
> 25.99	–	–	–	–	–	–	14.09	14.09
TOTAL	72.73	515.01	1,052.12	2,242.39	1,845.79	4,171.60	80,154.84	90,054.48

Table 11 is a summary of the DRB by mining method, sulfur content, and heating value. A complete listing of the DRB by county, seam, depth, heating value, and sulfur content is in appendix 4.

Accessible Reserve Base

The new accessible reserve base is 62 billion tons, compared with the previous estimate of 56 billion tons. Unlike the previous base, the present compilation does not exclude coal under prime farm land. However, underground-minable coal less than 4 feet thick, coal under surface features such as towns, interstate highways, and public lands, and coal rendered inaccessible (barrier pillars and small, irregular blocks between mines) by past and future mining have been excluded. Table 12 summarizes the accessible reserve base by mining method, heating value, and sulfur content.

Table 12a Summary of surface-minable Accessible Reserve Base in Illinois, as of January 1, 1994 (million short tons).

Heat content million Btu/ short ton)	Coal rank	Sulfur content (lbs sulfur/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	
	Bituminous							
<20	–	–	–	–	–	7.01	97.46	104.48
20 – 22.99	–	–	–	1.80	12.01	306.02	10,676.22	10,996.05
23 – 24.99	–	–	1.09	21.11	16.08	64.57	867.86	970.70
25 – 25.99	–	–	–	–	–	–	277.55	277.55
TOTAL	–	–	1.09	22.90	28.09	377.60	11,919.10	12,348.78

Table 12b Summary of underground-minable Accessible Reserve Base in Illinois, as of January 1, 1994 (million short tons).

Heat content million Btu/ short ton)	Coal rank	Sulfur content (lbs sulfur/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	
	Bituminous							
20 – 22.99	10.62	217.78	548.90	867.88	711.16	1,377.91	28,727.38	32,461.64
23 – 24.99	0.02	8.72	150.79	699.77	551.07	1,177.40	13,642.06	16,229.83
25 – 25.99	–	–	–	–	–	–	568.01	568.01
>25.99	–	–	–	–	–	–	3.71	3.71
TOTAL	10.64	226.50	699.70	1,567.65	1,262.23	2,555.31	42,941.16	49,263.19

Table 12c Summary of total Accessible Reserve Base in Illinois, as of January 1, 1994 (million short tons).

Heat content million Btu/ short ton)	Coal rank	Sulfur content (lbs sulfur/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	
	Bituminous							
<20	–	–	–	–	–	7.01	97.46	104.48
20 – 22.99	10.62	217.78	548.90	869.68	723.18	1,683.93	39,403.60	43,457.69
23 – 24.99	0.02	8.72	151.88	720.88	567.15	1,241.97	14,509.92	17,200.53
25 – 25.99	–	–	–	–	–	–	845.56	845.56
>25.99	–	–	–	–	–	–	3.71	3.71
TOTAL	10.64	226.50	700.78	1,590.55	1,290.32	2,932.91	54,860.25	61,611.96

Recoverable Reserves

The new estimate of recoverable reserves is 34 billion tons, compared with the previous estimate of 30 billion tons. Table 13 summarizes recoverable reserves by mining method, heating value, and sulfur content.

Digital Data

A digital database of identified resources and the DRB, accessible, and recoverable reserves has been provided to EIA. This data base contains more detailed thickness and depth categories than are shown in the tables of this report. The format of the digital data base is described in appendix 5.

Table 13a Summary of surface-minable Recoverable Reserve Base in Illinois, as of January 1, 1994 (million short tons).

Heat content million Btu/ short ton)	Coal rank	Sulfur content (lbs sulfur/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	
	Bituminous							
<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

Table 13b Summary of underground-minable Recoverable Reserve Base in Illinois, as of January 1, 1994 (million short tons).

Heat content million Btu/ short ton)	Coal rank	Sulfur content (lbs sulfur/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	
	Bituminous							
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

Table 13c Summary of total minable Recoverable Reserve Base in Illinois, as of January 1, 1994 (million short tons).

Heat content million Btu/ short ton)	Coal rank	Sulfur content (lbs sulfur/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	
	Bituminous							
<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

Cumulative Depletion and Production: Underground Mining

Cumulative depletion of underground-minable reserves by underground mining for the period January 1, 1979, to January 1, 1994, is shown in table 9. This represents the total coal extracted or left as interior pillars. Reported production by underground mines for the same period is also shown. The production is reported according to the location of the mine tipple and is overstated for counties (Christian and Wabash) where tipples receive coal from other locations and understated for counties (Macoupin and Montgomery) where coal is extracted through tipples in other counties (Macoupin and Montgomery). In Randolph and St. Clair Counties, a significant portion of

the production by underground mines was from surface-minable reserves. Valid recovery rates cannot be computed from production and depletion for these counties.

Cumulative Depletion and Production: Surface Mining

Cumulative depletion of surface-minable resources and cumulative production from surface mines are shown in table 10. Note that the latest resource estimate may be as much as 3% higher or lower than the original estimate simply because of changes in base maps and the procedures used to calculate areas. Consequently, there may be no logical relationship between apparent depletion and reported production for counties in which surface mine production during the period of study is less than a few percent of the resource base. The figures are also misleading in several counties where a significant amount of surface-minable resources was extracted by underground mines.

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APPENDIX 1 Source maps for coal resources

The reports listed under "source" are ISGS publications. "Y" in the "revise" column indicates that new data are available and the resource/reserve map should be revised.

County	Seam	Source	Map year	Scale (×1000)	Update mining*	Revise
Adams	Colchester	Reinertsen 1964	1964	125		
Bond	Litchfield	Cady 1952	1950	62.5		
Bond	Herrin	Treworgy and Bargh 1982	1978	62.5		
Bond	Colchester	Cady 1952	1950	62.5		
Brown	Colchester	Reinertsen 1964	1964	125	S	
Bureau	Danville	Cady 1952, Smith and Berggren 1963, Smith 1968	1950	125		Y
Bureau	Herrin	Cady 1952, Smith and Berggren 1963, Smith 1968	1950	125		Y
Bureau	Colchester	Cady 1952, Smith and Berggren 1963, Smith 1968	1950	125		Y
Calhoun	Colchester	Reinertsen 1964	1964	125		
Cass	Herrin	Smith 1961	1961	125		
Cass	Springfield	Nance and Treworgy 1981	1981	125		Y
Cass	Colchester	Smith 1961	1961	125		
Champaign	Danville	Treworgy and Bargh 1982	1978	62.5		Y
Champaign	Herrin	Treworgy and Bargh 1982	1978	62.5		Y
Christian	Danville	Cady 1952	1950	62.5		
Christian	Herrin	Treworgy and Bargh 1982	1978	62.5	U	Y
Christian	Springfield	Treworgy and Bargh 1982	1978	62.5		Y
Christian	Assumption	Cady 1952	1950	62.5		
Clark	Danville	Work map by CGT	1978	62.5		Y
Clark	Jamestown	Work map by CGT	1978	62.5		Y
Clark	Herrin	Work map by CGT	1978	62.5		Y
Clark	Springfield	Work map by CGT	1978	62.5		Y
Clark	Seelyville	Treworgy 1981	1978	62.5		Y
Clay	Herrin	Allgaier and Hopkins 1975	1975	125		
Clay	Springfield	Work map by CGT	1978	62.5		Y
Clay	Seelyville	Treworgy 1981	1978	62.5		
Clinton	Herrin	Treworgy and Bargh 1982	1978	62.5	U	Y
Coles	Danville	Work map by CGT	1978	62.5		Y
Coles	Herrin	Work map by CGT	1978	62.5	U	Y
Coles	Springfield	Work map by CGT	1978	62.5		Y
Coles	Seelyville	Treworgy 1981	1978	62.5		Y
Crawford	Bristol Hill	Nance and Treworgy 1981	1981	62.5		
Crawford	Danville	Work map by CGT	1978	62.5		
Crawford	Jamestown	Work map by CGT	1978	62.5		
Crawford	Herrin	Allgaier and Hopkins 1975	1975	125		
Crawford	Springfield	Work map by CGT	1978	62.5		
Crawford	Seelyville	Treworgy 1981	1978	62.5		
Cumberland	Trowbridge	Nance and Treworgy 1981	1981	62.5		
Cumberland	Herrin	Work map by CGT	1978	62.5		Y
Cumberland	Springfield	Work map by CGT	1978	62.5		Y
Cumberland	Seelyville	Treworgy 1981	1981	62.5		Y
De Witt	Springfield	Treworgy and Bargh 1982	1978	62.5		Y
Douglas	Herrin	Work map by CGT	1978	62.5	U	Y

*U = underground mining; S = surface mining

APPENDIX 1 ***continued***

County	Seam	Source	Map year	Scale (×1000)	Update mining*	Revise
Douglas	Springfield	Work map by CGT	1978	62.5		
Edgar	Danville	Work map by CGT	1978	62.5	S	
Edgar	Herrin	Work map by CGT	1978	62.5	S	
Edgar	Springfield	Work map by CGT	1978	62.5		
Edgar	Survant	Work map by CGT	1978	62.5		
Edgar	Seelyville	Treworgy 1981	1981	62.5		
Edwards	Herrin	Treworgy and Bargh 1982	1978	62.5		Y
Edwards	Springfield	Treworgy and Bargh 1982	1978	62.5		Y
Effingham	Shelbyville	Nance and Treworgy 1981	1981	62.5		
Effingham	Herrin	Allgaier and Hopkins 1975	1975	125		Y
Effingham	Springfield	Work map by CGT	1978	62.5		Y
Effingham	Seelyville	Treworgy 1981	1981	62.5		Y
Fayette	Shelbyville	Nance and Treworgy 1981	1981	62.5		
Fayette	Louden	Nance and Treworgy 1981	1981	62.5		
Fayette	Danville	Cady 1952	1950	62.5		
Fayette	Herrin	Allgaier and Hopkins 1975	1975	125		
Fayette	Springfield	Work map by CGT	1978	62.5		
Franklin	Belle Rive	Nance and Treworgy 1981	1981	62.5		
Franklin	Herrin	Treworgy and Bargh 1982	1978	62.5	U	Y
Franklin	Springfield	Treworgy and Bargh 1982	1978	62.5		
Franklin	Dekoven	Cady 1952	1950	62.5		
Franklin	Davis	Cady 1952	1950	62.5		
Franklin	Mt. Rorah	Cady 1952	1950	62.5		
Fulton	Danville	Smith and Berggren 1963	1963	125	S	Y
Fulton	Herrin	Smith and Berggren 1963	1963	125	S	Y
Fulton	Springfield	Smith and Berggren 1963	1963	125	S	Y
Fulton	Colchester	Smith and Berggren 1963	1963	125	S	Y
Fulton	Rock Island	Smith and Berggren 1963	1963	125		
Gallatin	Herrin	Treworgy and Bargh 1982, Smith 1957	1957	62.5	US	Y
Gallatin	Springfield	Circulars 527, 228	1957	62.5	US	Y
Gallatin	Dekoven	Cady 1952	1950	62.5	S	Y
Gallatin	Davis	Cady 1952	1950	62.5	S	Y
Gallatin	Willis	Cady 1952	1950	62.5		
Greene	Herrin	Smith 1961	1961	125		
Greene	Colchester	Smith 1961, Cady 1952	1950	125		
Grundy	Herrin	Jacobson 1985	1985	62.5		
Grundy	Houchin Creek	Jacobson 1985	1985	62.5		
Grundy	Colchester	Jacobson 1985	1985	62.5	S	
Hamilton	Herrin	Treworgy and Bargh 1982	1978	62.5		
Hamilton	Springfield	Treworgy and Bargh 1982	1978	62.5	U	
Hamilton	Dekoven	Cady 1952	1950	62.5		
Hamilton	Davis	Cady 1952	1950	62.5		
Hancock	Colchester	Reinertsen 1964	1964	125		
Henderson	Colchester	Reinertsen 1964	1964	125		
Henry	Danville	Smith and Berggren 1963	1963	125		Y
Henry	Herrin	Smith and Berggren 1963	1963	125		Y
Henry	Colchester	Smith and Berggren 1963	1963	125		Y
Henry	Rock Island	Searight and Smith 1969	1969	125		
Jackson	Seahorne	Smith 1957	1957	125		
Jackson	Herrin	Smith 1958	1958	125	S	Y
Jackson	Springfield	Smith 1958, Treworgy and Bargh 1982	1958	125		

