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**OCCUPATIONAL AND TRAINING
REQUIREMENTS FOR EXPANDED
COAL PRODUCTION
(as of October 1980)**

MASTER

April 1982

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Prepared for:
U.S. Department of Energy
Office of Energy Research
Manpower Assessment Program
Under Contract No. AC01-78IR10108

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OCCUPATIONAL AND TRAINING REQUIREMENTS FOR EXPANDED COAL PRODUCTION (as of October 1980)

April 1982

Prepared by:
The Conference Board
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New York, New York 10022
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This report was prepared by Harold Wool with the assistance of John B. Ostbo. It was completed in October 1980, but because of unavoidable delays, was not published until April 1982. Bernard Yabroff served as consultant in planning the coal industry training survey and Kay Worrell, Manager of the Conference Board's Survey Research Center, was responsible for production of the final survey instruments and for survey operations. Anne Johnson served as project secretary and administrative assistant, and also assisted in the survey analysis and related research.

The project staff are indebted to Robert Vines, Vice President for Safety and Training, Bituminous Coal Operators Association, and to Betsy Kraft, Director of Education and Training, National Coal Association, for their advice and counsel in addition to their communications to affiliated companies, urging participation in the survey. Alan Wampler, formerly Vice President for Training of BCOA, and members of the BCOA Training Committee also reviewed our survey instruments and made many helpful comments. We are particularly grateful to all the coal company officials who completed our survey questionnaires, and who provided much additional information in the course of our visits to 16 major coal companies throughout the country.

The detailed occupational data appearing in Chapter 3, based on the Bureau of Labor Statistic's Occupational Employment Statistics survey, were developed with the assistance of Tom Shirk of the Bureau's Division of Occupational Administrative Statistics. The BLS, however, is not responsible for the statistical validity of the more detailed disaggregations appearing in this report.

REPORT HIGHLIGHTS

Research Objectives

This study was initiated because of the anticipated rapid growth in trained personnel requirements in bituminous coal mining, and because the industry had already experienced significant problems in recruiting skilled manpower in the course of its employment expansion during the 1970's.

Major research tasks included --

- Development of base data on the scope of current industry training programs and on the occupational distribution of the coal mining labor force.
- Projections of future occupational requirements and training needs to 1995.
- Assessments of adequacy of existing training resources, to meet future growth needs.
- Recommendations on needed improvements in the coal industry manpower data system.

Employment Outlook

Employment in bituminous coal mining is projected to nearly double, from 234,000 in 1977 to 456,000 in 1995, as the net result of a projected threefold increase in coal output to nearly 2.0 billion in 1995 and of an expected significant improvement in overall productivity.

- Employment growth is expected to be moderate until 1985 but to accelerate between 1985 and 1995, due to the projected rapid growth in the labor-intensive deep mining sector of the industry in the latter period.

- The Western and Central coal mining regions will experience the most rapid increases in coal mining jobs, whereas employment in the Eastern (Appalachia) region is expected to level off until 1985 and to grow at an annual rate of about 3 percent, between 1985 and 1995.
- Nearly all of the industry's employment expansion is projected in underground mining. In surface mining, continued employment growth in the West will be largely offset by expected cutbacks in the Central and Eastern regions.

A large proportion of current coal mining employees are in occupations which require significant amounts of training for effective work performance.

- About 16 percent are in managerial, professional, technical, or supervisory positions.
- Nearly one-fifth are in skilled maintenance and craft occupations.
- An additional 35 percent are in the more skilled equipment operator occupations.
- Less than one-fifth are in the less skilled laborer or other entry-level jobs.

Employment growth to 1995 will be most rapid in those occupations requiring the greatest training or educational preparation.

- Employment of salaried employees and of skilled maintenance workers is expected to increase by about 150 percent by 1995, as compared to projected increases of only 67 percent for equipment operators and 60 percent for laborers or other entry-level workers.
- Increased mechanization, increased regulation, and the growing scale of coal company operations are major factors contributing to this increased requirement for professional and skilled personnel.
- Trained personnel needs will accelerate most rapidly in the West, with increases of 500 percent or more projected for managers, professionals, foremen, and mechanics.

Training Programs

Formal training for coal mining occupations was first initiated on a significant scale in the 1970's as the combined result of --

- Enactment of mandatory safety, health, and training requirements under the Mine Safety and Health Acts of 1969 and 1977 and concurrent state legislation.
- The influx into the industry of large numbers of new, inexperienced miners.
- The increased complexity and scale of coal mining operations and the accompanying growth in requirements for professional, technical, and other highly-trained personnel.

The new training infrastructure which has emerged to meet these needs includes both internal, company-operated training programs and those offered by various external providers. Among the latter are --

- Vocational schools, community colleges, and university extension departments.
- Public agencies such as MSHA and state mining departments.
- Coal industry trade associations.
- Vendors or training consultant groups.

The Conference Board survey of coal industry training programs, conducted in late 1979, was designed to provide comprehensive data on the scope of the coal industry's own training activities and on related training issues, based on a mail questionnaire survey addressed to all companies producing 300,000 or more tons.

- Responses were obtained from 91 companies accounting for 51 percent of total coal industry employment. Response rates ranged from 80 percent from the industry's 50 largest companies to only 19 percent from companies producing less than 2 million tons annually.

- Follow-up analysis indicated that a large proportion of the latter non-respondents had no specialized training units or staffs and probably performed minimal training, other than that required by law.

Nearly all of the larger responding companies reported that they now had specialized training units -- mainly established since 1970; however, only about one-third of those with less than 200 employees had such units.

- The higher per capita costs of in-house training in smaller companies are illustrated by the ratios of full-time trainers to total employees, which rose from 2.3 per 1000, for companies with 5000 or more employees, to 8.1 per 1000, in firms with less than 500 employees.

Mandated health and safety training was generally provided through company-operated programs.

- Several smaller companies, however, relied entirely on external sources, such as local schools, for new miner orientation.

Nearly one-half of respondents provided no formal skills training to their miners, other than mandated task training.

- Provision of any formal miner skills training -- other than o.j.t. -- varied directly with company size, from less than 40 percent among respondents with fewer than 200 employees, to over 80 percent among companies with 2500 or more employees.
- Participation in non-mandatory training was highest among foremen and skilled maintenance personnel; lowest for equipment operators and other production workers.

Training course lengths, based on data for a sub-sample of 58 larger mines, ranged from a median of about five weeks for initial courses for mechanics to only one day for upgrade training sessions.

- Reported course lengths were particularly variable for mechanics or electricians courses, which combine periods of formal classroom work with on-the-job training.

The estimated percentage of available working time devoted to formal training activities in the surveyed mines averaged only 1.5 percent for all production workers and 2.3 percent for foremen.

- Training conducted to comply with federal or state laws accounted for about one-half of total training time in these mines.
- A large proportion of the non-mandatory training activity for production workers consisted of specialized courses in maintenance skills.
- Company investments in miner or foreman training, as measured by these ratios, were about twice as great among reporting mines in the expanding Western and Central regions as in the East.

A large proportion of responding companies relied entirely on their own facilities and staff for conducting their training programs.

- About seven out of ten companies used company facilities, exclusively, in their health and safety, skills training, and foreman courses.
- About one-fourth reported use of both company and external facilities; relatively few used external facilities only, except for technician training.
- Some use of outside instructors for health and safety training and skills training was reported by about one-fourth of the companies; about 40 percent used outside instructors in foreman training.
- However, although about 80 percent of the companies reported that training materials were developed at least in part by their own staff, considerable use was also made of training materials prepared by government agencies or equipment manufacturers for health and safety training and skills training courses, respectively.

Company training officials expressed considerable dissatisfaction with their own companies' non-mandatory training programs.

- The proportion of respondents "not satisfied" with their current programs ranged from one-third, for miner skills training, and over 40 percent, for management training, to about one-half for foreman training.
- Dissatisfaction with these programs exceeded 50 percent among training officials of the larger companies completing the Board's detailed questionnaire, but were much lower among respondents to the summary questionnaire, many of whom were not training specialists.
- In contrast, over 90 percent reported satisfaction with their companies' current safety and health training programs.

The Training Outlook

Overall coal industry training needs will increase sharply between 1977 and 1995, but growth rates will vary widely by region, occupation and industry sector.

- Based on anticipated employment and hiring trends, training requirements for new miners, mechanics, and foremen will more than double over this period, as compared with a more limited increase in skills training of equipment operators.
- Training needs for all personnel categories are expected to grow steadily in the Central and Western regions; however, a short-term slackening in hiring and training is projected for Appalachia to 1985 followed by substantial growth in the period 1985-95.
- Training needs will generally be greatest in the underground mining sector, which is expected to account for most of the industry's employment growth during this period.

A more rapid growth in training requirements than indicated by these projections will develop to the extent that coal companies expand the scope and intensity of their existing non-mandatory training programs.

- Indicators of a probable intensification of coal company training activities include dissatisfaction with existing (non-mandatory) training programs expressed by many company training officials and the fact that about two-thirds of the surveyed companies reported plans to expand their training activities in the following year.

Training Program Implications

There is a need for coordinated planning of coal industry training resources at the local and regional levels to avoid possible shortages of trained personnel in some areas as well as possible short-term surpluses in other areas.

- Although the existing training infrastructure will probably be adequate to accommodate projected needs in the older coal mining regions of Appalachia, systematic expansion will be required in many Western coal mining areas.
- Smaller companies are likely to continue to rely extensively on external resources, such as local schools, for training of skilled personnel.

Possible roles for the Federal government in furthering the development of skilled manpower resources for the industry include: (1) establishment of a Mining Extension Service, as proposed in one recent report, and (2) assistance in establishment of cooperative training programs, by regional groupings of coal companies, to provide a closer linkage between training outputs and the industry's needs for trained personnel.

A number of major improvements in available data on coal industry training and employment trends are needed for effective planning.

- The most critical of these needs is systematic research to evaluate the cost-effectiveness of alternative training methods, using performance criteria such as accident reduction and productivity.

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Chapter 1

INTRODUCTION

BACKGROUND

The 1970's witnessed a sharp resurgence in the coal mining industry following two decades of severe contraction. By 1979, yearly output of bituminous coal was at a record 770 million tons, and employment, at 256,000 had increased to twice the level of the late 1960's. Moreover, by all accounts, coal looms increasingly large in our Nation's energy future. Thus, recent projections of future domestic coal output anticipate a need to triple our national coal tonnage between 1979 and the year 2000, and to double it again by the year 2030 (1).

These and similar forecasts of future coal output have been based on an assumption that -- though coal mining is much more labor intensive than other energy sources -- a sufficient supply of miners will be available to meet expanded coal production requirements. This assumption has not appeared unreasonable in view of the fact that coal mining still requires a very small fraction of our total labor supply and that coal mining is among the best paid of our Nation's industrial occupations. Nevertheless, a number of labor-related developments have provided grounds for concern regarding the potential costs and reliability of the future labor supply for the industry. These include: (1) a steady decline in coal mining productivity, which fell by about a third during the 1970's; (2) an upsurge of labor unrest in the

industry, climaxed by the 110-day UMWA* contract strike of 1977-78; and
(3) a sharp increase in unit labor costs, which more than doubled in real terms between 1967 and 1977.

In order to assess the implications of these and other labor factors for the future availability and cost of coal, The Conference Board, under contract with the Electric Power Research Institute, undertook a study in 1978, which included detailed projections of coal industry labor requirements, supply, and costs to 1990 as well as a more general appraisal of the longer term labor outlook to 2030. This report, completed in early 1980, presented a cautiously optimistic picture of the coal industry labor supply prospects. The industry's labor recruitment experience during the decade of the 1970's had indicated that -- despite the fact that coal mining is inherently dirty and dangerous work -- the industry's high wage structure was likely to serve as a sufficient inducement to attract the needed number of new, inexperienced miners from an expanding national labor force, at least during the mid-range period to 1990.

Although the supply of new coal mine workers was thus found likely to be adequate in terms of numbers in the 1980's, the qualitative adequacy of these labor resources appeared more uncertain. Our review of the industry's recruitment experience during the past decade of rapid employment growth had indicated that many coal mining companies had experienced serious difficulties in attracting a sufficient supply of skilled mechanics and supervisors, particularly in the rapidly expanding Western coal mine regions. These difficulties had been compounded by a growing requirement for skilled personnel, resulting from increased mechanization and regulation of mining operations.

The rapid growth in the industry's needs for skilled manpower, in combination with statutory requirements for formal occupational safety training for all mine personnel, has resulted in the emergence of a new training infrastructure in the industry, consisting of both internal company operated training programs and programs offered by public or private training and educational institutions in the major coal mining areas. This new emphasis on systematic training for coal mining occupations contrasts with earlier industry practice, which had traditionally relied on informal, "buddy-system" arrangements for breaking in new miners, and on the large resources of older, experienced miners for selection of personnel for skilled and supervisory-level jobs.

However, although coal industry spokesmen and educators have highlighted the critical need for developing and strengthening training and educational programs for coal mining occupations, there has been little or no systematic data on the scope of existing programs, on the number of personnel trained by occupation, and on the extent to which these programs are meeting the industry's current or prospective manpower needs. Such data are needed by public agencies, educational institutions, and industry groups concerned with assuring an adequate supply of trained manpower for the industry.

RESEARCH OBJECTIVES

The present study was therefore initiated under contract with the Division of Labor Affairs and Manpower Assessment of the Department of Energy to meet the need for systematic data on coal industry occupational requirements, and on coal mining training programs and resources. Such data can assist in assessing the adequacy of such programs and in planning for future training programs in

the industry. The project required both the development and analysis of new base data on coal industry occupations and training activities, and the projection of future requirements. Specifically, the following major research tasks were undertaken:

1. Development of comprehensive estimates of the current occupational distribution of coal mine employment, by region, type of mining, and other relevant characteristics.
2. Projection of coal mining labor requirements, to 1995, by occupation and region.
3. Development of comprehensive data on current coal company training programs, for the major coal mining occupations.
4. A projection of future training needs in key coal mining occupations, by region.
5. An analysis of the adequacy of existing statistical data sources on coal industry manpower needs and resources, and recommendations for improving these data systems.

RESEARCH METHODOLOGY

1. Occupational Projections -- A point of departure in our projection of coal industry occupational requirements was a series of projections of aggregate coal mining employment to 1995, by region and type of mining. These were based primarily on: (1) projections of coal mining output to 1995, recently issued by the Energy Information Administration as part of its mid-range energy projections series, and (2) projections of coal mining productivity, using a forecasting model developed by The Conference Board. These projections are described in Chapter 2 of this report.

A second step required the development of detailed base data on the current occupational distribution of coal mining employment. For this purpose, arrangements were made to develop detailed tabulations from the Occupational Employment Survey for the bituminous coal mining industry, which was conducted by BLS* in early 1978, in cooperation with state agencies. These tabulations provide, for the first time, comprehensive data on actual occupational staffing patterns in the industry by type of mining (deep, surface) and by region. Projections of these occupational distributions to 1995 were in turn developed based on extrapolation of past trends, as reflected in a number of historical data sources. (Chapter 3.)

2. Coal Industry Training Programs -- An initial task in assessing the current scope of training in the industry was a systematic review of the available literature. Our literature search encompassed both published materials and unpublished data available from government, trade association, and industry sources. These data were supplemented by field interviews with personnel and training officials of 16 major coal companies, and by meetings with government, trade association, and union officials concerned with coal industry training and education activities, both in Washington, D.C. and in key mining states, such as West Virginia. Our review of the recent evolution of coal mine training programs based on this research is presented in Chapter 4.

This research confirmed that despite a rapid growth in the number of training courses on coal mining technology and related subjects offered by vocational schools, community colleges, and university extension programs, the most important single source of occupational training in the industry probably

consists of training programs provided by coal companies themselves. Our study design therefore provided for execution of a large-scale mail questionnaire survey of coal mining companies to provide comprehensive, factual data on the scope of their training activities, as well as information on company training policies, plans, and training needs.

Two basic survey instruments were developed for this purpose in consultation with industry training officials: (1) a detailed company-level questionnaire to be completed by coal company training officials, which provided for both factual data on the overall scope of their companies' training activities as well as a number of attitudinal questions on such issues as the adequacy of their current programs and of training provided by various outside sources; and (2) a mine questionnaire requesting more specific detail on mine-level training activities for a sample of mines of these companies. In addition, a shorter form of the company questionnaire was used for companies not responding to the more detailed schedule. The survey sample included about 350 companies with tonnage of 300,000 or more in 1977, on the premise that companies below this size (usually employing less than 100 workers) are not in a position to provide more than the mandated health and safety training to their employees. Responses to these questionnaires were provided by 91 companies, which represented about 51 percent of the industry's total employment and about 65 percent of the total employment included in our sample. A detailed description of the sample and of the survey results is included in Chapter 5 of this report.

3. Training Requirements -- A logical point of departure in any assessment of training requirements is a set of standards, or norms, which specify the categories of employees requiring systematic training, the types of training to be provided, and the average length of such training, in course hours or days. In the coal mining industry, such minimum standards have been established under federal and state laws with respect to mandated health and safety training. Our survey results indicated that existing company health and safety programs conformed closely to the minimum course lengths required by these standards. However, they indicated wide variations among companies in the provision of other categories of training, such as technical or skills training courses for mine mechanics and equipment operators, or supervisory training courses for foremen. In the absence of any accepted industry standards for these training categories, training participation rates per employee accession and median course lengths in the mines of companies responding to our survey were accepted as norms for projection purposes. This implies that the current training practices in the relatively large mines covered by our survey provide a reasonable approximation of the amount and kinds of training which are desirable for the industry as a whole.

Using these norms and projected employment and hiring rates by occupation, estimates of training requirements by region were developed for four categories of training courses: (1) orientation training for newly-hired miners; (2) initial skills training for mechanics; (3) initial skills training for equipment operators; and (4) supervisory training. These projections, as well as a discussion of key training issues suggested by these data, are presented in Chapter 6.

REFERENCES

1. Estimates by the Electric Power Research Institute cited in Harold Wool and John B. Ostbo, The Labor Outlook in the Bituminous Coal Industry. Palo Alto, California: Electric Power Research Institute, 1980, Chapter 8.

Chapter 2

THE COAL INDUSTRY EMPLOYMENT OUTLOOK

INTRODUCTION

During the past three decades, the bituminous coal mining industry experienced a major cycle of contraction and subsequent recovery which profoundly affected the size and composition of its labor force. Against the backdrop of these trends, this chapter presents projections of coal mining production and employment to the year 1995, by region and type of mining, to serve as the framework for our assessment, in subsequent chapters, of the industry's occupational and training needs.

A number of alternative scenarios have been used in recent mid-range forecasts of energy production and employment. The point of departure in the present report has been the "medium" series projections of coal production published by the Department of Energy in 1979 and a related set of productivity and employment projections developed by The Conference Board. In view of the many uncertainties inherent in such projections, this chapter also includes a brief discussion of some of the critical assumptions underlying these projections.

RECENT COAL INDUSTRY TRENDS

The two decades following the end of World War II witnessed a very sharp contraction in coal industry markets and jobs. Bituminous coal and lignite production had fallen sharply from a postwar peak of 631 million tons in 1947 to 516 million in 1950 and to levels of slightly above 400 million tons in the early 1960's as a result of large scale conversions of many major energy-using industries from coal to oil or natural gas. (Table 2-1.)

The contraction in jobs was even more severe during this period. Bituminous coal mining employment, as measured by the BLS series, declined sharply from 368,000 in 1950 to 169,000 in 1960, and continued to drop to 132,000 in 1965, or less than half the 1950 levels, despite a modest recovery in output by the latter year. A major factor contributing to this sharp reduction in jobs was a sustained increase in productivity from a rate of 6.8 tons per miner per day in 1950 to 17.5 tons in 1965, as a result of extensive mechanization of both underground and surface mining systems throughout the period, including large-scale introduction of continuous mining machinery and introduction of much larger, more complex earth-moving equipment in the growing surface or strip mining sector of the industry.

The period since the mid-1960's, in turn, witnessed a reversal of many of these trends. Coal demand and output experienced a moderate recovery in the decade of the 1960's, primarily due to rapid growth in demand from the electric power utility industry, which had continued to rely on coal as its primary energy source despite significant inroads from competing fuels. This increased demand, combined with a slowdown in the rate of productivity growth, served to

Table 2-1

**PRODUCTION, PRODUCTIVITY AND EMPLOYMENT IN THE
BITUMINOUS COAL AND LIGNITE MINING INDUSTRY: 1950-79**

<u>Year</u>	<u>Production (Mill. Net Tons)</u>	<u>Productivity (Net Tons per Person per Day)</u>	<u>Employment (BLS) (000)</u>
1950	516.3	6.8	367.9
1955	464.6	9.8	218.7
1960	415.5	12.8	168.5
1965	512.1	17.5	131.8
1970	602.9	18.8	139.6
1975	648.4	14.7	209.3
1976	678.7	14.5	221.4
1977	691.3	14.8	221.9
1978	665.1	14.3	205.4
1979*	770.0	13.5	255.6

Average Annual Percent Change

1950-60	-2.2	6.6	-7.5
1960-70	3.8	3.9	-1.9
1970-75	1.4	-4.8	8.4
1975-79*	4.4	-2.2	5.1

Sources: Production and productivity data from U.S. Bureau of Mines, Minerals Yearbook, and U.S. Department of Energy, Energy Data Reports, selected issues. Employment based on Bureau of Labor Statistics series for total employees, from Employment and Earnings, United States, 1909-78 and selected monthly issues.

*Preliminary.

stabilize the number of coal mining jobs during the late 1960's at a level slightly above 130,000. Since 1970, however, employment in the industry has risen sharply, to 209,000 in 1975 and 256,000 in 1979, as the combined result of increased coal demand -- particularly following the 1973 OPEC oil embargo and the consequent sharp escalation of oil prices -- and of a sharp increase in unit labor requirements, as reflected in the sustained reduction in overall labor productivity, which fell by about one-third between 1969 and 1979.

The sharp reduction in productivity during the past decade has been the subject of intensive study in the past several years. Our own research, based on a detailed analysis of time series data, has suggested that these declines were the net result of a combination of factors operating concurrently during this period, including (1) regulatory factors, i.e., the additional labor costs associated with compliance with the Coal Mine Health and Safety Act of 1969, recent Federal and State reclamation laws, and union contractual requirements related to health and safety; (2) labor supply factors, i.e., the influx of large numbers of younger, inexperienced and less-disciplined miners, concurrent with increased retirements of older, experienced miners; (3) labor relations factors, i.e., the extensive labor unrest in the coal fields, reflected in a sharp increase in wildcat strikes and in other symptoms of poor worker morale; and (4) market factors, i.e., the effects of the sharp post-1973 increase in coal prices, which permitted entry or continued operation of many marginal, higher-cost mining operations. These negative factors, in combination, had more than offset the positive influence of a large shift in output from deep to less labor-intensive surface mining (discussed below) and the continued introduction of more advanced mining equipment and methods (1).

These recent aggregate trends have been accompanied by major shifts in the distribution of coal production and employment by type of mining. Deep mining, with its inherently higher operating costs had borne the full brunt of the post-war production cutbacks in the 1950's and has generally failed to recover from the low point reached in the early 1960's. Conversely, the growth of coal production in the past two decades has been almost entirely due to increased surface coal production. As a result, the surface mining share of total output had doubled over this period, from 31 percent in 1960 to 62 percent in 1979. (Table 2-2.)

Surface mining, however, has accounted for a much smaller proportion of the total coal mine work force because of its much higher rates of output per employee. As shown in Table 2-3, labor productivity in surface mining has been more than two times that in deep mining throughout this period. Nevertheless, the proportion of miners in surface mining increased from 16 percent in 1960, to 32 percent in 1977. As discussed in later chapters, surface mining entails a significantly different mix of occupational skills and tends to draw its work force from different sources than underground mining. Hence this trend has had significant implications for occupational and training requirements in the industry.

The shift from deep to surface mining has been accompanied by a significant geographical redistribution of coal output from East to West. The Eastern region, including the major coal mining areas of Pennsylvania, West Virginia, Eastern Kentucky, Ohio, and Virginia and other Appalachian states, has historically accounted for a major share of national coal output. This share,

PERCENTAGE DISTRIBUTIONS OF BITUMINOUS COAL PRODUCTION AND EMPLOYMENT BY TYPE OF MINING AND REGION: 1960, 1970, 1977

	<u>1960</u>	<u>1970</u>	<u>1977</u>
<u>Production (Net Tons)</u>			
<u>Type of Mining</u>			
Deep	69	56	39
Surface	31	44	62
<u>Region</u>			
East	73	69	57
Central	24	25	24
West	4	6	19
<u>Employment</u>			
<u>Type of Mining</u>			
Deep	84	77	68
Surface	16	23	32
<u>Region</u>			
East	83	84	79
Central	13	13	16
West	4	3	5

Source: U.S. Bureau of Mines, Minerals Yearbook, Selected Issues; and U.S. Department of Energy, Energy Data Reports

Table 2-3

PRODUCTIVITY IN BITUMINOUS COAL MINING
BY TYPE OF MINING: SELECTED YEARS, 1960-79

<u>Year</u>	<u>Average Net Tons per Person per Day</u>		
	<u>Total</u>	<u>Deep</u>	<u>Surface</u>
1960	12.8	10.6	23.2
1965	17.5	14.0	32.8
1969	19.9	15.6	36.1
1975	14.7	9.5	26.7
1979*	13.5	7.9	24.8

	<u>Average Annual Percent Change</u>		
1960-65	6.5	5.7	7.2
1965-69	3.3	2.7	2.4
1969-75	-5.2	-8.6	-5.2
1975-79*	-2.2	-4.5	-1.9

Source: U.S. Bureau of Mines and U.S. Department of Energy, Minerals Yearbook and Energy Data Reports, selected issues.

*Preliminary.

however, declined significantly during the past decade, from 69 percent in 1970 to 57 percent in 1977, as a result of rapid expansion of Western output, particularly in the highly productive surface mines of the Western Great Plains producing areas. The share of total employment accounted for by the Eastern region has declined much less than that of output -- from 84 percent in 1970 to 79 percent in 1977 -- primarily because of the steeper increase in unit labor requirements in the underground sector of the industry which is concentrated in the Appalachian region.

These shifts in distribution of coal mine output and jobs have also been accompanied by a pronounced increase in industrial concentration, with major shifts of mine ownership from independent coal companies to corporations engaged in oil or other energy-related industries. Ownership of non-captive mines has become increasingly concentrated in a relatively small number of major companies or operating groups, who in turn market their coal to a small number of large buyers, mainly under long-term contracts. Between 1960 and 1977, the percentage of total output accounted for by the top 50 companies or operating groups rose from 45 percent to 59 percent. Although a large number of smaller producers still account for a major portion of total output in Appalachia, the top four companies in each region accounted for nearly two-thirds of total output in the Midwest and Southwest, and for 38 percent in the Northern Great Plains, in 1976 (2). Since the capability of providing systematic in-house training is directly related to company size, this trend has had important implications for the recent -- and prospective -- development of company-sponsored training and educational assistance programs in the industry.

THE PRODUCTION OUTLOOK

There is a broad consensus among public and private organizations which have engaged in systematic forecasting of United States energy demand and production that a substantial expansion in U.S. coal production will be required in the mid-range period to 1995 in order to meet our Nation's growing energy needs and to reduce reliance upon increasingly costly and uncertain supplies of imported oil. There is much less consensus concerning the rate and phasing of this growth and the probable distribution of future coal production by region or type of mining.

For the purpose of projecting coal industry occupational requirements and related training needs, we have used as a point of departure one of a recent set of coal production projections published by the Energy Information Administration (EIA) of the Department of Energy in its 1978 Report to the Congress. (Table 2-4.) Of five mid-range energy scenarios described in this report, we have selected the EIA Series C, "medium" set of projections, rather than the alternative projections which are designed to depict the implications of "maximum" variations in the quantity or cost of energy. These, as well as other recent projections, are based upon a detailed set of assumptions concerning factors which will affect the future course of total energy demand and which will affect the allocation of this demand between coal and other major energy sources. Because of major uncertainties surrounding these variables, these output projections and related employment projections should be considered as illustrative of a possible growth path for the industry in the coming 15 years, rather than as a specific forecast of production trends and levels in the target year.

Table 2-4

**PROJECTIONS OF U.S. BITUMINOUS COAL AND LIGNITE PRODUCTION
BY REGION: 1977- 95**

Region/ Type of Mining	Million Net Tons				Annual Percent Changes		
	Actual, 1977	1985	1990	1995	1977-85	1985-90	1977-95
U.S. TOTAL	692	1033	1465	1998	5.1%	6.8%	6.1%
Deep	264	463	650	857	7.3	6.4	6.8
Surface	428	570	815	1141	3.6	7.2	5.6
EAST	394	443	484	548	1.5	2.1	1.8
Deep	198	261	347	427	3.5	5.0	4.3
Surface	196	182	137	121	-0.9	-4.0	-2.7
CENTRAL	164	304	374	466	8.0	4.4	6.0
Deep	52	167	256	349	15.7	7.6	11.1
Surface	112	137	118	117	2.6	-1.6	0.2
WEST	134	286	607	984	9.9	13.2	11.7
Deep	14	35	47	81	12.1	8.8	10.2
Surface	120	251	560	903	9.7	13.7	11.9

Source: U.S. Department of Energy, Energy Information Administration,
Annual Report to the Congress 1978, Volume 3, Table 9.3, Series C,
"Medium Projection."

As shown in Table 2-4, these projections anticipate a rapid acceleration in growth of coal output, particularly in the period 1985-95, which will result in expansion of domestic coal production from 692 million tons in 1977 to over 1.0 billion in 1985 and nearly 2.0 billion in 1995. Under this projection, the share of coal in total domestic energy production will increase from 26 percent in 1977 to 42 percent in 1995, offsetting sharp declines in the relative contributions of both gas and oil.

This projection anticipates a continued rapid expansion of coal output in the Western and Central Regions between 1977 and 1995, at annual rates of 11.7 percent and 6 percent, respectively, as compared to a much slower growth rate of only 1.8 percent in Appalachia. By 1995, nearly one-half of all coal output would be accounted for by the Western Region (primarily the Great Plains) as contrasted to only 19 percent in 1977. Conversely, the share of the East will have declined from 57 percent to 27 percent over this span of years.

However, despite the very rapid anticipated growth of Western surface mining, the EIA projection departs from previous trends in estimating a relatively significant shift in output mix from surface to deep mining in both the Appalachian and Central Regions, as well as a sharp growth in Western deep mining, primarily in the Rocky Mountain states. Thus, in contrast to the declining trend or stagnation of underground mining in recent decades, the EIA forecast provides for a sharp expansion of underground mining, at an average annual rate of 6.8 percent, between 1977 and 1995. This projected reversal in trend appears to be due, in part, to the estimated increased costs of strip mining in Appalachia and the Central Regions under the 1977 Surface Mining Control and Reclamation Act, as

well as to the size and characteristics of available coal reserves in these regions. This projected expansion of underground coal production, from 264 million tons in 1977 to 857 million in 1995, in turn has major implications for the industry's future labor requirements, as reviewed below.

PRODUCTIVITY PROJECTIONS

Coal mining productivity, generally expressed as net tons produced per miner per day, represents the critical linkage between projections of coal production and employment, or labor requirements. A number of recent projections of coal industry employment have assumed that productivity (by region and type of mining) will remain constant during the projection period. However, in view of the wide fluctuations of coal mining productivity during the post-World War II period, this approach appeared undesirable.

As an alternative, separate projections of coal mining productivity by type of mining and major coal producing regions were developed by the authors, using truncated econometric models fitted to time series data for the period 1950-75, and a set of assumptions concerning the key exogenous variables, in this model (3). Included among the latter were: (1) allowances for the near-term impact of recently promulgated regulations under the Surface Mining Control and Reclamation Act of 1977,* (2) estimates of the rate of introduction of new equipment, (3) labor supply trends, as reflected in the percentage of miners under 25 years of age and in average weeks worked, and (4) coal market trends, as measured by the projected price of coal in constant dollars. Because of uncertainty concerning the prospective trends in these variables, a range of projections was developed. The projections presented in Table 2-5 are based on "best judgment" estimates for each of the key variables.

Table 2-5

**PROJECTIONS OF COAL MINING LABOR PRODUCTIVITY
BY REGION AND TYPE OF MINING: 1977-95**

Region/Type of Mining	Average Net Tons Per Miner Per Day	
	Actual*	Projected**
	1977	1985 1990 1995
U.S. TOTAL	14.8	17.0 19.1 20.5
Deep	8.7	11.0 10.9 11.8
Surface	26.6	30.7 47.4 61.2
EAST	10.8	11.4 10.7 10.3
Deep	7.8	9.7 9.5 9.3
Surface	18.3	15.3 15.8 16.4
No. Appalachia	11.1	12.1 10.8 10.2
Deep	8.1	10.1 9.8 9.5
Surface	17.8	17.0 17.6 18.2
Cent. & So. Appalachia	10.6	11.0 10.6 10.3
Deep	7.7	9.4 9.1 8.9
Surface	18.8	14.4 15.0 15.5
CENTRAL	19.1	18.8 16.9 15.8
Deep	12.7	13.7 13.5 13.3
Surface	25.3	34.5 37.9 36.7
Midwest & Cent. West	18.0	15.2 14.2 13.7
Deep	12.7	13.7 13.5 13.3
Surface	23.4	21.0 19.5 18.1
Gulf	49.9	89.7 95.7 102.1
Surface	49.9	89.7 95.7 102.1
WEST	46.9	50.1 64.0 64.8
Deep	12.2	11.8 11.6 11.4
Surface	71.0	91.6 103.0 112.7
Great Plains	81.9	88.5 95.4 101.9
Deep	9.1	11.2 11.0 10.8
Surface	88.2	101.2 108.0 115.2
Rest of West	26.5	19.5 18.3 15.8
Deep	12.4	11.9 11.7 11.5
Surface	47.9	54.7 58.4 62.3

*U.S. Department of Energy, Weekly Coal Report No. 93, July 13, 1979, Table 3.

**Based on projections of production and productivity by type of mining in 12 coal supply sub-regions, as described in text.

PROJECTIONS OF COAL MINING PRODUCTIVITY
BY REGION AND TYPE OF MINING

The outlook under these projections is for a significant reversal in the declining trend in overall coal mining productivity, with average productivity (for deep and surface mines combined) rebounding by the early 1990's to the peak level of about 20 tons per miner per day attained in 1969. This will result, in large part, from the projected massive redistribution of coal output from the East to the Western and Central Regions and from the much higher productivity in the latter regions.

Under these projections, the changes in productivity, by type of mining, within each region or sub-region are expected to be much more moderate. In deep mining, a slightly higher level of productivity than in 1977 is projected in most regions in part because of anticipated maturation of the labor force and an associated improvement in the labor relations climate. In surface mining, productivity is projected to grow significantly in the West and in the Gulf regions where very large, highly mechanized mines -- many of which were in initial start-up phases during the past several years -- will reach optimum productivity levels during the projection period. On the other hand, some net reductions in productivity are projected for surface mining operations in Appalachia and the Midwest -- regions where surface mining has been significantly impacted by the increased cost of reclamation activities under the

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West of West
Deep
Surface

U.S. Department of Energy, Washington, D.C. 20585
Table 2

2-14
Based on projections of productivity by type of mining and by region and sub-region as described in text.