APPENDIX 1 ***continued***

County	Seam	Source	Map year	Scale (×1000)	Update mining*	Revise
Jackson	Murphysboro	Jacobson 1983	1983	125		Y
Jasper	Herrin	Trewergy and Bargh 1982	1978	62.5		Y
Jasper	Springfield	Work map by CGT	1978	62.5		Y
Jasper	Seelyville	Trewergy 1981	1981	62.5		Y
Jefferson	Opdyke	Nance and Trewergy 1981	1981	62.5	S	
Jefferson	Belle Rive	Nance and Trewergy 1981	1981	62.5		
Jefferson	Herrin	Trewergy and Bargh 1982	1978	62.5	U	Y
Jefferson	Springfield	Trewergy and Bargh 1982	1978	62.5		Y
Jersey	Herrin	Smith 1961	1961	125		
Jersey	Colchester	Cady 1952, Smith 1961	1950	125		
Johnson	New Burnside	no mapped resources			S	
Kankakee	Houchin Creek	Smith 1968	1968	125		
Kankakee	Colchester	Cady 1952, Smith 1968	1950	125		
Knox	Danville	Smith and Berggren 1963	1963	125	S	Y
Knox	Herrin	Smith and Berggren 1963	1963	125	S	Y
Knox	Springfield	Smith and Berggren 1963	1963	125	S	Y
Knox	Colchester	Cady 1952, Smith and Berggren 1963	1950	125		Y
Knox Rock	Island	Cady 1952	1950	62.5		
La Salle	Danville	Jacobson 1985	1985	62.5		
La Salle	Herrin	Jacobson 1985	1985	62.5		
La Salle	Houchin Creek	Jacobson 1985	1985	62.5		
La Salle	Colchester	Jacobson 1985	1985	62.5		
Lawrence	Danville	Work map by CGT	1978	62.5		
Lawrence	Jamestown	Work map by CGT	1978	62.5		
Lawrence	Herrin	Trewergy and Bargh 1982	1978	62.5		
Lawrence	Springfield	Work map by CGT	1978	62.5		
Lawrence	Survant	Cady 1952	1950	62.5		
Lawrence	Seelyville	Trewergy 1981	1981	62.5		
Livingston	Danville	Jacobson 1985	1985	62.5		
Livingston	Herrin	Jacobson 1985	1985	62.5		
Livingston	Houchin Creek	Jacobson 1985	1985	62.5		
Livingston	Colchester	Jacobson 1985	1985	62.5		
Logan	Danville	no mapped resources				Y
Logan	Herrin	Work map by JDT	1983	62.5		Y
Logan	Springfield	Trewergy and Bargh 1982	1978	62.5	U	Y
McDonough	Colchester	Reinertsen 1964	1964	125	S	Y
McLean	Danville	Cady 1952	1950	62.5		Y
McLean	Springfield	Trewergy and Bargh 1982	1978	62.5		Y
McLean	Colchester	Cady 1952	1950	62.5		Y
Macon	Herrin	Trewergy and Bargh 1982	1978	62.5		
Macon	Springfield	Trewergy and Bargh 1982	1978	62.5		
Macoupin	Wiley	Cady 1952	1950	62.5		
Macoupin	Danville	Cady 1952	1950	62.5		
Macoupin	Herrin	Smith 1963, Trewergy and Bargh 1982	1963	62.5	U	Y
Macoupin	Houchin Creek	Cady 1952, Trewergy and Bargh 1982	1950	62.5		
Macoupin	Colchester	Cady 1952, Smith 1961	1950	62.5		
Macoupin	Litchfield	Cady 1952	1950	62.5		
Madison	Wiley	Cady 1952	1950	62.5		
Madison	Herrin	Smith 1963, Trewergy and Bargh 1982	1963	62.5		Y

APPENDIX 1 ***continued***

County	Seam	Source	Map year	Scale (×1000)	Update mining*	Revise
Madison	Colchester	Cady 1952, Smith 1961	1950	62.5		
Madison	Litchfield	Cady 1952	1950	62.5		
Marion	Herrin	Treworgy and Bargh 1982	1978	62.5		
Marion	Springfield	Work map by CGT	1978	62.5		
Marshall	Danville	Cady 1952, Smith and Berggren 1963	1950	62.5		
Marshall	Herrin	Cady 1952	1950	62.5		
Marshall	Colchester	Cady 1952	1950	62.5		
Mason	Springfield	Treworgy and Bargh 1982	1978	62.5		
Menard	Danville	no mapped resources				
Menard	Herrin	no mapped resources				Y
Menard	Springfield	Treworgy and Bargh 1982	1978	62.5		Y
Mercer	Colchester	Reinertsen 1964, Searight and Smith 1969	1964	125		Y
Mercer	Rock Island	Reinertsen 1964, Searight and Smith 1969	1964	125		
Monroe	Herrin	Smith 1958	1958	125		
Montgomery	Danville	Cady 1952	1950	62.5		
Montgomery	Herrin	Treworgy and Bargh 1982	1978	62.5	U	Y
Montgomery	Houchin Creek	Cady 1952	1950	62.5		
Montgomery	Colchester	Cady 1952	1950	62.5		
Montgomery	Litchfield	Cady 1952	1950	62.5		
Montgomery	Wiley	Cady 1952	1950	62.5		
Morgan	Herrin	Smith 1961, Treworgy and Bargh 1982	1961	125		
Morgan	Springfield	Smith 1961	1961	125		Y
Morgan	Colchester	Smith 1961, Cady 1952	1950	125		Y
Moultrie	Herrin	Work map by CGT	1995	50		
Peoria	Danville	Smith and Berggren 1963	1963	125	S	Y
Peoria	Herrin	Smith and Berggren 1963	1963	125	S	Y
Peoria	Springfield	Smith and Berggren 1963	1963	125		Y
Peoria	Colchester	Smith and Berggren 1963, Cady 1952	1950	125		Y
Perry	Danville	no mapped resources			S	
Perry	Herrin	Smith 1958, Treworgy and Bargh 1982	1958	62.5	US	
Perry	Springfield	Smith 1958, Treworgy and Bargh 1982	1958	62.5	S	
Perry	Murphysboro	Jacobson 1983	1983			
Piatt	Springfield	Treworgy and Bargh 1982	1978	62.5		
Pike	Colchester	Reinertsen 1964	1964	125		
Pope	Abbot Fm.	no mapped resources			S	
Putman	Danville	Cady 1952	1950	62.5		
Putman	Herrin	Treworgy and Bargh 1982	1978	62.5		
Putman	Colchester	Cady 1952	1950	62.5		
Randolph	Herrin	Smith 1958, Treworgy and Bargh 1982	1958	125	US	
Randolph	Springfield	Smith 1958	1958	125	S	
Richland	Calhoun	Nance and Treworgy 1981	1981	62.5		
Richland	Danville	Work map by CGT	1978	62.5		
Richland	Herrin	Smith and Stall 1975	1975	62.5		
Richland	Springfield	Work map by CGT	1978	62.5		
Richland	Seelyville	Treworgy 1981	1981	62.5		

APPENDIX 1 ***continued***

County	Seam	Source	Map year	Scale (×1000)	Update mining*	Revise
Rock Island	Rock Island	Searight and Smith 1969	1969	125		
St. Clair	Herrin	Circulars 260, 527	1958	125	US	
Saline	Danville	Smith 1957	1957	125	S	
Saline	Herrin	Smith 1957, Treworgy and Bargh 1982	1957	125	US	Y
Saline	Springfield	Smith 1957, Treworgy and Bargh 1982	1957	125	US	Y
Saline	Houchin Creek	Cady 1952	1950	62.5		
Saline	Dekoven	Smith 1957, Cady 1952	1950	125	S	Y
Saline	Davis	Smith 1957, Cady 1952	1950	125	S	Y
Sangamon	Herrin	Treworgy and Bargh 1982	1978	62.5		Y
Sangamon	Springfield	Nance and Treworgy 1981, Treworgy and Bargh 1982	1978	62.5		Y
Sangamon	Houchin Creek	Cady 1952	1950	62.5		Y
Sangamon	Litchfield	Cady 1952	1950	62.5		
Schuyler	Springfield	Reinertsen 1964	1964	125		
Schuyler	Colchester	Reinertsen 1964	1964	125	S	
Scott	Herrin	Smith 1961	1961	125		Y
Scott	Colchester	Smith 1961, Cady 1952	1961	125		Y
Shelby	Trowbridge	Nance and Treworgy 1981	1983	62.5		
Shelby	Shelbyville	Nance and Treworgy 1981	1983	62.5		
Shelby	Danville	Cady 1952	1950	62.5		
Shelby	Herrin	Work map by CGT	1978	62.5		
Shelby	Springfield	Work map by CGT	1978	62.5		
Shelby	Seelyville	Treworgy 1981	1981	62.5		
Shelby	Assumption	Cady 1952	1950	62.5		
Stark	Danville	Smith and Berggren 1963	1963	125		Y
Stark	Herrin	Cady 1952, Smith and Berggren 1963	1950	125	S	Y
Stark	Colchester	Smith and Berggren 1963	1963	125		Y
Tazewell	Danville	Smith and Berggren 1963	1963	125		
Tazewell	Herrin	Smith and Berggren 1963, Treworgy and Bargh 1982	1963	125		
Tazewell	Springfield	Smith and Berggren 1963, Treworgy and Bargh 1982	1964	125		
Tazewell	Colchester	Cady 1952, Smith and Berggren 1963	1950	125		
Vermilion	Danville	Jacobson and Bengal 1981	1981	62.5	U	
Vermilion	Herrin	Jacobson and Bengal 1981	1981	62.5	US	Y
Vermilion	Seelyville	Cady 1952	1950	62.5		
Wabash	Friendsville	Nance and Treworgy 1981	1983	62.5		Y
Wabash	Herrin	Treworgy and Bargh 1982	1978	62.5		
Wabash	Springfield	Treworgy and Bargh 1982	1978	62.5	U	Y
Warren	Springfield	Smith and Berggren 1963	1963	125		
Warren	Colchester	Smith and Berggren 1963	1963	125		
Warren	Rock Island	Searight and Smith 1969	1969	125		
Washington	Herrin	Treworgy and Bargh 1982	1978	62.5	U	
Wayne	Herrin	Treworgy and Bargh 1982	1978	62.5		
Wayne	Springfield	Treworgy and Bargh 1982, work map by CGT	1978	62.5		
White	Herrin	Treworgy and Bargh 1982	1978	62.5	U	
White	Springfield	Treworgy and Bargh 1982	1978	62.5		
White	Dekoven	Cady 1952	1950	62.5		