EMPLOYMENT PROJECTIONS

Our projections of employment in coal mining by major region are presented in Table 2-6. These projections were based on the following procedures and assumptions:

1. Projections of labor requirements, expressed in person-days, were derived by coal supply region and type of mining from the projections of production and productivity described in the preceding sections.
2. The projections of number of person-days were converted into projections of employment (comparable to the DOE series) under an assumption that the average number of days worked in surface and deep mining, by region, would correspond to the average in the years 1973, 1975, and 1976. Our review of past trends in days per year worked per miner, as reported by DOE, had indicated that these trends were responsive to general labor market conditions in the industry, in addition to being impacted by any national major work stoppages. The years selected, the most recent years not affected by any general contract work stoppages in the industry, were also considered more representative of probable future coal industry labor markets conditions than earlier periods.
3. The resulting employment estimates were based on the DOE/BOM series for the industry. This series, by definition, excludes office employees, who are included in the BLS series for the industry. In most recent years, the BLS estimates have ranged between 5 and 10 percent higher than the corresponding DOE series as a net result of the differences in coverage and of other technical differences between the two series. For projection purposes, a sliding ratio adjustment of the "DOE-comparable" projections was used, ranging from a ratio of 1.08 for 1985 to about 1.11 in 1995, to allow for the expected growth in the proportion of salaried, office employees, as discussed in Chapter 3.

Table 2-6

PROJECTIONS OF EMPLOYMENT IN THE BITUMINOUS COAL AND LIGNITE MINING INDUSTRY,
BY REGION AND TYPE OF MINING, 1977-95

Region/Type of Mining	Employment (000)				Average Annual Percent Change		
	Actual* 1977	Projections 1985	1990	1995	1977-85	1985-95	1977-95
U.S. TOTAL	234.3	281.5	353.5	455.7	2.3%	4.9%	3.8%
Deep	160.2	193.5	273.5	369.7	2.4	6.7	4.8
Surface	74.1	88.0	80.0	86.0	2.2	-0.2	0.8
EAST	184.1	188.1	217.0	258.8	0.3	3.2	1.9
Deep	134.4	127.4	172.2	219.9	-0.7	5.6	2.8
Surface	49.7	60.7	44.8	38.9	2.5	-4.4	-1.4
CENTRAL	37.5	68.1	94.3	128.3	7.7	6.5	7.1
Deep	20.0	52.1	81.8	115.2	12.7	8.3	10.2
Surface	17.5	16.0	12.5	13.1	-1.1	-2.0	-1.6
WEST	12.7	25.3	42.2	68.6	8.0	10.5	9.8
Deep	5.8	14.0	19.5	34.6	11.6	9.5	10.4
Surface	6.9	11.3	22.7	34.0	6.4	11.6	9.3

*Total employment based on 11-month average for Jan.-Nov. as reported in BLS series. December excluded because of UMWA contract strike. Distributions by region and type of mining based on DOE, Weekly Coal Report No. 93, July 13, 1979.

The resulting projections indicate that annual employment growth in the industry, nationally, will be at a moderate rate of only 2.3 percent between 1977 and 1985, but will accelerate to a rate of 4.9 percent between 1985 and 1995. During the near-term period to 1985 employment growth is expected to be limited to the Central and Western regions, based on the premise that a modest improvement in productivity in Eastern deep mining will permit some increase in output there with no net expansion in work force. During the period 1985-95, substantial employment increases are projected for all major coal regions, including Appalachia, although employment growth rates will continue to be much higher in the Western and Central Regions.

Under these projections, all but a small fraction of the net employment growth in the industry of 220,000 over this 18-year span will be concentrated in the deep mining sector of the industry, even though -- as shown in Table 2-4 -- surface mining annual output is expected to increase by more than 700 million tons over this period as compared to an increase of 600 million in deep mining. This is due in large part to the fact that the DOE-projected growth in surface mining output will be concentrated in the WEST, where favorable geological mining conditions combined with a high-degree of mechanization have resulted in much lower unit labor requirements than in the Midwestern and Eastern regions, as shown in Table 2-5. We have, moreover, projected substantial additional increases in productivity in these Western surface mines as they move into sustained full-scale operation. Conversely, our region-specific productivity projections for deep mining assume a very limited net improvement as compared to 1977 levels, partly because accelerated hiring during the 1985-95 period -- and hence an increased inflow of inexperienced miners can be expected to exert some downward pressure on deep mine productivity during the latter period, in each region.

Thus, the combined effect of these regional shifts in output and of differential productivity trends implies a widening of the overall productivity ratio between surface and deep mining, from about 3:1 in 1977 to more than 5:1 by 1995.

RELIABILITY OF PROJECTIONS

The above projections of coal output and employment, as we have noted, are based on one of a number of possible scenarios concerning the prospective demand for coal and related requirements for coal mine labor. These scenarios entail a large number of separate assumptions or projections of key factors which will affect demand for coal, including the rate of growth of GNP, the relationship between GNP and energy demand under conditions of rising energy costs, the relative prices and availability of alternative energy sources, the impact of environmental and other regulatory factors on coal demand, the growth of coal demand for conversion to synthetic fuels and for export, and the impact of governmental policies designed to accelerate conversion from oil and gas to coal or other alternative fuels. The uncertainties with respect to these and other key variables tend to increase, moreover, with the length of the projection period. In addition, the potential for error tends to be compounded with the degree of disaggregation of these projections since regional projections -- for example -- require additional estimates of differential regional economic growth trends and of relative transportation cost factors as well as careful assessment of the characteristics of coal reserves in each supply region and of associated recovery costs.

One indication of the degree of variability in these output projections is provided by a comparison of the EIA projections for 1990 with an alternative set of

projections developed for the Electric Power Research Institute (EPRI) at about the same time. The latter projections, by region, were based on a set of assumptions specified by an EPRI working group and were further disaggregated by us, based on estimates of coal mine depletion rates and on planned capacity expansion, by type of mining, in each region. Although the two sets of projections corresponded quite closely for 1985, the EPRI-based projections anticipate a production level of less than 1.3 billion tons in 1990, or about 180 million less than projected by EIA in its "medium" series. The differences are accounted for mainly by a substantially higher level of surface output in the West, under the EIA series, and by higher deep mining outputs in the Eastern and Central regions. (Table 2-7.)

The EIA output projections for 1990 are also substantially higher than two of three alternative projections recently developed for the Committee on Nuclear and Alternative Energy Systems of the National Academy of Sciences. The latter projections, based on a considerably more conservative set of assumptions concerning growth in GNP and energy demand, provide for a range of total coal output (converted from quads), from 1.11 billion tons under a low "business as usual" scenario to 1.18 billion under an intermediate "enhanced supply" projection, and a high of 1.44 billion under a "national commitment" scenario (4). Only the latter approaches the EIA projection of 1465 million, under its "medium" series.

The productivity projections used to convert these outputs into estimates of labor requirements are equally subject to a wide possible margin of error, particularly as these are extended into the decade of the 1990's. At the national level, they are particularly sensitive to any deviations in the actual output mix by type of mining and region from those projected by the EIA, in view of the

Table 2-7

ALTERNATIVE PROJECTIONS OF COAL OUTPUT BY REGION: 1990

Region/Type of Mining	Million Net Tons		Difference (1) - (2)
	EIA (1)	EPRI/Conf. Bd. (2)	
U.S. TOTAL	1465	1282	183
Deep	650	535	115
Surface	815	747	68
EAST	484	408	76
Deep	347	271	76
Surface	137	137	0
CENTRAL	374	390	-16
Deep	256	184	72
Surface	118	206	-88
WEST	607	484	123
Deep	47	80	-33
Surface	560	404	156

Source: The Labor Outlook in the Bituminous Coal Industry, Table 2-3. (3).

very wide intra-industry variations in productivity among these sectors. Within each region, sensitivity tests -- assuming relatively small variations in the key explanatory variables -- have indicated that these could result in a considerable variation in resulting productivity growth rates. For example, as compared to a "best judgment" projection that productivity in deep mining in the Eastern region would increase at a rate of 1.2 percent annually between 1975 and 1985, the use of a high-low range of ± 5 percent in each of the explanatory variables used in The Conference Board projection model resulted in a range of possible annual productivity growth rates from 0.2 percent to 2.2 percent for this period (5).

In view of these inherent limitations, the employment projections presented here and the related projections of occupational and training requirements can at best be viewed as indicative of a probable growth pattern over the mid-range period to 1995, under the stated assumptions.

REFERENCES

1. For a detailed discussion of these trends see: Joe G. Baker, Determinants of Coal Mine Labor Productivity Change, Oak Ridge, Tennessee: Oak Ridge Universities, 1979. Harold Wool and John B. Ostbo, The Labor Outlook for the Bituminous Coal Mining Industry, Palo Alto, California: Electric Power Research Institute, 1980, Chapter 3.
2. National Academy of Sciences, Energy in Transition, 1985-2010. Washington, D.C.: NAS, 1979, p. 194.
3. A detailed description of this model and related projections appear in The Labor Outlook in the Bituminous Coal Mining Industry, Chapter 3.
4. National Academy of Sciences, op. cit., p. 568.
5. Harold Wool and John B. Ostbo, op. cit., Table 3-7.

Chapter 3

OCCUPATIONAL REQUIREMENTS

INTRODUCTION

Modern coal mining is a highly mechanized operation utilizing complex, heavy equipment to provide safe access to the coal seams, to remove the coal from the seams, and to load and transport the coal to the mine mouth or entrance, where it may be further processed at a coal preparation plant prior to shipment. Underground coal mining, which continues to account for a major proportion of the industry's work force, must -- in addition -- provide and maintain a whole series of life-support and equipment-support systems, including air supply and ventilation, water supply and drainage control, roof support, and underground electrical power, communications, and transportation systems.

The occupations of coal mine production workers are correspondingly diverse, as illustrated by the fact that the UMWA wage agreement establishes 38 separate job classifications for underground employees of deep mines, 32 for surface mines, and 30 at preparation plants. These range from general laborer and other entry-level occupations to skilled mechanics and electricians, as well as highly responsible operative jobs, such as continuous mining machine operators and roof bolters.

In addition, the industry employs a substantial -- and growing -- number of salaried employees, in line management and supervisory positions, in a variety

of professional and technical jobs, and in supporting clerical or administrative occupations.

Until recently, the only comprehensive data on the occupational distribution of the coal mining work force were those compiled in the decennial Censuses of Population. These suffered from a number of limitations, including inadequate delineation of coal mining occupations and inability to disaggregate these data by type of mining method, i.e., deep/surface. A more detailed occupational distribution of coal mining employees has been developed for this report, based on a special analysis of data collected by the BLS from a large sample of coal mine establishments in 1978, as part of its occupational employment statistics (OES) survey program.

These data, disaggregated by region and type of mining, in conjunction with available data on recent trends in occupational distribution, have -- in turn -- provided the basis for projections of the occupational distribution of coal mining employment presented in this chapter.

OCCUPATIONAL STRUCTURE OF THE COAL MINING WORK FORCE

Until very recently, the data base available for analyzing and projecting trends in the occupational distribution of coal mining employees was quite limited. The only comprehensive occupational data for the industry were those published in the decennial Censuses of Population -- most recently, for 1970. Apart from the fact that these data are now (as of 1980) seriously dated, the occupational classifications used in the Census did not separately identify many important occupations unique to the coal mining industry. Thus, of a total of 137,000 workers reported as employed in coal mining in 1970, about 47,000 production workers, or 34 percent,

were grouped in a single category, "mine operatives, not elsewhere classified (1)." Moreover, the industrial grouping used (including all coal mining industries) did not provide any separate distributions for those employed in deep and surface mining operations, despite the major differences in technology and occupational requirements for these two types of mining activities. A number of supplementary and more current sources of occupational data have been available for the industry, but these have also been found to be inadequate because of incomplete coverage and/or lack of sufficient occupational detail, as discussed later in this chapter.

The occupational distributions of bituminous coal mining employees presented in Table 1 and in related tables in this report are based on special unpublished tabulations from a survey of the industry conducted in early 1978 by BLS, in cooperation with state employment agencies, as part of its Occupational Employment Statistics (OES) program. The survey encompassed a large sample of coal mining establishments in all major coal mining states. Although prior occupational employment surveys of the bituminous coal mining industry were conducted under the OES program in 1973 and 1975, these earlier surveys excluded a number of major coal mining states and, therefore, are not directly comparable with the 1978 data. Since the OES surveys do not directly classify deep and surface coal mining establishments, the breakdowns used in this report were developed under a procedure which used the presence or absence of certain key occupations to separately identify various types of coal mining activities.

In accordance with general usage within the industry, coal mining employees have been broadly classified in Table 3-1 into two major categories, as either "salaried" employees or production workers. The salaried employees include all the "white collar" occupations, such as managers, professional and technical,

Table 3-1

OCCUPATIONAL DISTRIBUTION OF EMPLOYEES IN THE
BITUMINOUS COAL AND LIGNITE MINING INDUSTRY: 1977-78

	Number of Employees			Percent Distribution		
	Total*	Deep**	Surface	Total	Deep	Surface
<u>TOTAL, U.S.</u>	<u>234,300</u>	<u>140,900</u>	<u>64,100</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
<u>SALARIED EMPLOYEES</u>	<u>49,500</u>	<u>25,600</u>	<u>12,700</u>	<u>21.1</u>	<u>18.2</u>	<u>19.9</u>
<u>Managers & Officials</u>	<u>10,600</u>	<u>4,300</u>	<u>3,400</u>	<u>4.5</u>	<u>3.0</u>	<u>5.3</u>
<u>Professional & Technical Workers</u>	<u>10,100</u>	<u>4,400</u>	<u>2,700</u>	<u>4.3</u>	<u>3.1</u>	<u>4.2</u>
Engineers	3,400	1,900	900	1.5	1.3	1.3
Mining Engineers	(1,500)	(700)	(500)	(0.6)	(0.5)	(0.8)
All Other Engineers	(1,900)	(1,200)	300	(0.8)	(0.9)	(0.5)
Engineering Technicians	2,000	900	600	0.8	0.7	0.9
Accountants & Auditors	1,300	400	400	0.6	0.2	0.6
Other Prof. & Tech.	3,400	1,200	800	1.5	0.9	1.3
<u>Clerical Workers</u>	<u>11,900</u>	<u>4,500</u>	<u>3,500</u>	<u>5.1</u>	<u>3.2</u>	<u>5.5</u>
Office Clerical	8,600	2,700	2,500	3.7	1.9	3.9
Production Clerical	3,300	1,800	1,000	1.4	1.3	1.6
<u>Supervisors, Non-Working</u>	<u>16,900</u>	<u>12,400</u>	<u>3,100</u>	<u>7.2</u>	<u>8.8</u>	<u>4.9</u>
 PRODUCTION WORKERS#	 184,800	 115,300	 51,400	 78.9	 81.8	 80.1
<u>Mechanics/Crafts Workers</u>						
(Grades 3-5)	44,700	26,600	13,800	19.1	18.9	21.5
Mechanics	19,200	13,300	4,200	8.2	9.4	6.6
Mine Machinery Mechanics	(11,200)	(8,300)	(1,900)	(4.8)	(5.9)	(3.0)
All Other Mechanics	(8,000)	(5,000)	(2,300)	(3.4)	(3.5)	(3.6)
Electricians	5,200	3,900	900	2.2	2.8	1.3
Fire Bosses	1,700	1,600	-	0.7	1.1	-
Maintenance Repairers	3,100	2,600	200	1.3	1.9	0.4
Oilers	5,200	1,200	3,400	2.2	0.8	5.2
Welders & Flamecutters	6,300	2,200	3,300	2.7	1.6	5.2
Blasters	3,400	1,400	1,600	1.5	1.0	2.5
Other Mechanics/Crafts	600	400	200	0.3	0.3	0.3

Table 3-1
(Cont.)

	Number of Employees			Percent Distribution		
	Total*	Deep**	Surface	Total	Deep	Surface
<u>Equipment Operators (Grades 3-5)</u>	<u>81,800</u>	<u>43,800</u>	<u>30,700</u>	<u>34.9</u>	<u>31.1</u>	<u>47.9</u>
Heavy Equipment Opers.	29,700	4,800	21,300	12.7	3.4	33.3
Continuous Mining Machine Opers.	6,700	6,500	- -	2.9	4.6	- -
Loading Machine Opers., Deep	3,000	3,000	- -	1.3	2.1	- -
Cutting Machine Opers.	1,800	1,700	- -	0.8	1.2	- -
Longwall Mining Machine Opers.	1,400	1,400	- -	0.6	1.0	- -
Roofbolters	10,100	9,700	- -	4.3	6.9	- -
Shuttle Car Opers.	10,300	9,900	- -	4.4	7.0	- -
Drillers/Machine Opers.	4,000	1,100	2,200	1.7	0.8	3.4
Truck Drivers	8,800	2,300	5,300	3.7	1.6	8.3
Coal Washers	1,800	1,300	300	0.8	0.9	0.5
Crane/Derrick/Hoist Opers.	1,600	500	800	0.7	0.4	1.2
All Other Opers.	2,600	1,600	800	1.0	1.2	1.2
<u>Laborers/Entry-Level Workers (Grades 1-2)</u>	<u>43,900</u>	<u>34,800</u>	<u>5,100</u>	<u>18.7</u>	<u>24.8</u>	<u>7.9</u>
Helper, Trades	4,000	2,300	1,000	1.7	1.7	1.6
Belt Repairers	3,000	2,800	- -	1.3	2.0	- -
Brattice Builders	2,800	2,700	- -	1.2	1.9	- -
Track Layers	1,200	1,100	100	0.5	0.8	0.1
Tipple Opers.	3,100	1,100	1,100	1.3	0.8	1.7
Conveyor Opers.	1,500	1,300	100	0.6	0.9	0.1
Dinkey Opers.	1,500	1,400	- -	0.7	1.0	- -
All Other Laborers/Entry-Level Workers	26,800	22,100	2,800	11.4	15.7	4.4
<u>Other Production Workers##</u>	<u>14,400</u>	<u>10,000</u>	<u>1,800</u>	<u>6.2</u>	<u>7.1</u>	<u>2.8</u>

Sources: Total employees in 1977 from U.S. Department of Labor, Mine Safety and Health Administration. Occupational distributions adapted from BLS Occupational Employment Survey, 1978. (See text.)