APPENDIX 1 ***continued***

County	Seam	Source	Map year	Scale (×1000)	Update mining*	Revise
White	Davis	Cady 1952	1950	62.5		
Will	Colchester	Smith 1968	1968	125	S	
Williamson	Miscellaneous	Cady 1952, Smith 1957	1950	125	S	
Williamson	Danville	Smith 1957	1957	125	S	Y
Williamson	Herrin	Smith 1957, Treworgy and Bargh 1982	1957	125	US	Y
Williamson	Springfield	Smith 1957, Treworgy and Bargh 1982	1957	125	S	
Williamson	Dekoven	Cady 1952, Smith 1957	1950	125		
Williamson	Davis	Cady 1952, Smith 1957	1950	125		
Woodford	Danville	Cady 1952	1950	62.5		
Woodford	Springfield	Cady 1952	1950	62.5		
Woodford	Colchester	Cady 1952	1950	62.5		

* U = underground mining; S = surface mining

APPENDIX 2 Assumptions used to allocate reported mine production to individual seams

Coals reported mined	Assumptions
Herrin and Springfield:	Allocate production 60/40, *except* in Randolph County allocate 40/60.
Davis–Dekoven:	Allocate production 50/50.
Nos. 2 and 3:	Assume to be Davis and Dekoven; allocate production equally between seams.
Nos. 2 and 7 (Kankakee Co.):	No resources of Danville (No. 7) have been mapped and the coal is not known to be present; not sure which seam this might refer to. Allocate all production to Colchester (No. 2).
Nos. 2 and 5 (Fulton Co.):	Allocate 75% to Colchester, 25% to Springfield (No. 5) based on following year's production of Colchester only.
Nos. 5, 5A, and 6 (Gallatin Co.):	Allocate equally between Herrin and Springfield; no resources of Briar Hill (No. 5a) mapped.
Nos. 5 and 5A:	Based on thickness and assumption that Briar Hill is not always present; allocate 20% to Briar Hill, 80% to Springfield.
Nos. 5, 6, and 7(Perry Co.):	Danville production assumed to be minimal. Allocate production 60% to Herrin, 40% to Springfield.
Nos. 6 and 7 (Delta Mine):	Danville production assumed to be minimal. Danville is 25% of total thickness, but not consistently present. Allocate 90% to Herrin, 10% to Danville.
Nos. 4 and 5 (Williamson Co.):	Allocate 20% to Houchin Creek (No. 4), 80% to Springfield based on average thickness and assumption that Houchin Creek was not mined in all areas of pit.
Nos. 3, 4, 5, 5A, and 6 (Gallatin Co.):	Allocate 10% to Briar Hill, 20% to Davis, Dekoven, Springfield, and Herrin.
Nos. 3, 4, 5, and 6 (Gallatin Co.):	Allocate 25% to each.
Nos. 3 and 4:	Assume to be Davis and Dekoven; allocate 50/50.

APPENDIX 3 Factors used to calculate underground-minable reserves restricted by land use

The tonnage of underground-minable demonstrated reserves not restricted by land use was calculated by different accessibility factors for each county and each seam within a county. An accessibility factor of 94% was used for all surface-minable reserves.

County	Coal	% accessible
Bond	Herrin	94
Bond	Colchester	100
Bond	Rock Island	100
Bureau	Danville	85
Bureau	Herrin	90
Bureau	Colchester	94
Champaign	Danville	94
Champaign	Herrin	95
Christian	Danville	82
Christian	Herrin	95
Christian	Springfield	92
Christian	Rock Island	93
Clark	Danville	94
Clark	Jamestown	95
Clark	Herrin	67
Clark	Springfield	92
Clark	Seelyville	93
Clay	Herrin	81
Clay	Springfield	82
Clay	Seelyville	81
Clinton	Herrin	83
Coles	Danville	76
Coles	Herrin	75
Coles	Springfield	89
Coles	Seelyville	87
Crawford	Danville	58
Crawford	Jamestown	66
Crawford	Herrin	52
Crawford	Springfield	63
Crawford	Seelyville	62
Cumberland	Herrin	94
Cumberland	Springfield	95
Cumberland	Seelyville	93
De Witt	Springfield	90
Douglas	Herrin	94
Douglas	Springfield	96
Edgar	Danville	96
Edgar	Herrin	92
Edgar	Springfield	97
Edgar	Seelyville	95
Edwards	Herrin	87
Edwards	Springfield	85
Effingham	Herrin	91
Effingham	Springfield	92
Effingham	Seelyville	93
Fayette	Danville	94
Fayette	Herrin	92
Fayette	Springfield	90

continued

County	Coal	% accessible
Franklin	Herrin	87
Franklin	Springfield	85
Franklin	Mt. Rorah	92
Franklin	Dekoven	79
Franklin	Davis	78
Fulton	Springfield	100
Fulton	Colchester	100
Gallatin	Herrin	86
Gallatin	Springfield	87
Gallatin	Survant	100
Gallatin	Dekoven	94
Gallatin	Davis	94
Greene	Colchester	100
Grundy	Colchester	97
Hamilton	Herrin	88
Hamilton	Springfield	84
Hamilton	Dekoven	100
Hamilton	Davis	100
Henry	Colchester	100
Jackson	Springfield	97
Jasper	Herrin	90
Jasper	Springfield	91
Jasper	Seelyville	92
Jefferson	Herrin	89
Jefferson	Springfield	90
Jersey	Colchester	100
Kankakee	Colchester	100
Knox	Colchester	100
Knox	Rock Island	100
La Salle	Danville	87
La Salle	Herrin	73
La Salle	Colchester	91
Lawrence	Danville	86
Lawrence	Jamestown	81
Lawrence	Herrin	84
Lawrence	Springfield	83
Lawrence	Survant	87
Lawrence	Seelyville	88
Livingston	Danville	95
Livingston	Herrin	98
Livingston	Colchester	96
Logan	Herrin	91
Logan	Springfield	96
McLean	Danville	82
McLean	Springfield	92
McLean	Colchester	59
Macon	Herrin	93
Macon	Springfield	81

continued

APPENDIX 3 *continued*

County	Coal	% accessible
Macoupin	Danville	93
Macoupin	Herrin	96
Macoupin	Houchin Creek	100
Macoupin	Colchester	96
Macoupin	Wiley	82
Macoupin	Rock Island	91
Madison	Herrin	85
Madison	Colchester	99
Madison	Wiley	98
Madison	Rock Island	97
Marion	Herrin	87
Marion	Springfield	84
Marshall	Danville	97
Marshall	Herrin	63
Marshall	Colchester	95
Menard	Springfield	95
Montgomery	Danville	95
Montgomery	Herrin	96
Montgomery	Houchin Creek	97
Montgomery	Colchester	94
Montgomery	Wiley	83
Montgomery	Rock Island	91
Morgan	Herrin	98
Morgan	Colchester	91
Moultrie	Herrin	85
Peoria	Springfield	100
Peoria	Colchester	100
Perry	Herrin	97
Perry	Springfield	93
Piatt	Springfield	95
Putnam	Danville	94
Putnam	Herrin	86
Putnam	Colchester	95
Randolph	Herrin	90
Richland	Danville	88
Richland	Herrin	87
Richland	Springfield	88
Richland	Seelyville	94
St. Clair	Herrin	86
Saline	Herrin	87
Saline	Springfield	87
Saline	Survant	94
Saline	Dekoven	86
Saline	Davis	86
Sangamon	Herrin	88
Sangamon	Springfield	87
Sangamon	Houchin Creek	91
Sangamon	Rock Island	42
Scott	Colchester	100
Shelby	Danville	98
Shelby	Herrin	95
Shelby	Springfield	97
Shelby	Seelyville	95
Shelby	Rock Island	100
Stark	Herrin	100
Tazewell	Herrin	80
Tazewell	Springfield	86
Tazewell	Colchester	52
Vermilion	Danville	97
Vermilion	Herrin	94
Vermilion	Seelyville	61
Wabash	Herrin	66
Wabash	Springfield	62
Washington	Herrin	94
Wayne	Herrin	79
Wayne	Springfield	80
White	Herrin	81
White	Springfield	80
White	Dekoven	72
White	Davis	66
Williamson	Herrin	95
Williamson	Springfield	89
Williamson	Survant	68
Williamson	Mt. Rorah	82
Williamson	Dekoven	88
Williamson	Davis	88
Woodford	Danville	92
Woodford	Springfield	91
Woodford	Colchester	96

continued

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Adams County										
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							276.94	276.94
	Deep	150-500'	20-22.99							0.18	0.18
Adams Co., All Beds											
	Surface	0-150'	20-22.99							276.94	276.94
	Surface	Subtotal								276.94	276.94
	Deep	150-500'	20-22.99							0.18	0.18
	Deep	Subtotal								0.18	0.18
Adams Co. Totals										277.12	277.12
	Bond County										
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99							1,666.94	1,666.94
		500-1000'	20-22.99							30.81	30.81
Bond Co., All Beds											
	Deep	150-500'	20-22.99							1,666.94	1,666.94
		500-1000'	20-22.99							30.81	30.81
	Deep	Subtotal								1,697.74	1,697.74
Bond Co. Totals										1,697.74	1,697.74

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Brown County											
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							264.07	264.07
	Deep	150-500'	20-22.99							8.11	8.11
Brown Co., All Beds											
	Surface	0-150'	20-22.99							264.07	264.07
	Surface	Subtotal								264.07	264.07
	Deep	150-500'	20-22.99							8.11	8.11
	Deep	Subtotal								8.11	8.11
Brown Co. Totals										272.18	272.18
Bureau County											
Danville											
High Vol. C Bit.	Surface	0-150'	20-22.99							73.34	73.34
	Deep	150-500'	20-22.99							192.61	192.61
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							171.26	171.26
	Deep	150-500'	20-22.99							392.90	392.90
Colchester											
High Vol. C Bit.	Deep	150-500'	20-22.99							607.06	607.06
Bureau Co., All Beds											
	Surface	0-150'	20-22.99							244.60	244.60

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Surface	Subtotal								244.60	244.60
	Deep	150-500'	20-22.99							1,192.57	1,192.57
	Deep	Subtotal								1,192.57	1,192.57
Bureau Co. Totals										1,437.17	1,437.17
	Calhoun County										
Colchester High Vol. C Bit.	Surface	0-150'	20-22.99							12.21	12.21
Calhoun Co., All Beds	Surface	0-150'	20-22.99							12.21	12.21
	Surface	Subtotal								12.21	12.21
Calhoun Co. Totals										12.21	12.21
	Cass County										
Colchester High Vol. C Bit.	Surface	0-150'	20-22.99							79.09	79.09
	Deep	150-500'	20-22.99							4.87	4.87
Cass Co., All Beds	Surface	0-150'	20-22.99							79.09	79.09
	Surface	Subtotal								79.09	79.09
	Deep	150-500'	20-22.99							4.87	4.87