*Total column also includes employees in separate mechanical cleaning plants, shops and yards, and coal company offices.

**Includes surface employees at underground mines.

#Excludes production clerical workers.

##Includes equipment operators and crafts occupations not separately identified in OES reports. Also includes about 2000 workers in service occupations, such as cleaners and guards.

and clerical workers, as well as foremen or non-working supervisory personnel. The latter -- although classified as "blue collar" workers in the standard occupational groupings -- are considered as part of "management" and are excluded from the UMWA (or other union) bargaining units. The "production worker" group, in turn, includes all non-supervisory workers engaged in production development, maintenance, and allied direct support activities other than mine clerical workers, such as weighers or stock clerks, who are grouped here with other clerical workers, in the salaried category. This group corresponds closely to the employee categories covered by the UMWA contract in union mines and is often also referred to as "hourly paid" employees, even though a few (non-UMWA) companies in the industry now compensate their production workers on an annual salary basis.

Based on these data, a total of nearly 50,000, or 21 percent of the 234,000 workers employed in bituminous coal mining in 1977, were in salaried occupations. The largest single group in this category consisted of nearly 17,000 supervisors occupying such mine-level positions as section foreman, maintenance foreman, or preparation plant foreman. An additional 10,600, or 4.5 percent, were in higher-level managerial positions, including mine superintendents, department heads and other mine company officials or administrators. About 10,000 were employed in a wide range of professional and technical jobs, of whom the largest groups consisted of engineers and engineering technicians, such as surveyors and draftsmen. Although only about 3,400 were directly employed in engineering positions, the number of employees with engineering degrees in the industry is probably considerably greater since an engineering degree is considered a desirable qualification for advancement into line management positions.

in the industry. Among the non-technical professional occupations on the industry's payrolls, accountants were the largest single category, with a reported employment of about 1300. Clerical workers accounted for an additional 12,000, or 5.1 percent, of total employment. Of these, about 8600 were in office positions, such as secretaries, typists, accounting clerks, and office machine operators, and 3300 were employed in mine-level jobs, such as production clerks or stock clerks.

The large number of separate production worker occupations in the industry have been grouped in Table 3-1 under three main categories designed to reflect the general types of work performed, as well as the skill or experience levels required for these tasks. In the absence of any comprehensive data on the specific training needs for each of these occupations, we have used as a guide the job classifications established under the National UMWA Agreement. These classifications group all union mining jobs into five pay-grade categories, ranging from Grade 1, which includes laborers and other unskilled jobs, to Grade 5, which includes those jobs requiring the highest level of skill and responsibility. Occupations classified at grades 3-5 have been defined here as representing the more skilled or journeyman jobs; those at grades 1 or 2 have been defined as "Laborers and other Entry-Level Jobs." Job progression is normally accomplished in union mines through job-bidding procedures and assignment as a helper or trainee (up to specified maximum periods) to a more skilled job classification. Since the OES tabulations did not separately identify those in a training or quasi-apprenticeship status in each occupation, such trainees are included with those workers fully qualified in each occupational category, i.e., grades 3-5, even though their actual pay grades may be temporarily at the Grade 2 level.

The occupations at grades 3-5 have been further classified as either Mechanics and Crafts occupations or as Equipment Operators. The former group includes maintenance occupations such as mechanics and repairmen, mine electricians, welders and oilers, and other skilled positions, i.e., blasters and fire bosses. Fire bosses are unique to underground mining and are responsible for the inspection of underground mines for hazards, such as gas, firedamp, or inadequate ventilation. Under state and federal mine safety laws employees in certain of the occupations in the mechanics and crafts including mine electricians, blasters, and fire bosses, as well as mine foremen, are required to be "certified" by meeting minimum experience requirements and passing a written test before they are permitted to undertake the full range of their occupational duties without close supervision. In 1977, nearly 47,000 workers, or about one-fifth the industry's work force, was employed in the mechanics and crafts occupation group, with mechanics representing the largest single occupational classification within this group in both deep and surface mining.

The Equipment Operator group, grades 3-5, includes most of the other skilled or semi-skilled occupations directly associated with the extraction, transportation, and processing of coal at the mine or in separate coal preparation plants or other auxiliary facilities. The specific occupations required for these mining processes vary by mining method (deep or surface) and with the types of equipment or technology employed. The three major underground mining technologies currently employed are: (1) conventional mining, employing a separate mobile cutting and drilling machine, a coal loading machine, and shuttle

cars or conveyer systems to move the coal from face to surface; (2) continuous mining, which uses a single machine to combine the coal cutting and loading operations; and (3) the newer longwall mining method, which is designed to remove coal continuously in long panels along a face rather than in the usual room/pillar arrangement. Illustrative mine section manning tables for each of these mining methods are shown in Table 3-2. Of these three methods, continuous mining has been the most frequently employed in recent years, accounting for 64 percent of total underground output of bituminous in 1976, as compared to 31 percent by conventional mining and about 4 percent by longwall -- the latter still used concurrently with either continuous or conventional sections in the same mines (2). Among the major deep coal mining equipment operator occupations, the two most frequent are roof bolters and shuttle car operators, each employing more than 10,000 miners, since these are required in all categories of underground mines. Nearly 7000 additional miners are operators or helpers on continuous mining machines, as compared with considerably smaller numbers in operator occupations associated with either conventional or longwall mining systems. A number of other operative occupations at deep mines are associated with surface operations at these mines, including truck drivers, coal preparation plant operatives, and operators of other mobile or stationary equipment at the mines.

Surface or strip mining operations entail a sequence of major steps, including ground preparation, overburden removal, coal removal (including drilling and blasting where needed), coal haulage, and land reclamation. In modern, highly-mechanized surface mines, these steps -- other than blasting -- are performed by heavy, mobile equipment, such as bulldozers, stripping shovels or draglines, and coal hauling trucks. Although standard construction equipment was originally

Table 3-2

TYPICAL UNDERGROUND COAL MINE SECTION MANNING TABLES, BY MINING METHOD

Conventional Section		Continuous Miner Section		Longwall Crew	
Job Title	No.	Job Title	No.	Job Title	No.
Loader Oper./Helper	1-2	Continuous Miner Oper./Helper	2	Longwall Mach. Oper./Helper	3
Shuttle Car Operator	2	Shuttle Car Operator	2	Jack Setters	3-5
Roof Bolter Oper./Helper	2-6	Roof Bolter Oper./Helper	2-6	Headgate/Tailgate Men	2-4
Cutter Oper./Helper	1-2	Utility Man	1-2	Mechanic	1
Drill Operator	1	Scoop Operator	0-1	Foreman	1
Shot Fireman (Blaster)	1-2	Mechanic	0-1		
Utility Man	1-2	Foreman	1		
Scoop Operator	0-1				
Mechanic	0-1				
Foreman	1				
Normal Manning	16-18	Normal Manning	8	Normal Manning	11

Source: NUS Corporation, Coal Mining Cost Models, Volume 1, Underground Mines, pp. II-20-22. Prepared for Electric Power Research Institute, Palo Alto, CA, February 1977.

used for most of these processes, these have been mainly replaced by specialized -- and usually much heavier -- equipment specifically adapted to coal mining operations. The occupational designation, "heavy equipment operator," is the occupational category in which most of these operator jobs are grouped. Hence, in contrast to the much more specialized and diversified list of operator skills for underground mining, about 21,000, or 40 percent of all production workers in surface mines are included in this single category. Other additional sizable equipment operator skills at surface mines include truck drivers and drill machine operators, who account for an additional 7500, or 15 percent, of production worker staffing in these mines.

The category of Laborers and Other Entry-Level Workers, Grades 1 or 2, includes mainly unskilled labor categories or other positions normally requiring little or no specialized training or work experience, other than basic health and safety orientation to the mine environment. Certain of these jobs such as belt repairers, brattice builders, and dinkey operators are unique to underground coal mining, while others -- such as tippie operators -- are common to all mining operations. About 44,000, or 24 percent, of coal mine production workers were classified in this group in 1977.

The final group, Other Production Workers, includes about 12,000 mine operatives or crafts workers not specifically identified by occupation in the OES survey, and which, therefore, cannot be classified by skill level, as well as about 2000 service workers, such as janitors and guards. About 6.2 percent of all employees were included in this residual category.

The separate occupational distributions for deep and surface mines (Table 3-1),

indicate some major differences in occupational structures associated with these

two mining methods. As noted above, the most important production worker occu-

pation in surface mines are the operators of heavy mobile equipment and of coal

hauling trucks. These two occupations alone account for about one-half of

total production worker employment in surface mines. In contrast, deep mines

require a much more diversified array of production worker skills and a much

larger proportion of relatively unskilled workers in support or auxiliary roles,

many of which -- such as brattice builders and belt repairers -- are unique to

the underground mining environment. As a result, about 25 percent of all mine

employees were classified in the laborer or entry-level category in deep mines

as contrasted to only 8 percent in surface mines.

The occupational distributions have been further disaggregated in Table 3-3

for the three major coal producing regions, by type of mining. These have been

shown only for the major occupational groups because of sample size limitations.

Among the significant inter-regional differences indicated by these compari-

sons are: (1) a higher proportion of mechanics and craft workers among mines

in the Central and Western regions, associated with their larger scale and

greater reliance on heavier equipment (particularly in surface mining); (2) a

correspondingly smaller proportion of equipment operators particularly in Western

surface mines; and (3) a larger proportion of workers in the lower grade, entry-

level jobs among the latter mines, possibly due to their greater rate of hiring

of new, inexperienced workers.

Table 3-3

PERCENT DISTRIBUTION OF BITUMINOUS COAL MINING EMPLOYEES
BY MAJOR OCCUPATION GROUP, BY REGION* AND TYPE OF MINING: 1977

Occupation Group	EAST		CENTRAL		WEST	
	Deep	Surface	Deep	Surface	Deep	Surface
<u>SALARIED EMPLOYEES</u>	<u>20.2</u>	<u>22.5</u>	<u>21.0</u>	<u>22.9</u>	<u>22.4</u>	<u>23.2</u>
Managers & Officials	3.6	6.8	3.5	5.1	3.5	5.8
Professional & Technical Workers	4.1	4.2	4.0	5.1	6.9	5.8
Clerical Workers	4.1	7.3	4.1	7.4	5.9	4.4
Supervisors, Non-Working	8.4	4.2	9.0	5.7	8.6	5.8
<u>PRODUCTION WORKERS</u>	<u>79.8</u>	<u>77.5</u>	<u>79.0</u>	<u>77.1</u>	<u>77.6</u>	<u>76.8</u>
Mechanics/Crafts Workers (Grades 3-5)	17.8	18.7	21.5	23.4	19.1	29.0
Equipment Operators (Grades 3-5)	30.7	49.7	27.0	41.7	22.4	26.1
Laborers/Entry Level Workers (Grades 1-2)	25.7	2.4	26.0	4.0	31.0	5.8
Other Production Workers	5.6	6.7	4.5	8.0	5.1	15.9
<u>TOTAL</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Source: BLS Occupational Employment Survey. (See Table 4.)

*Regions defined as follows: EAST -- PA, OH, MD, WV, VA, KY, TN, AL.
CENTRAL -- IL, IN, IA, MO, KN, AR, OK, TX.
WEST -- ND, SD, MT, WY, CO, UT, AZ, NM, WA, AK.

NOTE: In these and subsequent occupational tables employees in central administration offices and in independent coal preparation plants, shops and yards have been allocated to deep and surface mining on a pro rata basis. (See text.)

OCCUPATIONAL TRENDS

The available historical data on the occupational distribution of coal mining employees -- although not directly comparable with the recent OES survey data for 1978 -- do provide a reasonably consistent pattern of major recent changes in the broad occupational structure of the coal mining work force. Table 3-4 presents summary occupational data from two available sources: the decennial Census of Population and from annual reports submitted by companies with 100 or more employees to the Equal Employment Opportunity Commission. In addition, the BLS publishes monthly and annual statistics on total employment and production workers and of other employees, i.e., "salaried workers," in the industry (Table 3-5). Additional insights on recent occupational trends have been obtained from detailed distributions of workers in selected major production worker occupations, based on sample wage surveys of the industry conducted by the BLS in 1967 and 1976, and from unpublished survey data compiled by the BCOA,* based on surveys of its member companies for the years 1974-76. The following trends are indicated by these and related data sources.

1. Salaried Work Force -- There has been a steady growth in the proportion of salaried or non-production workers. Based on the Census data, the overall proportion of workers in "salaried" occupations rose from 12.6 percent in 1960 to 16.1 percent in 1970. The EEOC reports, which exclude many smaller coal mining firms, indicate a continued growth from 17.0 percent in 1970 to 21.6 percent in 1978. Although each of the major categories of salaried or white collar occupations has shared in this growth, the rate of increase has been most rapid

Table 3-4

OCCUPATIONAL DISTRIBUTIONS OF COAL MINING EMPLOYEES: 1960, 1970, 1978
 BASED ON DECENNIAL CENSUS AND EEOC DATA

Occupational Groups	Percent Distribution			
	Decennial Census*	EEOC		
	1960	1970	1970	1978
<u>Salaried Occupations</u>	<u>12.6</u>	<u>16.1</u>	<u>17.0</u>	<u>21.6</u>
Professional & Technical	1.7	2.2	2.9	4.3
Engineers	(0.8)	(1.0)		
All Other	(0.9)	(1.2)		
Managers and Officials	1.6	2.0	10.1*	12.3*
Foremen	5.8	7.5		
Clerical, Incl. Sales	3.5	4.4	4.0	5.0
<u>Production Worker Occupations</u>	<u>87.3</u>	<u>83.8</u>	<u>83.0</u>	<u>78.5</u>
Mechanics/Craft Workers	14.7	23.4	28.6	26.8
Mechanics & Repairmen	(5.0)	(7.4)		
All Other	(9.7)	(16.0)		
Operatives & Laborers (Including Service Workers)	72.6	60.4	54.4	51.7
TOTAL	100.0	100.0	100.0	100.0

Sources: Decennial census data from decennial Censuses of Population, selected volumes. Include anthracite as well as bituminous coal and lignite mining. EEOC data from unpublished tabulations provided by Equal Employment Opportunity Commission, based on reports from bituminous coal and lignite mining companies with 100 or more employees.

*This category is believed to include salaried (non-working) supervisors as well as higher-level managerial personnel.

Table 3-5

Percent Distribution		Production Workers	All Other Employees
1973	100.0	95.5	4.5
1970	100.0	88.5	11.5
1975	100.0	86.5	13.5
1977	100.0	85.6	14.4
1979	100.0	85.2	14.8
1980	100.0	83.6	16.4

Source: U.S. Bureau of Labor Statistics. Employment and Earnings, various issues.

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*This category is believed to include as well as higher-level managers (non-working) supervisors coal and lignite mining operations and other employees. Equal Employment Opportunity Commission reports from bituminous lignite mining. The data is based on information provided by selected volumes. The data is based on information provided by sources: Decennial Census, Bureau of Economic Analysis of Population.

in the professional and technical occupations. This trend is further confirmed by the BLS employment series, which indicates a steady increase in the proportion of non-production workers over the past three decades.

2. Skilled Production Worker Occupations -- Despite the overall decline in the proportion of production workers, those in the craft and mechanics occupations, as defined by the Census, increased their share of total jobs from 14.7 percent in 1960 to 23.4 percent in 1970 according to the decennial Census data. The EEOC data comparisons for 1970 and 1978 suggest that the proportion of all employees in this group declined slightly between 1970 and 1978, while maintaining its share of total production worker jobs. However, more detailed comparisons based on the BLS wage surveys indicate a continued growth in the proportion of production workers in key mechanics and skilled craft occupations, from 13.8 percent of total production workers in 1967 to 15.6 percent in 1976. Thus, despite considerable definitional differences, two of these three sources do suggest a continued rising trend in the proportion of these skilled workers in the coal mine labor force.

3. Operatives and Laborers -- The proportion of mining jobs in the overall operatives and laborers groups (including both skilled and unskilled jobs) declined sharply between 1960 and 1970, based on the Census data, and continued to decline -- although at a slower rate -- between 1970 and 1978, based on the EEOC report. The more detailed BLS wage survey data indicate that this decline was concentrated among laborers and other entry-level occupations, whereas the proportions employed in the more skilled operator jobs actually increased.

The pattern which emerges from these comparisons is that of a continuing transformation of the coal mining job structure in recent decades, from one consisting predominantly of a blue collar work force, with limited skill requirements, to one in which a growing proportion of personnel were either in white collar and supervisory jobs, or in skilled production worker occupations requiring significant periods of specialized training. These trends in turn appear to be the net result of the following major influences:

- Increased mechanization, including progressive substitution of large-scale, complex equipment for many hand labor skills. Technological progress served to substantially reduce requirements for the unskilled laborer categories, but tended to increase requirements for professional and managerial staff, for skilled mechanics, and for certain categories of skilled equipment operators.
- Requirements imposed by new governmental regulations, which increased needs for professional, technical, and clerical staffs, as well as for certain categories of equipment operators, such as bulldozer operators for reclamation work at surface mines.
- The increased concentration and scale of operations of coal mining companies, which also tended to increase the requirement for managerial and professional staffs, to exercise company planning and control functions.

The above trends appear to have affected the job structures of both deep and surface mining establishments. However, the overall trend toward a more technical work force was accelerated during this period by the increased role of surface mining which -- as we have seen -- includes a larger proportion of skilled mechanics and equipment operators, and a smaller proportion of laborers, than do underground mining establishments.

OCCUPATIONAL PROJECTIONS

A set of projections of the occupational distribution of employment in the bituminous coal mining industry to 1995, including separate estimates by type of mining and by region, are presented in Tables 3-6 through 3-11. These projections have been developed for major occupational groups only, since the available historical trend data did not provide a valid basis for disaggregation of these estimates for more specific occupations. These projections assume that the influences which have contributed to the general upgrading in skill requirements of the coal mining work force in recent decades will generally continue to be operative in the period to 1965 within each region/type of mining sub-sector of the industry. They assume, however, that the rates of change in occupational distributions will be somewhat smaller than those observed for the period of the 1960's and 1970's when occupational requirements were impacted by a unique combination of rapid mechanization, industry consolidation, and new government regulations.

The methodology followed generally parallels -- at the industry sub-sector level -- the "occupation-industry matrix" method used by the BLS in its national occupational employment projections. Under this procedure, separate occupational distributions of employment are developed for each industry and then projected based on extrapolations of past trends in these distributions as modified by collateral information, such as anticipated technological developments in the industry. The projected distributions are then applied to estimates of aggregate employment in the industry, derived from a macro-economic model and a series of related estimates of productivity and hours of work.

The major steps used in our projection procedure are described below:

1. The base data used for these projections were the OES occupational distributions for each region, by type of mining. Although the OES data refer to employment in May 1978, we have assumed that the occupational distributions shown were approximately the same as for the year 1977, which served as the base year for the projections of production and aggregate employment presented in Chapter 1. The separate occupational distributions for deep and surface mining used in these projections differ from those in Table 3-1, since they include a pro rata allocation of employment by occupation in supporting activities, such as independent coal preparation plants and separate administrative offices of coal companies, to deep and surface mining, respectively, whereas Table 1 shows the occupational distribution of deep and surface mining establishments as directly reported.

2. A continued decline in the proportion of production workers is projected for each industry sector, based on the average annual rate of -0.4 percent indicated by BLS data for the period 1970-79. This results in a reduction in the overall percentage of production workers, from 78.9 percent in 1977, based on the OES survey, to 73.4 percent in 1995. The percentage of salaried employees, derived as a residual, increases from 21.1 percent in 1977 to 26.6 percent in 1995, or at an annual rate of 1.3 percent.

3. Within the salaried workers group, the proportion of professional and technical workers is projected to increase at a greater-than-average rate of 1.9 percent annually, offset by a slower-than-average increase (at 1.0 percent annually) for the clerical worker group. The proportions of workers in the managerial and supervisory groups are projected to increase at about the same rate as that estimated for all salaried employees.

4. Within the production worker group, the major trend indicated by the available data was an increase in requirements for skilled maintenance personnel and a decreasing requirement for laborers and other entry-level occupations, associated with increased mechanization. These trends were most pronounced for deep mining, which will account for a large and growing proportion of the industry's total work force, under our projections. The projection for deep mining assumes that the proportion of mechanics and craft workers, grades 3-5, will increase, as a percentage of total production worker employment, at a rate of 2.0 percent annually, offset by a decline for laborers and other entry-level workers, at an annual rate of -1.6 percent.

5. A final step in the procedure was a series of relatively small statistical adjustments to reconcile the projections of separate occupational groups, by sector, with the corresponding control totals for production workers and salaried employees, which were separately projected.

The resulting occupational projections for the industry, as a whole, reflect the combined effect of the separate projections of occupational distributions within each sector and of the changing distribution of total industry employment between deep and surface mining and by region, as described in Chapter 1. Under these projections, nearly all of the projected employment increase of about 220,000 between 1977 and 1995 will be in the deep mining sector, including affiliated supporting establishments, thus increasing the share of deep mining in the industry total from 68 percent in 1977 to 81 percent in 1995. Based on the OES data, deep mining establishments include a smaller percentage of personnel in the "white collar" occupations and in the skilled production worker groups, but a much

larger proportion of workers in the laborer category than do surface mines.

Thus, the projected sharp increase in deep mining employment will generally have the effect of tempering the rate of "upgrading" of the industry's overall occupational structure over this period.

Nevertheless, the most rapid employment growth is projected generally for those occupations requiring the greatest amount of specialized training and/or work experience. Included in this category are managerial and professional employees, supervisors, and those in the skilled mechanics and crafts occupations. Conversely, the lowest rates of growth over this period are projected for laborers, service workers, and other entry-level occupations.

The implications of these and related trends for the industry's prospective training requirements will be assessed in Chapter 6, after we review the development and current status of training in the industry in the next two chapters.

Table 3-6

PROJECTIONS OF EMPLOYMENT IN BITUMINOUS COAL AND
LIGNITE MINING BY MAJOR OCCUPATION GROUP: 1977-1995

U.S. SUMMARY

	Number of Employees (000)				Percent Distribution			
	Actual	Projected			Actual	Projected		
	1977	1985	1990	1995	1977	1985	1990	1995
<u>TOTAL, U.S.</u>	<u>234.3</u>	<u>281.5</u>	<u>353.5</u>	<u>455.7</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
<u>SALARIED EMPLOYEES</u>	<u>49.5</u>	<u>66.5</u>	<u>88.8</u>	<u>121.2</u>	<u>21.1</u>	<u>23.6</u>	<u>25.1</u>	<u>26.6</u>
Managers & Officials	10.5	14.0	18.1	24.0	4.5	5.0	5.1	5.3
Professional & Technical Workers	10.1	13.9	18.9	26.5	4.3	4.9	5.4	5.8
Clerical Workers	11.8	15.5	19.2	25.5	5.0	5.5	5.4	5.6
Supervisors, Non- Working	17.1	23.1	32.6	45.2	7.3	8.2	9.2	9.9
<u>PRODUCTION WORKERS</u>	<u>184.8</u>	<u>215.0</u>	<u>264.7</u>	<u>334.5</u>	<u>78.9</u>	<u>76.4</u>	<u>74.9</u>	<u>73.4</u>
Mechanics/Crafts Workers (Grades 3-5)	44.7	59.2	78.8	108.0	19.1	21.0	22.3	23.7
Equipment Operators (Grades 3-5)	81.8	94.5	111.3	137.0	34.9	33.6	31.5	30.1
Laborers/Entry Level Workers (Grades 1-2)	43.9	45.9	57.5	70.2	18.7	16.3	16.3	15.4
Other Production Workers	14.4	15.4	17.1	19.3	6.2	5.5	4.8	4.2

Source: U.S. Department of Energy from the Conference Board Survey.

Table 3-7

PROJECTIONS OF EMPLOYMENT IN BITUMINOUS COAL AND
LIGNITE MINING BY MAJOR OCCUPATION GROUP: 1977-1995

DEEP MINING

	Number of Employees (000)				Percent Distribution			
	Actual	Projected			Actual	Projected		
	1977	1985	1990	1995	1977	1985	1990	1995
<u>TOTAL, DEEP</u>	<u>160.2</u>	<u>193.5</u>	<u>273.5</u>	<u>369.7</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
<u>SALARIED EMPLOYEES</u>	<u>32.7</u>	<u>44.4</u>	<u>67.5</u>	<u>97.1</u>	<u>20.4</u>	<u>23.0</u>	<u>24.7</u>	<u>26.3</u>
Managers & Officials	5.8	7.8	11.9	17.2	3.6	4.0	4.3	4.6
Professional & Technical Workers	6.7	9.3	14.4	21.3	4.2	4.8	5.3	5.8
Clerical Workers	6.6	8.8	13.0	18.5	4.1	4.6	4.8	5.0
Supervisors, Non- Working	13.6	18.5	28.2	40.1	8.5	9.6	10.3	10.9
<u>PRODUCTION WORKERS</u>	<u>127.5</u>	<u>149.1</u>	<u>206.0</u>	<u>272.6</u>	<u>79.6</u>	<u>77.0</u>	<u>75.3</u>	<u>73.7</u>
Mechanics/Crafts Workers (Grades 3-5)	29.3	40.4	61.5	89.1	18.3	20.9	22.5	24.1
Equipment Operators (Grades 3-5)	48.0	56.5	77.9	102.3	30.0	29.2	28.5	27.7
Laborers/Entry Level Workers (Grades 1-2)	41.6	43.4	55.4	68.1	26.0	22.4	20.3	18.4
Other Production Workers	8.6	8.8	11.2	13.1	5.4	4.5	4.0	3.5

Source: U.S. Department of Energy from the Conference Board Survey.

Table 3-8

PROJECTIONS OF EMPLOYMENT IN BITUMINOUS COAL AND
LIGNITE MINING BY MAJOR OCCUPATION GROUP: 1977-1995

SURFACE MINING

	Number of Employees (000)				Percent Distribution			
	Actual	Projected			Actual	Projected		
	1977	1985	1990	1995	1977	1985	1990	1995
<u>TOTAL, SURFACE</u>	<u>74.1</u>	<u>88.0</u>	<u>80.0</u>	<u>86.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
<u>SALARIED EMPLOYEES</u>	<u>16.8</u>	<u>22.1</u>	<u>21.3</u>	<u>24.1</u>	<u>22.7</u>	<u>25.1</u>	<u>26.6</u>	<u>28.0</u>
Managers & Officials	4.7	6.2	6.2	6.8	6.4	7.1	7.8	7.9
Professional & Technical Workers	3.4	4.6	4.5	5.2	4.6	5.2	5.6	6.1
Clerical Workers	5.2	6.7	6.2	7.0	7.0	7.6	7.7	8.1
Supervisors, Non- Working	3.5	4.6	4.4	5.1	4.7	5.2	5.5	5.9
<u>PRODUCTION WORKERS</u>	<u>57.3</u>	<u>65.9</u>	<u>58.7</u>	<u>61.9</u>	<u>77.3</u>	<u>74.9</u>	<u>73.4</u>	<u>72.0</u>
Mechanics/Crafts Workers (Grades 3-5)	15.4	18.8	17.3	18.9	20.8	21.4	21.6	22.0
Equipment Operators (Grades 3-5)	33.8	38.0	33.4	34.7	45.6	43.2	41.8	40.4
Laborers/Entry Level Workers (Grades 1-2)	2.3	2.5	2.1	2.1	3.1	2.8	2.6	2.4
Other Production Workers	5.8	6.6	5.9	6.2	7.8	7.5	7.4	7.2

Source: U.S. Department of Energy from the Conference Board Survey.

Table 3-9

PROJECTIONS OF EMPLOYMENT IN BITUMINOUS COAL AND
LIGNITE MINING BY MAJOR OCCUPATION GROUP: 1977-1995

EAST

	Number of Employees (000)				Percent Distribution			
	Actual	Projected			Actual	Projected		
	1977	1985	1990	1995	1977	1985	1990	1995
<u>TOTAL, EAST</u>	<u>184.1</u>	<u>188.1</u>	<u>217.0</u>	<u>258.8</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
<u>SALARIED EMPLOYEES</u>	<u>38.4</u>	<u>44.6</u>	<u>54.4</u>	<u>68.6</u>	<u>20.9</u>	<u>23.7</u>	<u>25.1</u>	<u>26.5</u>
Managers & Officials	8.3	9.8	11.3	13.9	4.5	5.2	5.3	5.3
Professional & Technical Workers	7.6	9.0	11.1	14.4	4.1	4.8	5.1	5.6
Clerical Workers	9.1	10.7	12.2	14.7	5.0	5.7	5.6	5.7
Supervisors, Non- Working	13.4	15.1	19.8	25.6	7.3	8.0	9.1	9.9
<u>PRODUCTION WORKERS</u>	<u>145.7</u>	<u>143.5</u>	<u>162.6</u>	<u>190.2</u>	<u>79.1</u>	<u>76.3</u>	<u>74.9</u>	<u>73.5</u>
Mechanics/Crafts Workers (Grades 3-5)	33.2	36.5	44.5	55.6	18.0	19.4	20.5	21.5
Equipment Operators (Grades 3-5)	66.0	67.9	73.4	84.2	35.9	36.1	33.8	32.5
Laborers/Entry Level Workers (Grades 1-2)	35.8	29.2	34.8	39.9	19.4	15.5	16.0	15.4
Other Production Workers	10.7	10.0	9.9	10.5	5.8	5.3	4.6	4.4

Source: U.S. Department of Energy from the Conference Board Survey.

Table 3-10

PROJECTIONS OF EMPLOYMENT IN BITUMINOUS COAL AND
LIGNITE MINING BY MAJOR OCCUPATION GROUP: 1977-1995

CENTRAL

	Number of Employees (000)				Percent Distribution			
	Actual	Projected			Actual	Projected		
	1977	1985	1990	1995	1977	1985	1990	1995
<u>TOTAL, CENTRAL</u>	<u>37.5</u>	<u>68.1</u>	<u>94.3</u>	<u>128.3</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
<u>SALARIED EMPLOYEES</u>	<u>8.2</u>	<u>15.9</u>	<u>23.6</u>	<u>34.0</u>	<u>21.9</u>	<u>23.4</u>	<u>25.0</u>	<u>26.5</u>
Managers & Officials	1.6	2.9	4.3	5.9	4.3	4.3	4.5	4.6
Professional & Technical Workers	1.7	3.3	4.8	7.2	4.5	4.9	5.1	5.6
Clerical Workers	2.1	3.7	5.1	7.0	5.6	5.4	5.4	5.5
Supervisors, Non- Working	2.8	6.0	9.4	13.9	7.5	8.8	10.0	10.8
<u>PRODUCTION WORKERS</u>	<u>29.3</u>	<u>52.2</u>	<u>70.7</u>	<u>94.3</u>	<u>78.1</u>	<u>76.6</u>	<u>75.0</u>	<u>73.5</u>
Mechanics/Crafts Workers (Grades 3-5)	8.4	16.3	23.2	33.8	22.4	23.9	24.6	26.3
Equipment Operators (Grades 3-5)	12.7	20.5	27.0	35.3	33.9	30.1	28.7	27.5
Laborers/Entry Level Workers (Grades 1-2)	5.9	12.3	16.9	21.3	15.7	18.1	17.9	16.6
Other Production Workers	2.3	3.1	3.6	3.9	6.1	4.5	3.8	3.1

Source: U.S. Department of Energy from the Conference Board Survey.

Table 3-11

PROJECTIONS OF EMPLOYMENT IN BITUMINOUS COAL AND
LIGNITE MINING BY MAJOR OCCUPATION GROUP: 1977-1995

WEST

	Number of Employees (000)				Percent Distribution			
	Actual	Projected			Actual	Projected		
	1977	1985	1990	1995	1977	1985	1990	1995
<u>TOTAL, WEST</u>	<u>12.7</u>	<u>25.3</u>	<u>42.2</u>	<u>68.6</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
<u>SALARIED EMPLOYEES</u>	<u>2.9</u>	<u>6.0</u>	<u>10.8</u>	<u>18.6</u>	<u>22.8</u>	<u>23.7</u>	<u>25.6</u>	<u>27.1</u>
Managers & Officials	0.6	1.3	2.5	4.2	4.7	5.1	5.9	6.1
Professional & Technical Workers	0.8	1.6	3.0	4.9	6.3	6.3	7.1	7.2
Clerical Workers	0.6	1.1	1.9	3.8	4.7	4.4	4.5	5.5
Supervisors, Non- Working	0.9	2.0	3.4	5.7	7.1	7.9	8.1	8.3
<u>PRODUCTION WORKERS</u>	<u>9.8</u>	<u>19.3</u>	<u>31.4</u>	<u>50.0</u>	<u>77.2</u>	<u>76.3</u>	<u>74.4</u>	<u>72.9</u>
Mechanics/Crafts Workers (Grades 3-5)	3.1	6.4	11.1	18.6	24.4	25.3	26.3	27.1
Equipment Operators (Grades 3-5)	3.1	6.1	10.9	17.5	24.4	24.1	25.8	25.6
Laborers/Entry Level Workers (Grades 1-2)	2.2	4.4	5.8	9.0	17.3	17.4	13.7	13.1
Other Production Workers	1.4	2.4	3.6	4.9	11.1	9.5	8.6	7.1

Source: U.S. Department of Energy from the Conference Board Survey.

REFERENCES

1. U.S. Bureau of the Census. 1970 Census of Population, Occupation by Industry, Table 8.
2. National Coal Association. Coal Facts 1978-79, p. 82.

Chapter 4

THE EVOLUTION OF COAL MINING TRAINING PROGRAMS

INTRODUCTION

Although some basic training in first aid, accident prevention, and mine rescue work had been provided to coal miners for many decades, programs of formal training in mining skills are of comparatively recent origin in the industry. Traditionally coal mining had drawn most of its recruits from highly in-bred and localized labor forces. Newly hired inexperienced workers in underground mines were typically assigned to unskilled labor-type jobs, such as trackmen, timbermen, bratticemen, or inside laborers. They acquired the basic skills needed for operating mining equipment by being paired with more experienced miners, often fathers or other close relatives. Workers in the most skilled of the mining occupations, such as mine electricians, were more likely to have had some prior vocational preparation for these tasks. Nevertheless, the "buddy system" of informal on-the-job training was the prevailing method of acquiring mining skills and -- even as recently as the late 1960's -- formal skills training programs in the industry were conspicuous by their absence (1).