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Deep	Subtotal								4.87	4.87
Cass Co. Totals										83.96	83.96
	Champaign County										
Danville High Vol. C Bit.	Deep	150-500'	20-22.99							37.00	37.00
Herrin High Vol. C Bit.	Deep	150-500'	20-22.99						19.09	134.85	153.95
Champaign Co., All Beds	Deep	150-500'	20-22.99						19.09	171.85	190.94
	Deep	Subtotal							19.09	171.85	190.94
Champaign Co. Totals									19.09	171.85	190.94
	Christian County										
Danville High Vol. C Bit.	Deep	150-500'	20-22.99							16.88	16.88
		500-1000'	20-22.99							44.46	44.46
Herrin High Vol. C Bit.	Deep	150-500'	20-22.99			107.88	43.56	35.44	141.87	1,653.77	1,982.51
		500-1000'	20-22.99				12.55	10.62	85.94	723.01	832.12
Springfield High Vol. C Bit.	Deep	150-500'	20-22.99							495.38	495.38
		500-1000'	20-22.99							113.80	113.80

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Assumption											
High Vol. C Bit.	Deep	500-1000'	20-22.99							43.34	43.34
Christian Co., All Beds											
	Deep	150-500'	20-22.99			107.88	43.56	35.44	141.87	2,166.02	2,494.76
		500-1000'	20-22.99				12.55	10.62	85.94	924.61	1,033.72
	Deep	Subtotal				107.88	56.12	46.05	227.81	3,090.63	3,528.49
Christian Co. Totals						107.88	56.12	46.05	227.81	3,090.63	3,528.49
	Clark County										
Danville											
High Vol. C Bit.	Deep	150-500'	20-22.99	16.22	29.79	38.82	45.77	5.77	4.29	58.78	199.45
		500-1000'	20-22.99	0.10	9.57	46.72	32.15	3.97	1.44	0.54	94.49
Jamestown											
High Vol. C Bit.	Deep	150-500'	20-22.99							11.57	11.57
		500-1000'	20-22.99							45.54	45.54
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99						3.75		3.75
		500-1000'	20-22.99			0.95	17.61				18.56
Springfield											
High Vol. B Bit.	Deep	150-500'	23-24.99							81.15	81.15
		500-1000'	23-24.99							213.24	213.24
Seelyville											
High Vol. B Bit.	Deep	150-500'	23-24.99							19.68	19.68
		500-1000'	23-24.99							27.93	27.93

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed / Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Clark Co., All Beds											
	Deep	150-500'	20-22.99	16.22	29.79	38.82	45.77	5.77	8.04	70.35	214.78
			23-24.99							100.83	100.83
		500-1000'	20-22.99	0.10	9.57	47.67	49.76	3.97	1.44	46.08	158.59
			23-24.99							241.17	241.17
	Deep	Subtotal		16.32	39.36	86.49	95.53	9.74	9.48	458.44	715.36
Clark Co. Totals				16.32	39.36	86.49	95.53	9.74	9.48	458.44	715.36
Clinton County											
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99			11.07	13.99	37.91	22.10	2,034.24	2,119.30
		500-1000'	20-22.99							105.48	105.48
Clinton Co., All Beds											
	Deep	150-500'	20-22.99			11.07	13.99	37.91	22.10	2,034.24	2,119.30
		500-1000'	20-22.99							105.48	105.48
	Deep	Subtotal				11.07	13.99	37.91	22.10	2,139.71	2,224.78
Clinton Co. Totals						11.07	13.99	37.91	22.10	2,139.71	2,224.78
Coles County											
Danville											
High Vol. C Bit.	Deep	500-1000'	20-22.99							50.55	50.55
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99					69.11	25.58		94.69
		500-1000'	20-22.99				2.95	9.95	17.98		30.88
		>1000'	20-22.99			42.92	34.83	6.61	8.88		93.25

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Springfield											
High Vol. B Bit.	Deep	500-1000'	23-24.99							4.77	4.77
		>1000'	23-24.99							59.04	59.04
High Vol. C Bit.	Deep	500-1000'	20-22.99							15.45	15.45
		>1000'	20-22.99							4.73	4.73
Coles Co., All Beds											
	Deep	150-500'	20-22.99					69.11	25.58		94.69
		500-1000'	20-22.99				2.95	9.95	17.98	66.00	96.88
			23-24.99							4.77	4.77
		>1000'	20-22.99			42.92	34.83	6.61	8.88	4.73	97.97
			23-24.99							59.04	59.04
	Deep	Subtotal				42.92	37.78	85.68	52.44	134.53	353.35
Coles Co. Totals						42.92	37.78	85.68	52.44	134.53	353.35
	Crawford County										
Bristol Hill											
High Vol. B Bit.	Surface	0-150'	23-24.99						17.98		17.98
Danville											
High Vol. B Bit.	Deep	150-500'	23-24.99		6.19	65.32	55.93	35.31	4.04	1.87	168.66
		500-1000'	23-24.99			1.40	8.12	0.55			10.08
High Vol. C Bit.	Deep	150-500'	20-22.99	55.25	127.79	11.96					194.99
		500-1000'	20-22.99	1.14			0.89	0.66			2.69
Jamestown											
High Vol. B Bit.	Deep	150-500'	23-24.99							44.91	44.91
		500-1000'	23-24.99							128.79	128.79
High Vol. C Bit.	Deep	150-500'	20-22.99							225.34	225.34
		500-1000'	20-22.99							36.96	36.96

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Herrin											
High Vol. B Bit.	Deep	150-500'	23-24.99							34.44	34.44
		500-1000'	23-24.99							56.56	56.56
High Vol. C Bit.	Deep	150-500'	20-22.99						3.36		3.36
		500-1000'	20-22.99					0.92	6.41		7.33
Springfield											
High Vol. B Bit.	Deep	150-500'	23-24.99							82.04	82.04
		500-1000'	23-24.99							235.36	235.36
Seelyville											
High Vol. B Bit.	Deep	500-1000'	23-24.99							210.60	210.60
Crawford Co., All Beds											
	Surface	0-150'	23-24.99						17.98		17.98
	Surface	Subtotal							17.98		17.98
	Deep	150-500'	20-22.99	55.25	127.79	11.96			3.36	225.34	423.69
			23-24.99		6.19	65.32	55.93	35.31	4.04	163.25	330.04
		500-1000'	20-22.99	1.14			0.89	1.59	6.41	36.96	46.98
			23-24.99			1.40	8.12	0.55		631.31	641.39
	Deep	Subtotal		56.39	133.98	78.68	64.94	37.44	13.80	1,056.86	1,442.09
Crawford Co. Totals				56.39	133.98	78.68	64.94	37.44	31.79	1,056.86	1,460.07
	Cumberland County										
Trowbridge											
High Vol. C Bit.	Surface	0-150'	<19.99						0.28		0.28

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed / Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Herrin											
High Vol. B Bit.	Deep	>1000'	23-24.99	0.02	6.25	15.79	29.24	8.92	7.48	173.94	241.63
High Vol. C Bit.	Deep	500-1000'	20-22.99		2.71						2.71
		>1000'	20-22.99		100.03	139.46	4.34	0.03			243.86
Springfield											
High Vol. B Bit.	Deep	>1000'	23-24.99							193.80	193.80
Cumberland Co., All Beds											
	Surface	0-150'	<19.99						0.28		0.28
	Surface	Subtotal							0.28		0.28
	Deep	500-1000'	20-22.99		2.71						2.71
		>1000'	20-22.99		100.03	139.46	4.34	0.03			243.86
			23-24.99	0.02	6.25	15.79	29.24	8.92	7.48	367.74	435.43
	Deep	Subtotal		0.02	109.00	155.25	33.57	8.95	7.48	367.74	682.01
Cumberland Co. Totals				0.02	109.00	155.25	33.57	8.95	7.76	367.74	682.29
Douglas County											
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99				205.92	116.57	389.31		711.81
		500-1000'	20-22.99					2.60	51.41		54.01
Springfield											
High Vol. C Bit.	Deep	150-500'	20-22.99							63.41	63.41
Douglas Co., All Beds											
	Deep	150-500'	20-22.99				205.92	116.57	389.31	63.41	775.22

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
		500-1000'	20-22.99					2.60	51.41		54.01
	Deep	Subtotal					205.92	119.17	440.73	63.41	829.24
Douglas Co. Totals							205.92	119.17	440.73	63.41	829.24
	Edgar County										
Danville											
High Vol. C Bit.	Surface	0-150'	20-22.99							108.98	108.98
	Deep	150-500'	20-22.99							753.92	753.92
		500-1000'	20-22.99							0.03	0.03
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99					2.12	0.28		2.41
	Deep	150-500'	20-22.99				293.69	298.78	72.22		664.68
Springfield											
High Vol. B Bit.	Deep	150-500'	23-24.99							84.96	84.96
		500-1000'	23-24.99							11.51	11.51
High Vol. C Bit.	Deep	150-500'	20-22.99							245.57	245.57
Seelyville											
High Vol. B Bit.	Deep	150-500'	23-24.99							8.14	8.14
		500-1000'	23-24.99							371.42	371.42
High Vol. C Bit.	Deep	150-500'	20-22.99							158.28	158.28
		500-1000'	20-22.99							23.39	23.39
Edgar Co., All Beds											
	Surface	0-150'	20-22.99					2.12	0.28	108.98	111.39
	Surface	Subtotal						2.12	0.28	108.98	111.39

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Deep	150-500'	20-22.99				293.69	298.78	72.22	1,157.77	1,822.45
			23-24.99							93.09	93.09
		500-1000'	20-22.99							23.42	23.42
			23-24.99							382.93	382.93
	Deep	Subtotal					293.69	298.78	72.22	1,657.21	2,321.90
Edgar Co. Totals							293.69	300.90	72.50	1,766.20	2,433.29
	Edwards County										
Herrin											
High Vol. B Bit.	Deep	500-1000'	23-24.99							208.52	208.52
Springfield											
High Vol. B Bit.	Deep	500-1000'	23-24.99					22.12	27.14	117.52	166.79
		>1000'	23-24.99						1.00	13.21	14.21
Edwards Co., All Beds											
	Deep	500-1000'	23-24.99					22.12	27.14	326.04	375.31
		>1000'	23-24.99						1.00	13.21	14.21
	Deep	Subtotal						22.12	28.14	339.25	389.52
Edwards Co. Totals								22.12	28.14	339.25	389.52
	Effingham County										
Shelbyville											
High Vol. C Bit.	Surface	0-150'	20-22.99							1.20	1.20

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Herrin											
High Vol. B Bit.	Deep	>1000'	23-24.99							75.04	75.04
Springfield											
High Vol. B Bit.	Deep	>1000'	23-24.99							66.89	66.89
Effingham Co., All Beds											
	Surface	0-150'	20-22.99							1.20	1.20
	Surface	Subtotal								1.20	1.20
	Deep	>1000'	23-24.99							141.93	141.93
	Deep	Subtotal								141.93	141.93
Effingham Co. Totals										143.13	143.13
	Fayette County										
Shelbyville											
High Vol. C Bit.	Surface	0-150'	20-22.99							0.55	0.55
Loudon											
High Vol. C Bit.	Surface	0-150'	20-22.99							1.37	1.37
Danville											
High Vol. C Bit.	Deep	500-1000'	20-22.99							306.68	306.68
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99							24.37	24.37
		500-1000'	20-22.99							977.37	977.37