A number of developments operating concurrently on the industry have stimulated the development of more formal training programs in the coal mining industry during the past decade. The major impetus was provided by the Coal Mine Health and Safety Act of 1969. At the same time, the rapid expansion in mining jobs combined with increased retirements of older miners compelled coal mining companies to recruit large numbers of new, inexperienced entrants into the industry and, in turn, resulted in establishment of systematic training programs for

miners, supervisors, and other staff by some of the larger companies. Further impetus to establishment of formal training programs was provided by various forms of Federal training and educational assistance, as well as by the entry into the industry of large oil corporations and other companies whose top-management brought with them a strong commitment to company-supported skill development programs for both production workers and salaried employees.

This chapter reviews these major influences and describes the categories of training programs which have emerged in the industry during the past decade.

HEALTH AND SAFETY TRAINING

The underground mining environment, in which most coal miners are employed, is inherently unhealthy, hazardous, and difficult, as suggested by the following description:

"Every day in the mines, miners face an uncertain, threatening, potentially fatal situation, and they work under varying stresses. Compared to many types of work, miners must work with heavy, complicated equipment beneath tons of earth in a constricted, poorly illuminated, noisy environment. Whatever techniques are used, they are vulnerable to roof falls. Many mines have gas problems, some are susceptible to flooding, others have underground upheavals, and all have dust (2)."

Despite earlier, limited efforts under Federal and State laws to provide basic protections for miners from these hazards, the incidence rates of both fatal accidents and of non-fatal disabling injuries in coal mining, as well as associated health hazards such as "black lung" disease, had remained among the highest in any industry. The Federal Coal Mine Health and Safety Act, enacted in 1969 following a major 78-victim mine disaster the preceding year, provided -- for the first time -- a statutory framework for establishment of more comprehensive safety and health standards and for enforcement of these standards through a separate

regulatory bureau -- originally the Mining Enforcement and Safety Administration (MESA) in the Department of Interior, currently the Mining Safety and Health Administration (MSHA) of the Department of Labor.

One major departure in the 1969 Act was the establishment of the principle that coal mine operators were responsible for training of their employees in the health and safety-related aspects of their jobs. Although the Act provided authority for mandating training of all "certified" and "qualified" persons in coal mining, its initial application was to certain key specialists, such as mine or section foremen, fire bosses, mine electricians, or hoisting engineers -- occupations in which certification papers had long been required under a number of state mine safety laws. In addition, a number of health and safety training courses and related training materials were developed by MESA to assist companies in provision of the required training.

Additional impetus for establishment of industry-wide minimum health and safety training requirements for all coal miners was provided by the national collective bargaining agreement negotiated by the UMWA with the Bituminous Coal Operators Association in 1974. The agreement stated that "establishment of effective training programs for employees is essential to safe and efficient production of coal" and established the following specific training requirements: (1) initial orientation programs in specified safety subjects of not less than four days for all new, inexperienced employees at underground or surface mines, and of at least one day for new, experienced miners; (2) annual retraining programs of at least eight hours for all mine workers; and (3) safety training for all employees assigned to new jobs to include "a thorough job briefing relative to the hazards

of the job, including a trial run on the machine or equipment under the direction of an experienced person." The agreement also established a requirement for training programs for employees in maintenance jobs to include training in mechanical, welding, and electrical skills through such methods as "progressive job tasks, on-the-job training and classroom training," and established a Trainee Wage Grade for miners initially assigned to such training (3).

Finally, an additional safeguard provided in the contract was a requirement that no newly hired, inexperienced underground miners with less than 45 days experience be permitted to operate any mining machines at the face or to work on or operate any transportation equipment, mobile equipment, or medium or high voltage electricity, and that such employees work "in sight and sound" of another (experienced) miner during the first 45 days of his employment.

Since about three-fourths of all coal mine production workers and nearly 90 percent of those in deep mines, were in mines organized by the UMWA, this agreement, in turn, paved the way for enactment of mandatory training requirements for all coal miners in the 1977 Amendments to the Federal Mine Safety and Health Act. These Amendments and subsequent regulations promulgated in October 1978 provided for the following categories of training (4):

1. Orientation training of new inexperienced miners: 40 hours for miners in underground mines; 32 hours for miners working in surface mines or at surface areas of underground mines.
2. Orientation training of new experienced miners: 8 hours.
3. Annual refresher training for all miners: 8 hours.
4. Task training: For miners assigned to new work tasks as equipment operators or in blasting operations, including supervised practice during non-production periods and supervised operation during production.

5. Hazard training: For persons working at or visiting mines, other than regularly employed miners or contract personnel, on basic mine safety procedure.

All mine operators were required to submit detailed training plans to MSHA Training Centers for approval within specified periods after issuance of the regulations. MSHA was responsible for review and approval of these plans, as well as for certification of instructors. Authority was also given for establishment of "cooperative training programs" under which the required training could be provided by some agency other than the mine operator, including programs provided by MSHA, by other State or Federal agencies, by mine operator associations, educational institutions, or other approved agencies. The latter options were considered particularly important to meet the needs of smaller mine operators, not in a position to staff their own training programs.

A description of the subjects to be covered in each of the above course categories is included in Table 4-1. Although all of these subjects are directly related to health and safety protection, it will be apparent that -- particularly in the case of task training -- it is not practicable to separate training for safety or health purposes from "skills" training designed to assure efficient overall job performance.

It should be noted that some recently enacted state mining laws now provide for longer periods of training than specified in the current Federal law. Thus, both West Virginia and Pennsylvania have recently enacted laws which require 80 hours of pre-employment orientation for new deep miners, as compared with the 40 hours provided in the Federal law. Kentucky provides for 48 hours of orientation

Table 4-1

TRAINING OF COAL MINERS REQUIRED BY THE FEDERAL MINE SAFETY AND HEALTH ACT OF 1977

Mandatory Course Components/Training Time	Inexperienced Miners		Experienced Miners						All Miners	
	Orientation		Orientation/ New Hires		New Task		Annual Refresher		Hazard	
	Deep	Surface	Deep	Surface	Deep	Surface	Deep	Surface	Deep	Surface
Minimum Time Required (hours)	40	24	8	8	*	*	8	8	*	*
Introduction to work environment	X	X	X	X						
Statutory Rights/ Responsibilities	X	X	X	X						
Transportation/ Commu- nication	X	X	X	X			X	X		
Mine Map/Escapes/Evacua- tion/Barricading	X	X	X	X			X	X	X	X
Self Rescuer/Respiratory Devices	X	X					X	X	X	X
Health	X	X					X	X		
Clean-up/Rock Dusting	X									
Roof Control/Ventilation	X		X				X			
First Aid	X	X					X	X		
Electrical Hazards	X	X					X	X		
Mine Gases	X						X			
Task Health/Safety	X	X			X	X				
Hazard Recognition/ Avoidance	X	X	X	X					X	X
Ground Control/Highwalls/ Water Hazards/Spoil Banks/Illumination		X		X				X		
Explosives		X					X	X		
Mandatory Health/Safety Standards			X	X			X	X	X	X
Supervised Practice/Non- Production					X	X				
Supervised Practice/Produc- tion					X	X				
New or Modified Machines/ Equipment					X	X				
Prevention of Accidents							X	X		

Source: Adapted from Final Rules under Part 48, Health and Safety Training and Retraining of Miners, Federal Register, Friday, October 13, 1978, Part IV.

*No specified minimum course hours for these categories.

training and also requires 16 hours -- rather than 8 hours -- of annual refresher training, as well as specifying 20 hours of "task training," whereas the Federal law establishes no minimum standard in this category.

The mandatory training standards established by federal and state laws and by the union agreement were clearly a key factor in development of systematic in-service training programs in the industry. As will be evident later in this report, a major portion of the industry's training activity -- and, in fact, the only formal training still being offered by many of the smaller companies -- is currently devoted to meeting these various mandatory or contractual requirements. Nevertheless, beginning in the late 1960's, a number of concurrent changes in the industry's labor force and skill requirements contributed to the rapid emergence of a training "infrastructure" in the coal mining industry, including both internal company-administered training programs and those provided by external providers such as educational institutions, government agencies, or private vendors.

THE CHANGING STRUCTURE OF THE COAL MINING LABOR FORCE

For nearly two decades following World War II, the coal industry experienced a major contraction of production and employment. The combined impact of diminished coal markets and of rapidly rising productivity resulted in elimination of nearly 300,000 coal mining jobs. Hiring of coal miners dwindled to negligible numbers, as illustrated by an average monthly hiring rate of only 0.5 percent in 1960, and those who were hired could readily be recruited from the ranks of unemployed experienced miners.

The sharply diminished inflow of younger miners, combined with large-scale layoffs of those previously employed, was reflected in the altered age structure of the industry: between 1950 and 1960 the percentage of coal mine employees under age 35 dropped from 39 percent to less than 23 percent, while those aged 45 or over increased from 33 percent to 47 percent of the diminished total still employed in the industry. (Table 4-2.) Under these conditions, there was no need, or incentive, for initiation of formal training programs for new miners.

By the late 1960's, however, coal mining companies began to reenter the recruitment market. Coal mining employment levelled off as a result of gradual increases in coal demand and a slowdown in productivity growth. With increased retirements and other personnel turnover, many coal companies began to resume hiring of new miners on a significant scale. Although sizable labor reserves of older miners were still available in some mining communities, many of the younger ex-miners had meanwhile drifted away to nearby industrial areas in search of jobs or had entered the Armed Services. Thus, for the first time since World War II, the industry was faced with the need to attract and train substantial numbers of inexperienced workers for mining jobs as it entered the decade of the 1970's.

Table 4-2

AGE DISTRIBUTION OF COAL INDUSTRY EMPLOYEES*
SELECTED YEARS: 1950-1975

<u>Age Group</u>	<u>Decennial Census**</u> <u>Percent Distribution</u>			<u>Social Security Records#</u> <u>Percent Distribution</u>	
	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1969-70 Avg.</u>	<u>1975</u>
16-24 yrs.	12.0	5.2	8.9	11.1	20.9
25-34	27.3	17.6	19.2	19.0	30.2
35-44	27.4	30.3	22.7	19.1	19.1
45-54	19.5	30.0	28.4	29.5	17.9
55-64	12.0	15.4	18.9	18.8	10.9
65 yrs. & over	1.7	1.4	1.8	2.5	1.0
TOTAL	100.0	100.0	100.0	100.0	100.0

Source: Harold Wool and John B. Ostbo. The Labor Outlook in the Bituminous Coal Mining Industry. Palo Alto, California: Electric Power Research Institute, 1980, Table 5-8, p. 5-26.

*Data exclude women employees, who represented 2% or less of total coal industry employment in each of these years.

**Based on Decennial Censuses of Population, as of April in each year. Age based on attained age at time of enumeration.

#1969-70 data based on analysis of 1% sample of Continuous Work History Records of Male employees whose primary earnings were from the bituminous coal industry. Age based on attained age as of end of each year. (From unpublished tabulations by John Short and Associates.)

1975 data based on analysis of 10% sample of Social Security records of male employees whose primary earnings were from the bituminous coal industry, in 1st quarter 1975. Age based on attained age as of end of 1974. (From tabulations prepared for The Conference Board by the U.S. Department of Commerce, Bureau of Economic Analysis.)

The employment expansion in coal mining following 1969, combined with increased retirements of older miners, resulted in a sharp step-up in coal mine hiring. On the basis of our analysis of social security data on bituminuous coal miners, we have estimated that accessions into coal mining during the period 1970-78 totalled about 290,000, exclusive of intra-industry job transfers and of turnover among casual or short-term employees (5). A substantial majority of these entrants consisted of younger men with little or no prior experience in the industry. As a result the period since 1970 witnessed a major shift in age distribution of the industry's work force. By 1975, about 51 percent of all men employed in the industry were under age 35, as compared with only 30 percent five years earlier.

Rapid technological change also contributed to an increased need for formal training programs. The share of underground production mined with continuous mining machines increased from less than 10 percent in the mid-1950's to more than 60 percent in a 20-year period, while the still more sophisticated longwall mining systems began to be introduced in the latter part of this period. In surface mining, huge, complex power shovels and draglines were introduced with dipper/bucket capacities exceeding 100 cubic yards in some cases. The major capital investments entailed in these new and costly types of equipment, in turn, reinforced the need for more adequate training of both equipment operators and maintenance personnel to reduce equipment down-time and consequent production losses.

These emerging training needs, moreover, were not confined to those in production worker jobs. Traditionally, the coal mining industry relied on its own internal manpower resources for advancement of personnel into supervisory and line

management positions. This practice was reenforced by requirements of state certification laws for three to five years of mining experience for qualification for mine foreman and other key supervisory jobs. Thus, the typical mine foreman in the late 1960's was a man in his forties or older with many years of mining experience and who -- despite limited formal education -- was intimately familiar with practical mining operations. The rapid increase in mining employment in the 1970's, however, was accompanied by the need to recruit large numbers of additional personnel into foremen and other supervisory jobs from a restricted supply of experienced miners with the requisite years of mining experience. Faced with a shortage of qualified personnel, many companies were forced -- by their own account -- to reduce selection standards and to advance many younger miners, with minimal qualifications, to the foreman ranks. At the same time, the responsibilities of the mine foreman and mine superintendent became increasingly demanding because of the need to comply with a large number of new safety and environmental regulations and to adjust to the much more difficult labor relations climate which emerged in the 1970's. These new responsibilities brought with them an increased awareness of the need for specialized training programs to prepare newly-appointed foremen -- as well as many older foremen -- for this wider range of supervisory skills.

THE EMERGENCE OF A TRAINING INFRASTRUCTURE

The coal mining industry entered the decade of the 1970's with only the bare rudiments of a capability for training of its personnel in either the safety or the technical aspects of their jobs. Only a small number of the larger, more safety-minded coal mining companies had initiated systematic training programs for their miners prior to enactment and implementation of the Federal Mine

Health and Safety Act of 1969. Thus, one survey of 33 large underground mines in West Virginia conducted in 1974 found that only five of these mines had instructional programs which had been in effect for over five years -- a finding paralleling that of our own more recent survey, reported in the next chapter (6). Moreover, coal miner training, where provided, was often informal and limited to brief safety lectures or orientations as suggested by the following description from a 1970 study by J. Davitt McAteer:

"A second aspect of most safety programs is a weekly or monthly safety lecture given to miners by a mine or shift foreman. When given, these lectures are normally fifteen-minute sessions held at the beginning of shifts on Mondays. In our survey, these lectures were found to be given irregularly and the lecture was given by the shift foreman who read from a printed brochure...(7)"

Other forms of miner training, such as training in mining skills, appear to have been even more casual, as illustrated by the following observations based on a 1970 survey of miners in several underground mines of one large company in southern West Virginia.

"The usual means of safety training, such as the weekly 'face meeting,' the occasional demonstration of a new device, or some training course aimed at a newly required qualification would have to be regarded as less than successful mechanisms for advancing one's performance and safety if the receptivity expressed by many (company) miners is a rough gauge of the relevance of these procedures (8)."

Opportunities for specialized training in coal mining methods at secondary and post-secondary educational institutions or universities were equally limited. At the professional level, the schools of mining engineering had suffered a severe decline in enrollments and faculty during the preceding two decades as a result of the depressed condition of coal mining and other mining industries. Only a few of these universities, notably The Pennsylvania State University,

West Virginia University, and the College of Eastern Utah, were engaged in miner training activities through their extension services prior to 1970. Similarly, among other existing external training sources, such as vocational high schools or community colleges, few -- if any -- provided courses designed to orient students to coal mining as a vocation or to provide technical training in coal mining skills:

From these beginnings, the combined stimulus provided by the new mandatory health and safety training standards, the accompanying Federal and State grant programs, and the industry's demands for a skilled workforce produced a rapid growth in both internal (company-operated) and external training programs during the past decade. Describing the situation in West Virginia in 1975, Letcher noted:

"Instructional programs for the coal industry in West Virginia have proliferated in response to need. State agencies, Federal agencies, the industry, the United Mine Workers of America, educational and vocational institutions, manufacturers, and others have all contributed programs and materials to fill the training void (9)."

The training infrastructure which has emerged in the industry during the past decade can -- at best -- be described as highly diversified and fragmented. It has been geared, in large part, to assisting coal companies and employees (or prospective employees) in meeting the new array of mandatory training and certification requirements established by federal and state laws, and -- in the case of educational institutions or other external providers -- to responding to the new market created by the availability of financial assistance for these programs from federal or state grants and from some mine companies. The wide range in coal mine company size and the variations in state training and certification standards,

in availability of community-level vocational training resources, and in local labor market conditions have all contributed to the diversity of training resources and programs within the industry. The following major categories of training providers have been identified, based on our literature review and field visits:

- Company-operated training programs
- Educational institutions, such as public or private voc-tech schools, community colleges, and university extension schools
- Federal and state mine agencies, including MSHA, other federal agencies (such as the Federal Mediation and Conciliation Service), and state mining departments
- Coal mining equipment manufacturers
- National or regional trade associations
- Training consultants and firms, specializing in development of training programs or materials

Following is a brief description of these training sources:

1. Coal Company Programs -- Training programs provided directly by coal mine companies to their employees, using company facilities and staffs, have -- by all accounts -- become the primary source of both mandated safety training and of non-mandatory training within the industry (10). Although a few of the large companies, such as Bethlehem Steel, had pioneered in the development of formal company-wide safety training programs for management or other mine-level personnel in the early 1960's, it was not until the resurgence of coal mine hiring in the late 1960's and early 1970's that even the largest of these companies appear to have expanded their activities to include provision of a broader range of technical and supervisory-level courses. Some of the titles of articles appearing in

the trade publication Coal Age during this period are indicative of these new initiatives:

- "CONSOL digs for manpower" (Coal Age, August 1968)
- "Peabody classroom on wheels helps solve manpower shortage" (Coal Age, May 1969)
- "Above ground school for underground workers" (Coal Age, September 1970)
- "New AMAX mine spurs educational experiment..." (Coal Age, February 1973)

By the end of the 1970's nearly all of the industry's top 20 companies and a significant number of those in the intermediate-size range appear to have established formalized training units or departments, both to conduct mandatory health and safety training and to provide at least some skills and supervisory training. Our interviews with company training officials, as well as findings of other investigators, indicate a general preference among these companies for conducting training at company facilities, with company staff, wherever this is practicable, for a combination of reasons: (1) the need to adapt training content to the specific equipment and operational configurations of individual mines, (2) the desire to have direct control over training content and quality, and (3) the inherent economies of on-site instruction.

Although the larger mining companies which we visited have separate training departments or units at the company headquarters level, operational responsibility for design and administration of training courses (other than management training) is often decentralized to the mine and divisional levels in view of the considerable variation in training needs among various company units. These larger companies now have internal capabilities for conducting all of the mandatory

health and safety training, and most of the mining skills training (which often include both classroom and on-the-job training components). Classroom-type training is typically provided to miners at or near the mine site. A number of companies use special underground mine sections, or training centers, to provide direct "hands-on" training under real or simulated operating conditions. A few companies, including U.S. Steel and the American Coal Company, have also built above-ground simulated mine training centers, equipped to provide training in a full-range of courses from orientation and operator skills training to courses for maintenance personnel, supervisors, and emergency medical technicians (EMT), without the hazards entailed in an operating mine environment (11).

The most sophisticated of these training programs, typically operated by affiliates of some of the major steel, oil, and electric utility companies, incorporate many of the following elements:

- Training needs by skill are determined as part of a comprehensive corporate manpower -- or human resources development -- planning system.
- Training contents are determined by systematic job or task analyses of major mining occupations.
- Professional, full-time instructional staff is employed.
- Use is made of a variety of modern training materials and methodologies, such as simulators, TV, and programmed learning techniques.
- A systematic program of evaluation is used to assess training effectiveness, as measured by such criteria as improved on-the-job performance and mine safety.

"Model" programs incorporating at least some of these features have been featured in the industry's trade and professional journals and at conferences on coal industry training and personnel issues in the past several years. Yet, there is

general recognition that these programs are still far from representative of the current stage of development of coal company training efforts, even among many of the larger company units. Moreover, by all accounts, most of the smaller coal companies have treated training as an adjunct to their safety program and still limit their training activities to the objective of minimal compliance with mandatory health and safety training standards. As noted in a recent survey, in a typical small mine operation, "the training director, safety engineer, foreman, mine manager, superintendent, and owner could be the same individual. Whatever formal training the small mine employees are given will tend to come from a state or MESA (MSHA) instructor (12)."

2. Educational Institutions -- A wide array of educational institutions have responded to the increased demand for training of coal mine personnel during the past decade, ranging from public and private vocational or technical schools and community colleges to the mining engineering departments and extension services of universities in coal-mining states or regions. Each of these categories of educational institutions performs certain distinctive roles in provision of specialized training to coal mining employees or prospective employees. Thus, vocational high schools in the coal mining areas of states such as West Virginia and Kentucky offer orientation courses to coal mining in order to help prepare students for entry-level mining jobs, as well as vocational training courses for specific mining skills. Community colleges offer one or two-year coal technology courses, designed to qualify graduates for skilled maintenance or other technical positions in coal mines. Universities offer programs leading to baccalaureate and advanced degrees in mining engineering and related specialties. There is,

however, a substantial overlap in functions and training objectives among these institutions. For example, all of these categories of institutions are likely to include in their offerings orientation courses designed to satisfy mandatory health and safety standards for new, inexperienced miners or to assist mine personnel in meeting certification test requirements. Such courses may be provided at their own campus or facility or through extension programs located at or near the site of coal mine employers.

At the secondary school level, the State of West Virginia -- the nation's largest coal mining state -- has also developed the most comprehensive network of voc-tech training courses in coal mining occupations. Although some mine-related occupational training courses, at both the secondary and post-secondary levels, were already being provided in the early 1970's, impetus for a major expansion in these programs was provided by the subsequent expansion in mining jobs and by State legislation effective in May 1976, which established a mandatory 80-hour requirement for pre-employment health and safety training for underground miners. By 1976, course offerings had been expanded to include skill development courses in such subjects as mine maintenance, mine machinery operations and repair, and mine electrification as well as a general "Introduction to Mine" course offered to students at the ninth and tenth grade levels. Enrollments in these courses at the State's secondary schools and voc-tech centers totalled about 1000 in the 1975-76 school year. In addition, 3160 adult trainees were enrolled in the newly established miner orientation courses. Enrollments in the latter programs mounted to 11,600 in FY 1977, the first full year of operations under the new mandatory pre-employment training standard. However, the slowdown in employment growth in the State's coal mining industry and poor

placement experience among graduates of these programs resulted in a sharp drop in enrollments in the following two years. Thus, by 1979, enrollments in the Miner orientation courses had declined to about 8000, while the number enrolled in miner skills training or general introductory courses in secondary and voc-tech schools had fallen to about 700, less than half the 1976 level (13).

Funding for expanded vocational training for miners in West Virginia, as in other mining states, has come from a variety of sources, including regular State and Federal vocational education funds, MSHA grants, and funds provided under the Federal Comprehensive Employment and Training Act program. The latter program, designed primarily to assist disadvantaged job seekers, had provided funding for over 1000 trainees in FY 1977 and 1978, with about one-half in the basic miner orientation course. However, placement rates from these courses, which had averaged over 70 percent in FY 1975 and 1976, subsequently declined to 49 percent in FY 1978, resulting in a sharp cutback in CETA funding for this training in the two subsequent years (14).

In addition to skills and orientation programs offered by state and local vocational/technical schools, more comprehensive courses leading to certificates or associate degrees in mining technology and related fields have also been offered by a growing number of community colleges and by university extension departments operating in coal mining regions. One survey, conducted by John R. Doggette of Oak Ridge Associated Universities, identified 17 colleges with a combined total of 24 programs in coal mining in 1975-76, all but three of which had been established in the previous five years. An additional 12 colleges then reported that they were planning to introduce coal-mining technology programs in the near future (15). A more recent canvass, conducted by John Short Associates

in 1979, identified a combined total of 57 vocational/technical schools and colleges offering courses in mine technology or maintenance, with a total enrollment of 7750 (16). Although the two surveys are not comparable in coverage, it is probable that growth in the number of available post-secondary coal mining educational programs continued throughout the 1970's.

Although systematic, comprehensive data on the characteristics of all of these educational programs are still not available, our review of a sample of these offerings, based on responses to our written communications to these schools and on the results of a partial survey conducted by a Coal Task Force for the Department of Energy's Office of Education, Business and Labor Affairs, suggests the following generalizations:

- Institutional sponsorship of coal mining technology programs is highly diversified, ranging from publicly-funded voc-tech centers in states such as West Virginia and Kentucky, to public or private two-year community colleges, and to the extension departments of universities such as Pennsylvania State and West Virginia University.
- The types of programs offered at these schools (below the baccalaureate level) may be classified into three categories: (1) those leading to a two-year associate degree in underground or surface coal mining technology or some closely related field, such as reclamation technology; (2) programs of one-year or lesser duration, leading to a certificate in a specific mining occupation, such as mine mechanic or electrician; and (3) a variety of short non-degree, non-certificate programs, including mandatory health and safety training, mine rescue training, emergency medical technician, mine foreman training, and various specialized skill training courses, adapted to the needs of local mining companies. Many of the community colleges and university extension programs surveyed offer all three of these program categories, as well as providing academic credits which may be acceptable for a baccalaureate degree. Voc-tech schools, however, are normally limited to the shorter courses designed to meet federal/state mandatory requirements or to provide specialized training in specific mining skills.

- Funding for these programs has come from a variety of sources, including federal and state grants and local mining companies, as well as direct tuition payments. Sources of federal funding assistance have included MSHA, CETA, and the Office of Surface Mining as well as funds made available to the states under vocational education legislation.
- These community-based programs all stress close linkages with the local coal mining industry. Thus, of the 17 community colleges surveyed by Doggette in 1975, 13 colleges relied on local firms for at least some of their instructional staff, company facilities were provided to 12 of these colleges, and 11 reported use of company-provided equipment. Company representatives are also typically included on advisory boards, designed to assist in the schools' curriculum and program planning (17).

Since the coal mining programs offered by these schools have differing objectives and include both enrollees currently employed in the industry and those interested in qualifying for coal mining jobs, there is no single criterion or yardstick for measuring the overall effectiveness of these programs. In the case of pre-employment training programs, the obvious criterion is the school's placement rate, i.e., the proportion of graduates who find employment in the industry in jobs which provide an opportunity for utilizing their specialized training. These placement rates appear to have been quite high for students completing the two-year coal mine technology programs. Thus, of 17 college or university extension programs reporting to the DOE Coal Task Force in 1978, 12 reported placement rates in excess of 90 percent while the remainder reported rates between 80 and 89 percent. Such placement statistics must, however, be carefully qualified because of the limited sample, the small proportion of total enrollees who have graduated to date, and because of varying interpretations of a "successful" placement. These statistics contrast, moreover, with very low placement rates reported by West Virginia voc-tech schools, where only 15 percent of those completing underground orientation training, and 37 percent of those completing surface courses in 1978, were reported as employed in coal mining (18).

There is some evidence, also, indicating that the recent growth in these training programs has -- at least temporarily -- exceeded the industry's demand for qualified graduates in some regions. John Short, in his recent study, cites several illustrations of a substantial "over-supply" of training both in Appalachian areas and in some Western mining communities. These problems have been attributed to lack of adequate coordination and planning among the various regional training providers (internal and external). They have also been aggravated by the recent slackening of hiring in some coal mining regions, as illustrated by the following comments in a communication received from the coordinator of mining training programs of one large Eastern university:

"Our main problem at present is the lack of a significant growth in the mining industry. _____ University initiated Mining Technology long before it became popular to do so. In the meantime, approximately 40 other schools in the United States have started these programs and have simply flooded the market with this type of graduate. If the industry were growing significantly each year, this would be no problem. However, the promise of the growth in the industry has simply not taken place to date. Thus a significant number of our graduates in the last two years have not found jobs in the mining industry. As a result, our enrollment has suffered and the potential for employment of this type of graduate in the future is somewhat in doubt (19)."

A further major deterrent to growth of these programs is the prevailing hiring pattern, resulting from union contractual requirements and from general industry practice, under which newly-employed miners -- irrespective of prior training -- are expected to start at entry-level jobs in the industry and to compete for higher-skilled openings with other employees, under job bidding procedures. Thus, although prior training may facilitate entry into the industry and may help qualify employees for more rapid promotion, this training does not directly provide entrée into the more skilled mining jobs.

3. Federal and State Agencies -- In addition to the training provided by publicly-funded educational institutions, the Federal and state governments provide training assistance to the coal industry through a number of other agencies and programs. At the Federal level, the Bureau of Mines since its inception in 1910 has had a responsibility for programs to improve mine safety and initiated some limited training in simple first aid courses as early as 1913. These responsibilities were broadened under the 1969 Federal Mine Health and Safety Act and assigned to the Mining Enforcement Safety Administration, which -- in turn -- was transferred to the Department of Labor in 1977 (PL 95-164). The Federal Mediation and Conciliation Service (FMCS) has provided labor relations training courses to both mine management and union personnel since 1975. Other federal agencies which have provided support for various types of coal mine training activities include the Labor Department's Employment and Training Administration, the Office of Surface Mining, the Appalachian Regional Commission, and the Department of Energy. However, unlike MSHA and FMCS, the latter agencies have generally confined their assistance to funding of institutional training or related research activities, rather than providing direct training services. At the state level, some state mining agencies also provide direct instruction to miners on such subjects as mine gas detection and testing or miner rescue work, financed entirely or mainly by Federal funds.

The most comprehensive of these training activities has consisted of the training courses and training materials provided by the Mining Enforcement and Safety Administration (subsequently MSHA) mainly through its network of 10 regional training centers and at its National Mine Health and Safety Academy. These have included direct training of miners and mine supervisors in accident prevention

and related courses, training and certification of "cooperative institutions," and development and issuance of a wide variety of training materials on these subjects.

The direct provision of safety training to mine personnel by MESA/MSHA staff has been designed particularly to assist small mine operators, e.g., those with fewer than 20 employees, to comply with the Federal training requirements. This activity appears to have peaked in 1974 when 88 full-time instructors, based at MESA regional training centers, provided 87 different courses in mine safety subjects with a total (gross) attendance of 51,624 mine personnel. These classes were conducted "wherever a group could be assembled and scheduled," including mine sites, union halls, company warehouses, churches, local schools, or other local facilities. Such arrangements were, however, costly in terms of instructor travel time and related logistical factors. Moreover, the training provided, based on packaged courses, films, and similar materials, could not readily be adapted to the separate safety problems and needs of individual mines. For this reason, agency emphasis was placed on the task of training and certification of "cooperative instructors," i.e., company personnel, who have -- in turn -- accounted for the major portion of all mine safety training. Thus, in 1974, cooperative instructors presented safety courses with a gross attendance of nearly 344,000 miners -- almost seven times that of courses provided directly by the MESA staff (20).

In addition to these mine-based training activities, the National Mine Health and Safety Academy has played a significant and growing role in mine safety training. Established under the authority of the 1969 Federal Coal Mine Health and Safety Act, the Academy's initial activities beginning in 1971 were focused on training mine inspectors for MESA. Since 1976, the Academy has been housed in a modern

facility at Beckley, West Virginia, where it has provided resident courses for federal or state mine inspectors, company safety directors, supervisors, and others concerned with mining health and safety. The resident program includes courses of 9 to 13 weeks in duration to qualify experienced mining personnel as mine inspectors; a 28-week college cooperative program; a "professional development" program consisting of two-week courses in fields such as safety management and system safety engineering, and a large variety of other specialized short courses. Enrollments have increased steadily, from 1517 trainees in FY 1976 to 9796 in FY 1978. Although about two-thirds of the enrollees have been federal employees, the remainder have consisted of personnel from state and local agencies, from coal mine companies, and from college programs (21).

These direct MESA/MSHA training activities have been supplemented by an extensive program of development and publication of mine safety training materials, which have received extensive distribution within the mining industry. The most comprehensive of these publications consists of a series of programmed-instruction workbooks on 19 separate mine safety subjects, published by the Academy since 1977 (22). In addition, the agency has developed a variety of visual aids, including transparencies, 35 mm slides, flip charts, and posters, to be used in conjunction with other course materials (23).

The Federal Mediation and Conciliation Service, whose responsibilities include technical assistance to union and management personnel in labor relations matters in addition to provision of mediation and conciliation services, has also contributed to training of coal mine personnel through provision of labor relations courses to both UMWA and to mine management staff of companies affiliated with

the Bituminous Coal Operators Association. This program, initiated in 1975 as a result of the extensive outbreak of wildcat strikes in the industry, included several types of labor relations seminars or courses, ranging from short 1½ day courses for joint training of foremen and shop stewards to an intensive two-weeks "bootstraps" program for mine committeemen, who would in turn become "trainers" of other active union members. During the period August 1975 - June 1977, a total of 2100 personnel from 63 companies participated in these courses, which were conducted by 21 Federal mediators (24).

Among other relevant federal agency programs, the CETA program, administered by the Department of Labor's Employment and Training Administration, has provided funding for training and subsistence allowances for several thousand unemployed workers, to help them qualify for entry into coal mining jobs. The Women's Bureau of the Department of Labor has also provided a grant to the Women's Employment Project, for a pilot program of training and counselling of women seeking entry into coal mining jobs. The Appalachian Regional Commission has provided funding for construction of a simulated mine and for other training activities in Appalachian coal mining areas. The Bureau of Mines and the Department of Energy have separately provided funds for research related to the industry's training needs (including the current study). More recently, the Office of Surface Mining has also initiated programs designed to support training of specialists in reclamation technology and related fields. Support for undergraduate and graduate students in mining engineering programs has also been available through federal student loan programs, fellowships, research grants, and similar programs.

At the state level, some direct training in mine safety subjects is provided by most state mining departments, in connection with their responsibilities for

miner certification and for mine inspection programs. Most of this training is related to federal or state mandatory training and certification standards and is financed by MSHA grants. The level of this activity is suggested by the number of mine safety instructors employed in these activities, which range from two in Alabama to 13 in Kentucky, among six state mining departments which responded to our query.

4. Other Training Sources -- Additional sources of training services to the coal industry which have emerged or expanded in recent years include coal mining machinery manufacturers, consultant firms, and industry trade associations. Although comprehensive data on the number and scope of such programs are not available, some descriptive material on the types of services provided is discussed below:

Vendor Training. Coal mine equipment manufacturers typically provide at least some initial training to key personnel of companies purchasing their equipment. Several of the larger mine machinery manufacturers have, moreover, developed comprehensive training programs and aids to instruct mine personnel in the operation and maintenance of their equipment. In a 1974 survey of 10 mining machinery manufacturing companies which accounted for over 90 percent of the production-mining equipment sold in West Virginia, Letcher found that six companies had no regular training or instructional programs. However, the remaining four companies had provided training to about 1000 mining personnel in West Virginia in 1974. The largest of these programs, operated by the Joy Manufacturing Company, included courses in basic electricity, solid state circuits, electrical and hydraulic circuits, mechanical components, maintenance and trouble shooting techniques (25).

Consultant Firms. A number of private consultant firms specializing in management and training services have provided training assistance to coal mining companies, ranging from planning and design of training programs to direct provision of training courses or materials. At the manpower planning stage, one illustration is provided by the experience of Jim Walter Resources, which retained a consulting firm, Kurt Salmon Associates, to assist its staff both in projecting the number and types of personnel who would be required for operating its extensive coal mine properties in Alabama and in developing the needed training programs and resources (26). A number of other consulting firms have directly provided training courses for mine companies on subjects ranging from basic health and safety training to labor relations courses, while others have specialized in marketing of packaged training programs and related materials.