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Springfield											
High Vol. C Bit.	Deep	500-1000'	20-22.99							125.56	125.56
Fayette Co., All Beds											
	Surface	0-150'	20-22.99							1.92	1.92
	Surface	Subtotal								1.92	1.92
	Deep	150-500'	20-22.99							24.37	24.37
		500-1000'	20-22.99							1,409.61	1,409.61
	Deep	Subtotal								1,433.98	1,433.98
Fayette Co. Totals										1,435.90	1,435.90
	Franklin County										
Belle Rive											
High Vol. C Bit.	Surface	0-150'	20-22.99							1.75	1.75
Herrin											
High Vol. B Bit.	Deep	150-500'	23-24.99				1.77	4.76	2.54	3.74	12.81
		500-1000'	23-24.99			6.43	30.98	10.32	16.95	1,327.40	1,392.08
High Vol. C Bit.	Deep	500-1000'	20-22.99				0.19	1.92	1.85	4.87	8.83
Springfield											
High Vol. B Bit.	Deep	150-500'	23-24.99							241.42	241.42
		500-1000'	23-24.99				0.03	17.30	254.33	1,237.44	1,509.11
		>1000'	23-24.99							25.54	25.54
High Vol. C Bit.	Deep	150-500'	20-22.99							71.02	71.02
		500-1000'	20-22.99							162.95	162.95
Dekoven											
High Vol. B Bit.	Deep	500-1000'	23-24.99							106.39	106.39

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Davis											
High Vol. B Bit.	Deep	500-1000'	23-24.99							179.52	179.52
High Vol. C Bit.	Deep	500-1000'	20-22.99							5.71	5.71
Mt. Rorah											
High Vol. B Bit.	Deep	500-1000'	23-24.99							63.24	63.24
		>1000'	23-24.99							11.22	11.22
High Vol. C Bit.	Deep	500-1000'	20-22.99							0.75	0.75
Franklin Co., All Beds											
	Surface	0-150'	20-22.99							1.75	1.75
	Surface	Subtotal								1.75	1.75
	Deep	150-500'	20-22.99							71.02	71.02
			23-24.99				1.77	4.76	2.54	245.16	254.23
		500-1000'	20-22.99				0.19	1.92	1.85	174.27	178.24
			23-24.99			6.43	31.01	27.63	271.29	2,913.99	3,250.34
		>1000'	23-24.99							36.76	36.76
	Deep	Subtotal				6.43	32.98	34.31	275.68	3,441.20	3,790.59
Franklin Co. Totals						6.43	32.98	34.31	275.68	3,442.95	3,792.34
	Fulton County										
Danville											
High Vol. C Bit.	Surface	0-150'	20-22.99							41.98	41.98
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							242.67	242.67
	Deep	150-500'	20-22.99							3.63	3.63

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Springfield											
High Vol. C Bit.	Surface	0-150'	20-22.99							576.00	576.00
	Deep	150-500'	20-22.99							80.22	80.22
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							958.29	958.29
	Deep	150-500'	20-22.99							82.31	82.31
Rock Island											
High Vol. C Bit.	Surface	0-150'	20-22.99							8.03	8.03
	Deep	150-500'	20-22.99							0.15	0.15
Fulton Co., All Beds											
	Surface	0-150'	20-22.99							1,826.96	1,826.96
	Surface	Subtotal								1,826.96	1,826.96
	Deep	150-500'	20-22.99							166.30	166.30
	Deep	Subtotal								166.30	166.30
Fulton Co. Totals										1,993.26	1,993.26
	Gallatin County										
Herrin											
High Vol. A Bit.	Surface	0-150'	23-24.99							177.71	177.71
High Vol. B Bit.	Deep	150-500'	23-24.99							566.08	566.08
		500-1000'	23-24.99							112.12	112.12
Springfield											
High Vol. A Bit.	Surface	0-150'	25-25.99							67.68	67.68
	Deep	150-500'	25-25.99							140.25	140.25
		500-1000'	25-25.99							24.10	24.10

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
High Vol. B Bit.	Surface	0-150'	23-24.99							36.97	36.97
	Deep	150-500'	23-24.99							485.73	485.73
		500-1000'	23-24.99							445.38	445.38
Dekoven											
High Vol. A Bit.	Surface	0-150'	25-25.99							22.30	22.30
	Deep	150-500'	25-25.99							141.38	141.38
		500-1000'	25-25.99							54.27	54.27
High Vol. B Bit.	Deep	150-500'	23-24.99							0.31	0.31
		500-1000'	23-24.99							338.02	338.02
		>1000'	23-24.99							46.42	46.42
Davis											
High Vol. A Bit.	Surface	0-150'	25-25.99							33.33	33.33
	Deep	150-500'	25-25.99							209.85	209.85
		500-1000'	25-25.99							73.27	73.27
High Vol. B Bit.	Deep	150-500'	23-24.99							0.36	0.36
		500-1000'	23-24.99							447.80	447.80
		>1000'	23-24.99							67.69	67.69
Willis											
High Vol. A Bit.	Deep	150-500'	>25.99							5.98	5.98
Gallatin Co., All Beds											
	Surface	0-150'	23-24.99							214.68	214.68
			25-25.99							123.31	123.31
	Surface	Subtotal								337.99	337.99
	Deep	150-500'	23-24.99							1,052.48	1,052.48
			25-25.99							491.49	491.49
			>25.99							5.98	5.98
		500-1000'	23-24.99							1,343.32	1,343.32
			25-25.99							151.64	151.64

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
		>1000'	23-24.99							114.10	114.10
	Deep	Subtotal								3,159.01	3,159.01
Gallatin Co. Totals										3,497.01	3,497.01
	Greene County										
Herrin High Vol. C Bit.	Surface	0-150'	20-22.99							75.00	75.00
Colchester High Vol. C Bit.	Surface	0-150'	20-22.99							377.99	377.99
	Deep	150-500'	20-22.99							17.93	17.93
Greene Co., All Beds	Surface	0-150'	20-22.99							452.99	452.99
	Surface	Subtotal								452.99	452.99
	Deep	150-500'	20-22.99							17.93	17.93
	Deep	Subtotal								17.93	17.93
Greene Co. Totals										470.92	470.92
	Grundy County										
Herrin High Vol. C Bit.	Surface	0-150'	20-22.99							43.10	43.10
Houchin Creek High Vol. C Bit.	Surface	0-150'	20-22.99							113.11	113.11

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed / Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99						42.64	260.86	303.50
	Deep	150-500'	20-22.99						8.16	260.02	268.18
Grundy Co., All Beds											
	Surface	0-150'	20-22.99						42.64	417.08	459.72
	Surface	Subtotal							42.64	417.08	459.72
	Deep	150-500'	20-22.99						8.16	260.02	268.18
	Deep	Subtotal							8.16	260.02	268.18
Grundy Co. Totals									50.80	677.09	727.90
Hamilton County											
Herrin											
High Vol. B Bit.	Deep	150-500'	23-24.99							0.05	0.05
		500-1000'	23-24.99							1,827.43	1,827.43
		>1000'	23-24.99							217.60	217.60
Springfield											
High Vol. B Bit.	Deep	500-1000'	23-24.99			30.71	434.21	149.43	92.46	484.14	1,190.95
		>1000'	23-24.99				3.67	22.36	138.67	426.60	591.30
Hamilton Co., All Beds											
	Deep	150-500'	23-24.99							0.05	0.05
		500-1000'	23-24.99			30.71	434.21	149.43	92.46	2,311.57	3,018.39
		>1000'	23-24.99				3.67	22.36	138.67	644.20	808.90
	Deep	Subtotal				30.71	437.88	171.79	231.13	2,955.82	3,827.34

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Hamilton Co. Totals						30.71	437.88	171.79	231.13	2,955.82	3,827.34
	Hancock County										
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							28.73	28.73
Hancock Co., All Beds											
	Surface	0-150'	20-22.99							28.73	28.73
	Surface	Subtotal								28.73	28.73
Hancock Co. Totals										28.73	28.73
	Henry County										
Danville											
High Vol. C Bit.	Surface	0-150'	<19.99							22.34	22.34
			20-22.99							34.49	34.49
Herrin											
High Vol. C Bit.	Surface	0-150'	<19.99							99.64	99.64
			20-22.99							91.68	91.68
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							112.97	112.97
	Deep	150-500'	20-22.99							3.24	3.24
Henry Co., All Beds											
	Surface	0-150'	<19.99							121.98	121.98
			20-22.99							239.14	239.14

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Surface	Subtotal								361.12	361.12
	Deep	150-500'	20-22.99							3.24	3.24
	Deep	Subtotal								3.24	3.24
Henry Co. Totals										364.36	364.36
	Jackson County										
Herrin											
High Vol. B Bit.	Surface	0-150'	23-24.99					5.35	11.88	46.03	63.26
High Vol. C Bit.	Surface	0-150'	20-22.99			0.20		0.75	1.61	13.46	16.03
Springfield											
High Vol. B Bit.	Surface	0-150'	23-24.99							90.94	90.94
	Deep	150-500'	23-24.99							99.46	99.46
High Vol. C Bit.	Surface	0-150'	20-22.99							5.59	5.59
	Deep	150-500'	20-22.99							41.34	41.34
Seahorne											
High Vol. B Bit.	Surface	0-150'	23-24.99							12.55	12.55
Jackson Co., All Beds											
	Surface	0-150'	20-22.99			0.20		0.75	1.61	19.05	21.61
			23-24.99					5.35	11.88	149.52	166.75
	Surface	Subtotal				0.20		6.10	13.49	168.57	188.37
	Deep	150-500'	20-22.99							41.34	41.34
			23-24.99							99.46	99.46

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Deep	Subtotal								140.80	140.80
Jackson Co. Totals						0.20	6.10	13.49		309.37	329.16
	Jasper County										
Herrin											
High Vol. B Bit.	Deep	500-1000'	23-24.99							30.05	30.05
		>1000'	23-24.99							251.16	251.16
High Vol. C Bit.	Deep	500-1000'	20-22.99							19.54	19.54
Springfield											
High Vol. B Bit.	Deep	500-1000'	23-24.99							56.99	56.99
		>1000'	23-24.99							174.86	174.86
Jasper Co., All Beds											
	Deep	500-1000'	20-22.99							19.54	19.54
			23-24.99							87.05	87.05
		>1000'	23-24.99							426.02	426.02
	Deep	Subtotal								532.60	532.60
Jasper Co. Totals										532.60	532.60
	Jefferson County										
Opdyke											
High Vol. C Bit.	Surface	0-150'	20-22.99							17.62	17.62
Belle Rive											
High Vol. C Bit.	Surface	0-150'	20-22.99							4.21	4.21

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Herrin											
High Vol. B Bit.	Deep	500-1000'	23-24.99		4.47	7.00	105.00	45.42	31.52	1,000.30	1,193.71
High Vol. C Bit.	Deep	150-500'	20-22.99							54.13	54.13
		500-1000'	20-22.99		7.51	0.72	1.40	2.06	1.26	367.76	380.70
Springfield											
High Vol. B Bit.	Deep	500-1000'	23-24.99							892.35	892.35
		>1000'	23-24.99							89.72	89.72
High Vol. C Bit.	Deep	500-1000'	20-22.99							241.02	241.02
Jefferson Co., All Beds											
	Surface	0-150'	20-22.99							21.83	21.83
	Surface	Subtotal								21.83	21.83
	Deep	150-500'	20-22.99							54.13	54.13
		500-1000'	20-22.99		7.51	0.72	1.40	2.06	1.26	608.78	621.73
			23-24.99		4.47	7.00	105.00	45.42	31.52	1,892.65	2,086.06
		>1000'	23-24.99							89.72	89.72
	Deep	Subtotal			11.98	7.71	106.39	47.48	32.78	2,645.28	2,851.63
Jefferson Co. Totals					11.98	7.71	106.39	47.48	32.78	2,667.11	2,873.46
Jersey County											
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							52.83	52.83
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							77.47	77.47
	Deep	150-500'	20-22.99							109.84	109.84

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Jersey Co., All Beds											
	Surface	0-150'	20-22.99							130.30	130.30
	Surface	Subtotal								130.30	130.30
	Deep	150-500'	20-22.99							109.84	109.84
	Deep	Subtotal								109.84	109.84
Jersey Co. Totals										240.14	240.14
	Kankakee County										
Houchin Creek											
High Vol. C Bit.	Surface	0-150'	20-22.99							14.89	14.89
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99						9.73	2.13	11.86
	Deep	150-500'	20-22.99							27.10	27.10
Kankakee Co., All Beds											
	Surface	0-150'	20-22.99						9.73	17.02	26.75
	Surface	Subtotal							9.73	17.02	26.75
	Deep	150-500'	20-22.99							27.10	27.10
	Deep	Subtotal								27.10	27.10
Kankakee Co. Totals									9.73	44.13	53.86

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed / Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Knox County											
Danville											
High Vol. C Bit.	Surface	0-150'	20-22.99							1.17	1.17
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							215.57	215.57
Springfield											
High Vol. C Bit.	Surface	0-150'	20-22.99							464.78	464.78
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99						159.45	361.21	520.66
Rock Island											
High Vol. C Bit.	Deep	150-500'	20-22.99							43.78	43.78
Knox Co., All Beds											
	Surface	0-150'	20-22.99						159.45	1,042.73	1,202.18
	Surface	Subtotal							159.45	1,042.73	1,202.18
	Deep	150-500'	20-22.99							43.78	43.78
	Deep	Subtotal								43.78	43.78
Knox Co. Totals									159.45	1,086.51	1,245.96
La Salle County											
Danville											
High Vol. C Bit.	Surface	0-150'	20-22.99							37.47	37.47
	Deep	150-500'	20-22.99							370.84	370.84

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							134.46	134.46
	Deep	150-500'	20-22.99							128.28	128.28
Houchin Creek											
High Vol. C Bit.	Surface	0-150'	20-22.99							47.15	47.15
	Deep	150-500'	20-22.99							13.95	13.95
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99						0.58	258.27	258.85
	Deep	150-500'	20-22.99						97.10	629.64	726.75
		500-1000'	20-22.99						13.88	203.60	217.48
La Salle Co., All Beds											
	Surface	0-150'	20-22.99						0.58	477.35	477.93
	Surface	Subtotal							0.58	477.35	477.93
	Deep	150-500'	20-22.99						97.10	1,142.72	1,239.82
		500-1000'	20-22.99						13.88	203.60	217.48
	Deep	Subtotal							110.99	1,346.31	1,457.30
La Salle Co. Totals									111.57	1,823.66	1,935.24
	Lawrence County										
Danville											
High Vol. C Bit.	Deep	150-500'	20-22.99		220.69	120.96	6.72			11.58	359.95
		500-1000'	20-22.99							27.88	27.88
Jamestown											
High Vol. C Bit.	Deep	150-500'	20-22.99							368.81	368.81
		500-1000'	20-22.99							42.56	42.56

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99					33.34	34.14	43.00	110.48
		500-1000'	20-22.99							48.38	48.38
Springfield											
High Vol. B Bit.	Deep	150-500'	23-24.99							260.09	260.09
		500-1000'	23-24.99							104.60	104.60
Survant											
High Vol. B Bit.	Deep	500-1000'	23-24.99							95.64	95.64
		>1000'	23-24.99							0.20	0.20
Seelyville											
High Vol. B Bit.	Deep	500-1000'	23-24.99							33.83	33.83
		>1000'	23-24.99							0.44	0.44
Lawrence Co., All Beds											
	Deep	150-500'	20-22.99		220.69	120.96	6.72	33.34	34.14	423.39	839.24
			23-24.99							260.09	260.09
		500-1000'	20-22.99							118.82	118.82
			23-24.99							234.08	234.08
		>1000'	23-24.99							0.65	0.65
	Deep	Subtotal			220.69	120.96	6.72	33.34	34.14	1,037.03	1,452.88
Lawrence Co. Totals					220.69	120.96	6.72	33.34	34.14	1,037.03	1,452.88
Livingston County											
Danville											
High Vol. C Bit.	Surface	0-150'	20-22.99							93.42	93.42
	Deep	150-500'	20-22.99							212.52	212.52

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							102.76	102.76
Houchin Creek											
High Vol. C Bit.	Surface	0-150'	20-22.99							124.09	124.09
	Deep	150-500'	20-22.99							17.22	17.22
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99						4.94	1.89	6.84
	Deep	150-500'	20-22.99						4.53	179.88	184.41
Livingston Co., All Beds											
	Surface	0-150'	20-22.99						4.94	322.17	327.11
	Surface	Subtotal							4.94	322.17	327.11
	Deep	150-500'	20-22.99						4.53	409.61	414.15
	Deep	Subtotal							4.53	409.61	414.15
Livingston Co. Totals									9.48	731.78	741.26
	Logan County										
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99							658.16	658.16
Springfield											
High Vol. C Bit.	Deep	150-500'	20-22.99							1,450.49	1,450.49
Logan Co., All Beds											
	Deep	150-500'	20-22.99							2,108.66	2,108.66

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Deep	Subtotal								2,108.66	2,108.66
Logan Co. Totals										2,108.66	2,108.66
	McDonough County										
Colchester High Vol. C Bit.	Surface	0-150'	20-22.99							349.77	349.77
McDonough Co., All Beds	Surface	0-150'	20-22.99							349.77	349.77
	Surface	Subtotal								349.77	349.77
McDonough Co. Totals										349.77	349.77
	McLean County										
Danville High Vol. C Bit.	Deep	150-500'	20-22.99							188.13	188.13
		500-1000'	20-22.99							35.51	35.51
Springfield High Vol. C Bit.	Deep	150-500'	20-22.99							43.14	43.14
		500-1000'	20-22.99							140.43	140.43
Colchester High Vol. C Bit.	Deep	500-1000'	20-22.99							84.60	84.60
McLean Co., All Beds	Deep	150-500'	20-22.99							231.27	231.27
		500-1000'	20-22.99							260.54	260.54

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Deep	Subtotal								491.81	491.81
McLean Co. Totals										491.81	491.81
	Macon County										
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99							88.95	88.95
Springfield											
High Vol. C Bit.	Deep	150-500'	20-22.99							320.47	320.47
		500-1000'	20-22.99							248.60	248.60
Macon Co., All Beds											
	Deep	150-500'	20-22.99							409.43	409.43
		500-1000'	20-22.99							248.60	248.60
	Deep	Subtotal								658.03	658.03
Macon Co. Totals										658.03	658.03
	Macoupin County										
Danville											
High Vol. C Bit.	Deep	150-500'	20-22.99							14.06	14.06
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							188.58	188.58
	Deep	150-500'	20-22.99			95.93	124.69	76.10	109.84	2,831.17	3,237.73

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed / Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							13.08	13.08
	Deep	150-500'	20-22.99							194.93	194.93
		500-1000'	20-22.99							77.91	77.91
Wiley											
High Vol. C Bit.	Deep	150-500'	20-22.99							0.13	0.13
		500-1000'	20-22.99							43.90	43.90
High Vol. C Bit.	Deep	500-1000'	20-22.99							70.72	70.72
Macoupin Co., All Beds											
	Surface	0-150'	20-22.99							201.65	201.65
	Surface	Subtotal								201.65	201.65
	Deep	150-500'	20-22.99			95.93	124.69	76.10	109.84	3,040.29	3,446.85
		500-1000'	20-22.99							192.53	192.53
	Deep	Subtotal				95.93	124.69	76.10	109.84	3,232.82	3,639.39
Macoupin Co. Totals						95.93	124.69	76.10	109.84	3,434.47	3,841.04
Madison County											
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							406.91	406.91
	Deep	150-500'	20-22.99			102.44	212.47	150.44	42.56	894.43	1,402.33
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							116.78	116.78
	Deep	150-500'	20-22.99							17.49	17.49

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Madison Co., All Beds											
	Surface	0-150'	20-22.99							523.69	523.69
	Surface	Subtotal								523.69	523.69
	Deep	150-500'	20-22.99			102.44	212.47	150.44	42.56	911.93	1,419.83
	Deep	Subtotal				102.44	212.47	150.44	42.56	911.93	1,419.83
Madison Co. Totals						102.44	212.47	150.44	42.56	1,435.62	1,943.52
Marion County											
Herrin											
High Vol. B Bit.	Deep	500-1000'	23-24.99							84.84	84.84
High Vol. C Bit.	Deep	500-1000'	20-22.99							222.44	222.44
Springfield											
High Vol. B Bit.	Deep	500-1000'	23-24.99							110.72	110.72
High Vol. C Bit.	Deep	500-1000'	20-22.99							136.58	136.58
Marion Co., All Beds											
	Deep	500-1000'	20-22.99							359.02	359.02
			23-24.99							195.56	195.56
	Deep	Subtotal								554.58	554.58
Marion Co. Totals										554.58	554.58

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Marshall County											
Danville											
High Vol. C Bit.	Surface	0-150'	20-22.99							115.45	115.45
	Deep	150-500'	20-22.99							95.70	95.70
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99							7.12	7.12
Colchester											
High Vol. C Bit.	Deep	150-500'	20-22.99						15.00	163.27	178.28
		500-1000'	20-22.99						104.21	24.91	129.11
Marshall Co., All Beds											
	Surface	0-150'	20-22.99							115.45	115.45
	Surface	Subtotal								115.45	115.45
	Deep	150-500'	20-22.99						15.00	266.09	281.10
		500-1000'	20-22.99						104.21	24.91	129.11
	Deep	Subtotal							119.21	291.00	410.21
Marshall Co. Totals									119.21	406.45	525.66
Menard County											
Springfield											
High Vol. C Bit.	Surface	0-150'	20-22.99							506.78	506.78
	Deep	150-500'	20-22.99							731.70	731.70
Menard Co., All Beds											
	Surface	0-150'	20-22.99							506.78	506.78

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Surface	Subtotal								506.78	506.78
	Deep	150-500'	20-22.99							731.70	731.70
	Deep	Subtotal								731.70	731.70
Menard Co. Totals										1,238.49	1,238.49
	Mercer County										
Colchester High Vol. C Bit.	Surface	0-150'	20-22.99							4.13	4.13
Mercer Co., All Beds	Surface	0-150'	20-22.99							4.13	4.13
	Surface	Subtotal								4.13	4.13
Mercer Co. Totals										4.13	4.13
	Monroe County										
Herrin High Vol. C Bit.	Surface	0-150'	20-22.99							7.13	7.13
Monroe Co., All Beds	Surface	0-150'	20-22.99							7.13	7.13
	Surface	Subtotal								7.13	7.13
Monroe Co. Totals										7.13	7.13

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Montgomery County										
Danville High Vol. C Bit.	Deep	500-1000'	20-22.99							51.61	51.61
Herrin High Vol. C Bit.	Deep	150-500'	20-22.99			59.96	23.45	31.41	27.71	1,870.85	2,013.39
		500-1000'	20-22.99							1,622.33	1,622.33
Houchin Creek High Vol. C Bit.	Deep	150-500'	20-22.99							97.01	97.01
Colchester High Vol. C Bit.	Deep	500-1000'	20-22.99							176.31	176.31
Wiley High Vol. C Bit.	Deep	500-1000'	20-22.99							78.09	78.09
High Vol. C Bit.	Deep	500-1000'	20-22.99							183.15	183.15
Montgomery Co., All Beds											
	Deep	150-500'	20-22.99			59.96	23.45	31.41	27.71	1,967.86	2,110.40
		500-1000'	20-22.99							2,111.49	2,111.49
	Deep	Subtotal				59.96	23.45	31.41	27.71	4,079.35	4,221.89
Montgomery Co. Totals						59.96	23.45	31.41	27.71	4,079.35	4,221.89
	Morgan County										
Herrin High Vol. C Bit.	Surface	0-150'	20-22.99							95.70	95.70
	Deep	150-500'	20-22.99							65.89	65.89

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							162.46	162.46
	Deep	150-500'	20-22.99							43.17	43.17
Morgan Co., All Beds											
	Surface	0-150'	20-22.99							258.15	258.15
	Surface	Subtotal								258.15	258.15
	Deep	150-500'	20-22.99							109.05	109.05
	Deep	Subtotal								109.05	109.05
Morgan Co. Totals										367.21	367.21
	Moultrie County										
Herrin											
High Vol. C Bit.	Deep	500-1000'	20-22.99							261.91	261.91
Moultrie Co., All Beds											
	Deep	500-1000'	20-22.99							261.91	261.91
	Deep	Subtotal								261.91	261.91
Moultrie Co. Totals										261.91	261.91
	Peoria County										
Danville											
High Vol. C Bit.	Surface	0-150'	20-22.99							233.82	233.82
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							852.76	852.76

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Springfield											
High Vol. C Bit.	Surface	0-150'	20-22.99							585.56	585.56
	Deep	150-500'	20-22.99							395.62	395.62
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							49.41	49.41
	Deep	150-500'	20-22.99							46.28	46.28
Peoria Co., All Beds											
	Surface	0-150'	20-22.99							1,721.55	1,721.55
	Surface	Subtotal								1,721.55	1,721.55
	Deep	150-500'	20-22.99							441.89	441.89
	Deep	Subtotal								441.89	441.89
Peoria Co. Totals										2,163.44	2,163.44
	Perry County										
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99				3.40	13.81	6.90	613.93	638.04
	Deep	150-500'	20-22.99				5.45	3.92	0.77	1,231.40	1,241.55
		500-1000'	20-22.99				1.61	6.80	3.57	16.84	28.82
Springfield											
High Vol. C Bit.	Surface	0-150'	20-22.99							89.16	89.16
	Deep	150-500'	20-22.99							98.64	98.64
		500-1000'	20-22.99							52.86	52.86
Murphysboro											
High Vol. C Bit.	Deep	150-500'	20-22.99							409.28	409.28

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
		500-1000'	20-22.99							233.46	233.46
Perry Co., All Beds											
	Surface	0-150'	20-22.99				3.40	13.81	6.90	703.09	727.20
	Surface	Subtotal					3.40	13.81	6.90	703.09	727.20
	Deep	150-500'	20-22.99				5.45	3.92	0.77	1,739.32	1,749.47
		500-1000'	20-22.99				1.61	6.80	3.57	303.17	315.14
	Deep	Subtotal					7.06	10.72	4.34	2,042.49	2,064.61
Perry Co. Totals							10.45	24.54	11.24	2,745.58	2,791.81
	Pike County										
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							116.62	116.62
Pike Co., All Beds											
	Surface	0-150'	20-22.99							116.62	116.62
	Surface	Subtotal								116.62	116.62
Pike Co. Totals										116.62	116.62
	Putnam County										
Danville											
High Vol. C Bit.	Deep	150-500'	20-22.99							206.68	206.68
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99							77.85	77.85

Coal bed / Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Colchester											
High Vol. C Bit.	Deep	150-500'	20-22.99							347.23	347.23
		500-1000'	20-22.99							27.54	27.54
Putnam Co., All Beds											
	Deep	150-500'	20-22.99							631.75	631.75
		500-1000'	20-22.99							27.54	27.54
	Deep	Subtotal								659.30	659.30
Putnam Co. Totals										659.30	659.30
	Randolph County										
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							182.76	182.76
	Deep	150-500'	20-22.99							87.93	87.93
Springfield											
High Vol. C Bit.	Surface	0-150'	20-22.99							139.24	139.24
	Deep	150-500'	20-22.99							23.88	23.88
Randolph Co., All Beds											
	Surface	0-150'	20-22.99							322.01	322.01
	Surface	Subtotal								322.01	322.01
	Deep	150-500'	20-22.99							111.80	111.80
	Deep	Subtotal								111.80	111.80
Randolph Co. Totals										433.81	433.81

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Richland County										
Calhoun											
High Vol. C Bit.	Surface	0-150'	20-22.99							6.60	6.60
Richland Co., All Beds											
	Surface	0-150'	20-22.99							6.60	6.60
	Surface	Subtotal								6.60	6.60
Richland Co. Totals										6.60	6.60
	St.Clair County										
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99					0.25	13.87	1,077.96	1,092.08
	Deep	150-500'	20-22.99			25.73	93.52	104.62	160.19	789.65	1,173.70
St.Clair Co., All Beds											
	Surface	0-150'	20-22.99					0.25	13.87	1,077.96	1,092.08
	Surface	Subtotal						0.25	13.87	1,077.96	1,092.08
	Deep	150-500'	20-22.99			25.73	93.52	104.62	160.19	789.65	1,173.70
	Deep	Subtotal				25.73	93.52	104.62	160.19	789.65	1,173.70
St.Clair Co. Totals						25.73	93.52	104.87	174.07	1,867.60	2,265.79
	Saline County										
Danville											
High Vol. B Bit.	Surface	0-150'	23-24.99							69.08	69.08

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Herrin											
High Vol. A Bit.	Surface	0-150'	25-25.99							8.21	8.21
High Vol. B Bit.	Surface	0-150'	23-24.99							209.02	209.02
	Deep	150-500'	23-24.99							763.83	763.83
		500-1000'	23-24.99							240.90	240.90
Springfield											
High Vol. A Bit.	Surface	0-150'	25-25.99							34.22	34.22
	Deep	150-500'	25-25.99							1.41	1.41
High Vol. B Bit.	Surface	0-150'	23-24.99			1.36	0.97	4.17	15.19	33.44	55.12
	Deep	150-500'	23-24.99			49.28	50.89	72.43	53.17	153.41	379.18
		500-1000'	23-24.99			69.33	66.27	115.09	6.81	123.23	380.73
Houchin Creek											
High Vol. B Bit.	Deep	150-500'	23-24.99							12.69	12.69
		500-1000'	23-24.99							1.94	1.94
Dekoven											
High Vol. A Bit.	Surface	0-150'	25-25.99							47.48	47.48
	Deep	150-500'	25-25.99							187.10	187.10
		500-1000'	25-25.99							6.83	6.83
High Vol. B Bit.	Deep	150-500'	23-24.99							31.21	31.21
		500-1000'	23-24.99							209.12	209.12
Davis											
High Vol. A Bit.	Surface	0-150'	25-25.99							70.96	70.96
	Deep	150-500'	25-25.99							257.52	257.52
		500-1000'	25-25.99							10.15	10.15
High Vol. B Bit.	Deep	150-500'	23-24.99							45.15	45.15
		500-1000'	23-24.99							401.13	401.13
Saline Co., All Beds											
	Surface	0-150'	23-24.99			1.36	0.97	4.17	15.19	311.53	333.21
			25-25.99							160.87	160.87

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Surface	Subtotal			1.36	0.97	4.17	15.19		472.40	494.08
	Deep	150-500'	23-24.99		49.28	50.89	72.43	53.17		1,006.30	1,232.07
			25-25.99							446.03	446.03
		500-1000'	23-24.99		69.33	66.27	115.09	6.81		976.32	1,233.82
			25-25.99							16.99	16.99
	Deep	Subtotal			118.61	117.17	187.51	59.98		2,445.64	2,928.91
Saline Co. Totals					119.97	118.13	191.68	75.17		2,918.03	3,422.99
	Sangamon County										
Herrin											
High Vol. C Bit.	Deep	150-500'	20-22.99							1,763.90	1,763.90
Springfield											
High Vol. C Bit.	Surface	0-150'	20-22.99							278.17	278.17
	Deep	150-500'	20-22.99							1,970.13	1,970.13
Houchin Creek											
High Vol. C Bit.	Deep	150-500'	20-22.99							85.27	85.27
High Vol. C Bit.	Deep	500-1000'	20-22.99							4.19	4.19
Sangamon Co., All Beds											
	Surface	0-150'	20-22.99							278.17	278.17
	Surface	Subtotal								278.17	278.17
	Deep	150-500'	20-22.99							3,819.30	3,819.30

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
		500-1000'	20-22.99							4.19	4.19
	Deep	Subtotal								3,823.49	3,823.49
Sangamon Co. Totals										4,101.67	4,101.67
	Schuyler County										
Springfield High Vol. C Bit.	Surface	0-150'	20-22.99							96.38	96.38
Colchester High Vol. C Bit.	Surface	0-150'	20-22.99							517.63	517.63
	Deep	150-500'	20-22.99							6.65	6.65
Schuyler Co., All Beds	Surface	0-150'	20-22.99							614.01	614.01
	Surface	Subtotal								614.01	614.01
	Deep	150-500'	20-22.99							6.65	6.65
	Deep	Subtotal								6.65	6.65
Schuyler Co. Totals										620.66	620.66
	Scott County										
Herrin High Vol. C Bit.	Surface	0-150'	20-22.99							5.99	5.99
Colchester High Vol. C Bit.	Surface	0-150'	20-22.99							169.96	169.96

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Scott Co., All Beds											
	Surface	0-150'	20-22.99							175.94	175.94
	Surface	Subtotal								175.94	175.94
Scott Co. Totals										175.94	175.94
	Shelby County										
Trowbridge High Vol. C Bit.	Surface	0-150'	<19.99						8.56		8.56
Shelbyville High Vol. C Bit.	Surface	0-150'	20-22.99							43.26	43.26
Danville High Vol. C Bit.	Deep	500-1000'	20-22.99							129.17	129.17
Herrin High Vol. C Bit.	Deep	500-1000'	20-22.99							898.08	898.08
Springfield High Vol. C Bit.	Deep	500-1000'	20-22.99							92.35	92.35
Shelby Co., All Beds											
	Surface	0-150'	<19.99						8.56		8.56
			20-22.99							43.26	43.26
	Surface	Subtotal							8.56	43.26	51.82
	Deep	500-1000'	20-22.99							1,119.60	1,119.60
	Deep	Subtotal								1,119.60	1,119.60

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Shelby Co. Totals									8.56	1,162.86	1,171.42
	Stark County										
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							227.70	227.70
	Deep	150-500'	20-22.99							0.21	0.21
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							0.14	0.14
Stark Co., All Beds											
	Surface	0-150'	20-22.99							227.83	227.83
	Surface	Subtotal								227.83	227.83
	Deep	150-500'	20-22.99							0.21	0.21
	Deep	Subtotal								0.21	0.21
Stark Co. Totals										228.05	228.05
	Tazewell County										
Danville											
High Vol. C Bit.	Surface	0-150'	20-22.99							4.59	4.59
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							63.12	63.12
	Deep	150-500'	20-22.99							54.26	54.26

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Springfield											
High Vol. C Bit.	Surface	0-150'	20-22.99							29.67	29.67
	Deep	150-500'	20-22.99							199.87	199.87
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							12.66	12.66
	Deep	150-500'	20-22.99							33.20	33.20
Tazewell Co., All Beds											
	Surface	0-150'	20-22.99							110.03	110.03
	Surface	Subtotal								110.03	110.03
	Deep	150-500'	20-22.99							287.33	287.33
	Deep	Subtotal								287.33	287.33
Tazewell Co. Totals										397.36	397.36
	Vermilion County										
Danville											
High Vol. C Bit.	Surface	0-150'	20-22.99							375.84	375.84
	Deep	150-500'	20-22.99							1,465.71	1,465.71
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99					1.42	168.08	56.44	225.95
	Deep	150-500'	20-22.99				144.42	93.87	657.29	497.27	1,392.85
Seelyville											
High Vol. C Bit.	Deep	150-500'	20-22.99							29.37	29.37

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Vermilion Co., All Beds	Surface	0-150'	20-22.99					1.42	168.08	432.28	601.79
	Surface	Subtotal						1.42	168.08	432.28	601.79
	Deep	150-500'	20-22.99				144.42	93.87	657.29	1,992.35	2,887.93
	Deep	Subtotal					144.42	93.87	657.29	1,992.35	2,887.93
Vermilion Co. Totals							144.42	95.30	825.38	2,424.63	3,489.72
	Wabash County										
Friendsville High Vol. C Bit.	Surface	0-150'	20-22.99							48.56	48.56
Herrin High Vol. B Bit.	Deep	500-1000'	23-24.99							418.11	418.11
Springfield High Vol. B Bit.	Deep	500-1000'	23-24.99				103.80	183.89	16.31	167.53	471.53
Wabash Co., All Beds	Surface	0-150'	20-22.99							48.56	48.56
	Surface	Subtotal								48.56	48.56
	Deep	500-1000'	23-24.99				103.80	183.89	16.31	585.63	889.64
	Deep	Subtotal					103.80	183.89	16.31	585.63	889.64
Wabash Co. Totals							103.80	183.89	16.31	634.19	938.20

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Warren County											
Springfield											
High Vol. C Bit.	Surface	0-150'	20-22.99							0.79	0.79
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99							176.86	176.86
Warren Co., All Beds											
	Surface	0-150'	20-22.99							177.65	177.65
	Surface	Subtotal								177.65	177.65
Warren Co. Totals										177.65	177.65
Washington County											
Herrin											
High Vol. C Bit.	Surface	0-150'	20-22.99							11.39	11.39
	Deep	150-500'	20-22.99							3,299.30	3,299.30
		500-1000'	20-22.99							384.01	384.01
Washington Co., All Beds											
	Surface	0-150'	20-22.99							11.39	11.39
	Surface	Subtotal								11.39	11.39
	Deep	150-500'	20-22.99							3,299.30	3,299.30
		500-1000'	20-22.99							384.01	384.01
	Deep	Subtotal								3,683.31	3,683.31
Washington Co. Totals										3,694.70	3,694.70

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Wayne County										
Herrin											
High Vol. B Bit.	Deep	500-1000'	23-24.99							183.71	183.71
		>1000'	23-24.99							18.21	18.21
Springfield											
High Vol. B Bit.	Deep	500-1000'	23-24.99						51.94	5.78	57.71
		>1000'	23-24.99						105.12	90.98	196.10
Wayne Co., All Beds											
	Deep	500-1000'	23-24.99						51.94	189.49	241.43
		>1000'	23-24.99						105.12	109.19	214.31
	Deep	Subtotal							157.05	298.68	455.73
Wayne Co. Totals									157.05	298.68	455.73
	White County										
Herrin											
High Vol. B Bit.	Deep	150-500'	23-24.99							32.80	32.80
		500-1000'	23-24.99							600.77	600.77
		>1000'	23-24.99							0.63	0.63
Springfield											
High Vol. B Bit.	Deep	500-1000'	23-24.99					0.75	79.16	511.84	591.75
		>1000'	23-24.99						338.46	189.89	528.35
Dekoven											
High Vol. B Bit.	Deep	500-1000'	23-24.99							0.67	0.67
		>1000'	23-24.99							2.54	2.54

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
White Co., All Beds											
	Deep	150-500'	23-24.99							32.80	32.80
		500-1000'	23-24.99					0.75	79.16	1,113.28	1,193.19
		>1000'	23-24.99						338.46	193.06	531.52
	Deep	Subtotal						0.75	417.62	1,339.13	1,757.51
White Co. Totals								0.75	417.62	1,339.13	1,757.51
	Will County										
Colchester											
High Vol. C Bit.	Surface	0-150'	20-22.99						13.64	0.22	13.86
Will Co., All Beds											
	Surface	0-150'	20-22.99						13.64	0.22	13.86
	Surface	Subtotal							13.64	0.22	13.86
Will Co. Totals									13.64	0.22	13.86
	Williamson County										
Danville											
High Vol. B Bit.	Surface	0-150'	23-24.99							55.83	55.83
Herrin											
High Vol. B Bit.	Surface	0-150'	23-24.99				25.45	10.61	25.74	175.17	236.97
	Deep	150-500'	23-24.99				0.29	4.10	12.17	265.25	281.81
		500-1000'	23-24.99							44.82	44.82

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
Springfield											
High Vol. B Bit.	Surface	0-150'	23-24.99						10.01	174.00	184.01
	Deep	150-500'	23-24.99					4.72	166.87	436.94	608.52
		500-1000'	23-24.99					6.38	84.23	5.34	95.95
Houchin Creek											
High Vol. B Bit.	Deep	150-500'	>25.99							3.47	3.47
Dekoven											
High Vol. A Bit.	Surface	0-150'	25-25.99							21.87	21.87
	Deep	150-500'	25-25.99							59.33	59.33
High Vol. B Bit.	Deep	150-500'	23-24.99							88.91	88.91
		500-1000'	23-24.99							63.70	63.70
Davis											
High Vol. A Bit.	Surface	0-150'	25-25.99							36.23	36.23
	Deep	150-500'	25-25.99							4.66	4.66
High Vol. B Bit.	Deep	150-500'	23-24.99							30.19	30.19
		500-1000'	23-24.99							39.64	39.64
Wise Ridge											
High Vol. B Bit.	Deep	150-500'	23-24.99							4.64	4.64
Mt. Rorah											
High Vol. B Bit.	Deep	150-500'	23-24.99							4.30	4.30
Murphysboro											
High Vol. A Bit.	Surface	0-150'	25-25.99							31.59	31.59
High Vol. B Bit.	Surface	0-150'	23-24.99							8.71	8.71
Williamson Co., All Beds											
	Surface	0-150'	23-24.99				25.45	10.61	35.75	413.71	485.52
			25-25.99							89.70	89.70

Appendix 4 Remaining Demonstrated Reserve Base in Illinois, January 1, 1994 (million short tons).

Coal bed Coal rank/Type of mining		Depth	Heat content (million Btu/ short ton)	Sulfur content (lbs of sulfur/million Btu) ≤0.40	0.41-0.06	0.61-0.83	0.84-1.24	1.25-1.67	1.68-2.50	>2.50	Total all sulfur categories
	Surface	Subtotal					25.45	10.61	35.75	503.41	575.22
	Deep	150-500'	23-24.99				0.29	8.82	179.04	825.58	1,013.73
			25-25.99							63.98	63.98
			>25.99							8.11	8.11
		500-1000'	23-24.99					6.38	84.23	153.50	244.11
	Deep	Subtotal					0.29	15.20	263.27	1,051.18	1,329.94
Williamson Co. Totals							25.74	25.81	299.02	1,554.58	1,905.16
	Woodford County										
Danville											
High Vol. C Bit.	Deep	150-500'	20-22.99							30.04	30.04
Springfield											
High Vol. C Bit.	Deep	150-500'	20-22.99							45.72	45.72
Colchester											
High Vol. C Bit.	Deep	150-500'	20-22.99						0.47	63.38	63.85
		500-1000'	20-22.99						33.67	46.27	79.94
Woodford Co., All Beds											
	Deep	150-500'	20-22.99						0.47	139.14	139.61
		500-1000'	20-22.99						33.67	46.27	79.94
	Deep	Subtotal							34.14	185.41	219.55
Woodford Co. Totals									34.14	185.41	219.55

APPENDIX 5 Format of digital files of demonstrated reserves provided to the Energy Information Administration

EIA will be provided with three digital files, all of which will have the same format. The files will have a fixed record length of 101 characters. The three files provided are (1) identified resources and demonstrated reserves, (2) accessible reserves, and (3) recoverable reserves. Data will be aggregated to the county level by seam. For each seam in a county, there will be one or more records according to the number of different combinations of reliability, thickness, depth, Btu, and rank. The layout of each record is described below.

15 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WIDTH	TYPE	N.DEC	Explanation
1	COUNTY	3	I	–	County FIPS code
4	SEAM	4	I	–	ISGS seam code
8	RELIABILITY	1	I	–	ISGS reliability classification
9	THICK	3	I	–	Thickness in inches
12	DEPTH	4	I	–	Depth category
16	BTU	5	N	2	Btu category
21	RANK	1	C	–	Rank (A, B, or C)
22	S.40	10	I	–	Tonnage, lbs S <0.40/million Btu
32	S.60	10	I	–	Tonnage, lbs S 0.41–0.60/million Btu
42	S.83	10	I	–	Tonnage, lbs S 0.61–0.83/million Btu
52	S1.24	10	I	–	Tonnage, lbs S 0.83–1.24/million Btu
62	S1.67	10	I	–	Tonnage, lbs S 1.24–1.67/million Btu
72	S2.5	10	I	–	Tonnage, lbs S 1.67–2.5/million Btu
82	S2.5+	10	I	–	Tonnage, lbs S >2.5/million Btu
92	ALL-SUL	10	I	–	Tonnage, all sulfur categories

ISGS Seam Codes

1670	Trowbridge
1750	Calhoun
1760	Shelbyville
1780	Opdyke
1790	Loudon
1800	Belle Rive
1910	Bristol Hill
2490	Danville
2610	Jamestown
2660	Herrin
2790	Springfield
2840	Houchin Creek
2940	Survant
3020	Colchester
3030	Mt. Rorah
3170	Seelyville
3210	Dekoven
3240	Wiley
3250	Davis
3370	Murphysboro
3490	Rock Island

Item Types

I	=	Integer
N	=	Decimal
C	=	Character

Reliability Codes

3	=	measured
1	=	indicated
2	=	inferred

Depth Categories (feet)

50	=	0 to 50
100	=	50 to 100
150	=	100 to 150
200	=	150 to 200
250	=	200 to 300
350	=	300 to 400
450	=	400 to 500
		... etc.

Btu Categories (million Btu/ton)

19.00	=	15 - 19.99
21.50	=	20 - 22.99
24.00	=	23 - 24.99
25.50	=	25 - 25.99