Trade Associations. In recognition of the critical need for developing improved skills-training and foreman-training programs for the industry, two national coal industry trade associations -- the National Coal Association and the Bituminous Coal Operators Association -- initiated a program in 1976 for development of a series of training programs capable of use on an industry-wide basis. The National Photographic Laboratories, which had previously designed similar programs for the American Petroleum Institute, was selected as contractor for this program, with subjects and content materials to be developed by a committee including key industry training officials. A series of six courses was developed in the following three years, covering supervisory training and selected maintenance subjects. Industry training officials whom we have interviewed have considered these materials to be of high quality. However, the relatively high unit cost of the packages has apparently been a major deterrent for many of these companies.

At the regional level, there are several instances of cooperative action by coal mining companies and other interested government and private organizations, in joint planning for meeting the industry's training and educational needs. For example, the Illinois Basin Coal Mining Council, described as an informal group of representatives of industry, government, labor and educational institutions, has conducted confidential surveys of manpower needs of the major coal mining companies in the region and has also sponsored several conferences on manpower and training issues in the industry (27). Similar surveys have also been conducted by other regional or local industry groups, including the West Virginia Coal Association, the Rocky Mountain Employer's Council, and the Gillette, Wyoming Chamber of Commerce. A series of annual conferences on coal mine training issues, "Training Resources Applied to Mining" (TRAM), jointly sponsored by The Pennsylvania State and West Virginia Universities, has also provided a forum for informal exchange of information on training methods and developments in the industry, particularly among companies operating in the Appalachian region.

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Despite availability of a good deal of piecemeal information on the growing scope of training in the industry, as described above, it was apparent that -- at the close of the decade of the 1970's -- no comprehensive body of data had yet been developed on the scope and types of training actually being provided to coal mining personnel which could provide a sound factual basis for assessing future needs. The Conference Board Survey of Coal Industry Training Programs, described in the following chapter, was therefore initiated to assist in filling this information gap.

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Chapter 5

THE CONFERENCE BOARD SURVEY OF COAL INDUSTRY TRAINING PROGRAMS

SURVEY DESIGN AND RESPONSE RATES

1. Survey Questionnaire -- The Conference Board survey of coal industry training programs was initiated in the fall of 1979 in order to provide DOE with nationwide information about training programs provided by coal mining companies to their personnel. Although a considerable amount of descriptive material had been previously published, this represented the first effort to undertake a systematic, large-scale survey of all types of training provided by coal mining companies to their employees, including both mandated health and safety training and the various types of "non-mandatory" training provided by many coal companies to enhance the skills and productivity of their personnel.

The survey design, using structured, check-list formats, provided for completion of two mail questionnaires:

- A company questionnaire, addressed to the corporate office of each coal mining company above a specified minimum tonnage size, concerning company-wide training activities and policies.
- A mine questionnaire requesting certain supplemental training data, with respect to a small, pre-selected sample of coal mines operated by these companies.

The detailed, eight-page company questionnaire, developed in consultation with a number of industry training officials, inquired about: (1) the company's training organization and staff, (2) the types of training programs offered, (3) the number of employees trained, and (4) training facilities used. The questionnaire also included a number of questions concerning company training policies, plans, and needs, and it requested respondents to assess the adequacy of their own training programs as well as those provided by various outside agencies or institutions. Also included were questions about company employment, turnover, tonnage, and related characteristics.

The mine-level instrument, which accompanied the initial distribution of the detailed company-level questionnaire, was designed to obtain mine-specific data on types of training courses offered, course length, and facilities used, which are known to vary considerably -- even among mines of the same company -- due to variations in state training regulations and in local needs and resources.

Since it was expected that many of the smaller coal mining companies were likely to have very limited formal training programs, a much shorter, abridged company questionnaire was also developed to be used in follow-up of those companies which failed to respond to the detailed schedule. The abridged, two-page questionnaire requested only summary information on types of training provided and types of facilities, as well as certain attitudinal questions such as respondent's satisfaction with on-going programs.

Copies of these questionnaires are included in Appendix B.

2. Survey Methods -- The bituminous coal and lignite mining industry, in contrast to many other major United States industries, is very heterogeneous in terms of firm size and mining methods. At one extreme, 20 large corporations or affiliated producing groups, each producing at least six million tons of coal in 1977, accounted for a total of 318 million tons or 46 percent of total United States' output that year. At the other extreme, over 3200 small companies, with annual tonnage of less than 300,000 each, accounted for less than 20 percent of the total output (1). Many of the latter operate one or a few small mines, either as a family enterprise or with a very small number of employees. Thus, of a total of about 5100 separate operating bituminous coal mines in 1977 with one or more employees, 3334 reported fewer than 20 employees each. The aggregate employment in these mines was only about 29,000, or 13 percent of the industry's total employment that year (2).

Our initial review of the available literature and consultations with coal industry training experts had indicated that these smaller coal producers were not in a position to provide more than mandatory health and safety training to their personnel and -- because of their small size -- were most unlikely to have developed any specialized "in-house" training staff. The study plan therefore provided for limitation of the survey to the 351 large or medium-sized companies or affiliated producing groups with minimum output of 300,000 tons in 1977. Based on average productivity statistics, the lowest of the size categories to be included in the survey, those with 300,000 to 500,000 annual tonnage, typically employed between 100 and 200 employees per company. This was considered the smallest size

group in which formal company-level training programs, other than the legally-required training, were likely to occur.

The survey plan provided for inclusion of all of these 351 companies or affiliated groups in the distribution of the detailed company questionnaires. However, only a sample of the mines operated by these companies were to be included in the supplemental mine-level survey. For this purpose, a stratified sample of about 350 mines operated by these companies was selected, based on mine size, number of mines operated by each company, and number of states in which the company's mines were located. The procedure was designed to include within the mine-level sample a large proportion of the largest mines and a much smaller proportion of the smaller mines which met certain minimum tonnage criteria (100,000 tons for deep mines; 250,000 tons for surface mines). The latter criteria, based on average productivity statistics by type of mine, were designed to limit the coverage of this survey to mines which employed at least 50 miners in the survey year. For companies in the smallest tonnage size group (under 500,000 tons), only half of the companies were requested to complete these mine questionnaires. Companies included in the survey received both the company questionnaire and one or more supplemental mine questionnaires, for those mines which had been pre-selected for inclusion in the sample.

In order to assure maximum company response, officers of the two major national employer associations in the bituminous coal industry -- the National Coal Association and the Bituminous Coal Operators Association -- addressed letters to the senior personnel or training officials of the top fifty coal companies, urging

their cooperation with the survey. These letters were mailed in August 1979, shortly before the initial mailing of The Conference Board questionnaire. The Conference Board questionnaires for these fifty largest companies were, in turn, addressed to these officials. Similar personalized approaches were not practicable with respect to the remaining 300 companies covered by the survey since the latter generally had no listed official with specialized responsibilities for the personnel or training function. In order to further increase response rates, extensive telephone follow-ups were made by The Conference Board survey staff, with primary emphasis on the larger coal companies or producing groups. Finally, in November of 1979, the abridged (two-page) company questionnaire was mailed to all companies which had not responded to the initial mailing or follow-ups.

3. Response Rates -- As shown in Table 5-1, a total of 91 companies or operating groups responded to the survey, of whom one-half (47) returned the detailed company questionnaire. The 91 companies accounted for a total of nearly 131,000 employees in June 1979, which represented about 51 percent of the industry's total employment and about 65 percent of the total employment in the companies included in our sample.

Although the overall response rate of 27 percent was relatively low, an analysis by tonnage-size group indicates a very high response rate of 80 percent for the top 50 companies, i.e., those producing two million tons or more in 1977. Moreover, the combined tonnage of these responding companies in 1977 (388 million tons) represented 92 percent of the total tonnage of this size class and accounted for about one-half of total U.S. bituminous coal tonnage in

Table 5-1
SURVEY SAMPLE AND RESPONSE RATES

	Total, All Companies/Groups	Tonnage Size Class (1977)	
		2.0 Million Tons or More	300,000 to 1.9 Million Tons
<hr/>			
	Number of Companies/Groups		
<hr/>			
Number in Sample	337*	50	264
Number of Responses, Total	91	40	51
Detailed Company Questionnaire	47	28	19
Abridged Company Questionnaire	44	12	32
Percent Responding	27%	80%	19%
<hr/>			
	Tonnage Statistics (Millions)		
<hr/>			
Total Tonnage of Companies in Sample	542	417	125
Total Tonnage of Reporting Companies/Groups	421	388	33
Returning Detailed Questionnaire	340	327	13
Returning Abridged Questionnaire	81	61	20
Percentage of Total Tonnage Rep- resented by Responding Companies/ Groups	78%	93%	26%

*Of a total of 351 companies or affiliated operating groups originally listed, 14 were excluded because they were no longer in operation or were found to be affiliated with other companies included in the sample.

Source: U.S. Department of Energy from the Conference Board Survey.

that year. In contrast, only 51 or about 19 percent of the smaller companies, i.e., those producing between 300,000 and 1.9 million tons, returned either the detailed or abridged questionnaires. The latter, in turn, accounted for 26 percent of the total tonnage in this size group.

We believe that several factors accounted for this sharp difference in response rates between these two size groups. The very satisfactory response rates for the large companies was clearly facilitated by the identification of specific company officials responsible for training in these companies and by the advance letter addressed to them by the two coal industry associations. The much lower response rates for the smaller companies, in turn, were due in part to our inability to identify, by name, the official responsible for training in these companies. Moreover, based on follow-up calls to about 20 randomly selected smaller non-responding companies, we found -- not unexpectedly -- that none of these companies had an officer or staff unit primarily responsible for that company's training activities. In most instances, this function was performed by the company officer responsible for health and safety programs or for general administrative matters. It was probable that a large proportion of these companies were limiting their training activities to mandatory health and safety training. Consequently, most of the information requested in the training survey -- particularly in the detailed questionnaire -- appeared irrelevant to their company.

Some confirmation for our assumption that non-responding companies, among those with less than two million annual tonnage were much less likely to be engaged in non-mandatory training activities is provided by the results of an earlier Conference Board survey of employee education and training programs among

corporations with 500 or more employees, covering a wide range of business and industry activities. Response rates in this mail survey ranged from 33 percent, for companies with 10,000 up to 50,000 employees, to only 11 percent among companies with 500 to 1000 employees. A short postcard questionnaire addressed to a sample of non-responding firms indicated that the smaller companies among those who had failed to return the original questionnaire had significantly lower rates of training activity than did those which responded. As noted by the author, "This is in line with expectations in survey research that those involved in activities under study are more likely to participate than those who are not (3)."

In addition to the responses to the two company-level questionnaires described above, a total of 58 supplemental mine-level questionnaires were returned by 33 of the reporting companies. These questionnaires required a further stage of internal distribution of these schedules by company-level training officials to staff officers responsible for training at the designated mines. Our analysis of the completed questionnaires indicates, as would be expected, a concentration of responses among the larger mines, as indicated by an average employment of 435 employees per mine contrasted to an average of only 48 per mine in all bituminous and lignite mining establishments with one or more paid employees (4).

In summary, our analysis of response rates to the survey indicates that these results can be considered as indicative of the scope of training activities being conducted by large and medium-size coal mining companies, which probably account for a very large proportion of total training activity within the industry, other than mandated health and safety training. However, the results

cannot be generalized to apply to the industry as a whole in view of the collateral evidence concerning the very limited non-mandatory training being conducted by the smaller coal mining companies, who were either excluded from the sample or who failed to respond to the survey questionnaires.

COMPANY TRAINING ORGANIZATION AND STAFF

The existence of a separate unit or staff function primarily responsible for employee training and education activities provides one measure of the degree of emphasis placed upon this activity by various companies. For this reason, the detailed company questionnaire included a number of questions designed to identify the focal point of responsibility for training activities in each company, the year when this function was first established, and the size of the training staff. Although this information was not requested in the abridged questionnaire, some insight on this question was provided by the title of the responding company officials.

These responses confirm that the emergence of organized training programs is a relatively recent development in the coal industry. Of 45 companies providing specific information about their internal training organization, 32 companies reported that they had a separate staff function or unit responsible for training either at company headquarters or at regional or divisional headquarters, while three additional companies reported such units only at individual mine sites. Over half of these companies (20 out of 35) reported this function had been organized since 1975; ten companies indicated that they had established their training units or functions between 1970 and 1974; and only five reported that they had been established prior to enactment of mandatory training requirements for miners under the Federal Mine Health and Safety Act of 1969.

Large and medium-sized corporations were much more likely to have specialized training units or staffs than the smaller companies covered by the survey. In addition to a training manager or staff specialist at the main company office, the large companies normally have training supervisors or coordinators at regional or divisional offices as well as at the larger mine operations. The following are typical titles of such training unit heads: Director or Manager of Training; Director, Employee Development; Manager, Education and Training; Training Supervisor; Training Coordinator.

On the other hand, among the ten companies with less than 200 employees responding to the full questionnaire, about two-thirds reported that they had no specialized training unit or staff functions. In these companies, responsibility for training activities was typically combined with health and safety management or with broader personnel or administrative functions.

This pattern was also indicated by the titles of the officials responding to the abridged questionnaire, which was mainly completed by the smaller companies in The Conference Board sample. Thus of 44 respondents to this questionnaire, only four had titles indicating that they were exclusively responsible for training and education activities.

The relationship between company size and ability to support a full-time training staff unit is further documented by the comparisons of training staff ratios in Table 5-2. The Board survey found a consistent inverse relation between company size and the ratio of full-time training staff per 1000 employees. In the coal industry, this ratio ranged from 2.3 trainers per 1000 employees for companies with 5000 or more employees, to 8.1 for companies with less than 500 employees. In addition to obvious economies of scale in organizing and managing

Table 5-2

NUMBER OF FULL-TIME TRAINING STAFF PER 1000 EMPLOYEES,
BY COMPANY SIZE: COAL COMPANIES AND ALL PRIVATE COMPANIES

<u>Company Size</u> (Number of Employees)	<u>Coal Companies</u>	<u>All Private Companies*</u>
10,000 and over	2.3	1.7
5,000 - 9,999		2.4
2,500 - 4,999	3.0	1.7
1,000 - 2,499	3.7	1.7
500 - 999	6.4	2.8
Less than 500	8.1	-
All Companies	2.9	1.8

*Seymour Lusterman, Education in Industry, New York City: The Conference Board, 1977, Table 3-1. Survey coverage limited to corporations with 500 or more employees.

Source: U.S. Department of Energy

training programs, these differences probably reflect the higher turnover, and hence training requirements, characteristic of smaller mining companies. In addition some of the latter companies were in the early phases of a projected expansion program and, hence, had geared their training staff size to the needs of a larger projected work force.

These ratios are compared with similar ratios based on a 1975 Conference Board survey of a sample of corporations with 500 or more employees in a broad range of industrial and business activities. With the exception of the coal companies in the largest size category, i.e., those employing 5000 or more workers, staffing requirements for coal industry training programs were substantially higher, by ratios of about 2:1, than corresponding ratios in other companies in the same size groups. These differences can probably be attributed, in large part, to the requirements imposed by federal and state laws on all coal companies, irrespective of size, to provide mandatory health and safety training to their mine workers and to the preference of many of these companies for conducting this training with in-house staff rather than relying on external training sources.

In interpreting the data in Table 5-2, allowance must also be made for varying practices in different companies concerning extent of use of outside training consultants and instructors or staff detailed from other company organizations to support the training function. As noted in one recent survey, based on extensive field visits, "The training director often receives support in the form of instructors and course-material development from other company organizations such as safety, industrial engineering, or maintenance when the company is

very large." In contrast, in small mine operations, "the training director, safety engineer, foreman, mine manager, superintendent, and owner could be the same individual (5)."

CATEGORIES OF TRAINING PROGRAMS

A number of possible criteria are available for classifying the wide range of training or educational-assistance programs provided by coal companies to their employees. These include:

- occupational categories of personnel trained (e.g., entry-level miners, skilled miners, foremen, technicians, management, or professional-level personnel).
- whether or not the course is mandatory under federal or state mine safety laws.
- training objective (e.g., initial skill training, advanced or specialized training, certification test preparation).
- training methods (e.g., on-the-job, classroom training).

The classification scheme adopted for The Board's detailed company-level questionnaire incorporates elements of all of these criteria. It was developed in consultation with key coal industry training officials in an effort to be as comprehensive as possible within the limits imposed by the need to obtain adequate response rates to a voluntary, mail survey schedule. Following is a description of these training categories.

1. Miner Health and Safety Training -- This includes the initial orientation courses for newly hired miners and the annual refresher training which must be provided to all miners under the provisions of the Federal Mine Health and Safety Law,

as amended in 1977, and under various state mine safety laws. These are designed to instruct all underground mining personnel as well as all surface mining employees engaged in production, equipment maintenance, and similar functions on the health and safety aspects of the mining environment.

2. Miner Skills Training -- In accordance with common industry usage, "skills training" refers to training provided to miners which is designed primarily to instruct them on the technical aspects of their occupation under a systematic program of instruction. Separate data on skills training were requested in The Board's detailed questionnaire for two major occupational groups: maintenance mechanics or electricians and equipment operators and other hourly-paid employees. For each of these categories, respondents were further requested to provide breakdowns of their training activity to differentiate between initial skills training, i.e., courses designed to qualify employees for entry into these occupations; upgrade training, i.e., courses provided to experienced workers to qualify them for jobs at higher-skill levels or to train them on new equipment and procedures; and skills certification training, i.e., courses provided to employees to assist them in passing written tests required to obtain state certificates of skill qualification in certain mining occupations, such as underground mine electricians and shot firers.

In view of the traditional industry practice of reliance upon informal on-the-job training or learning experiences for acquisition of most mining skills, respondents were also asked to differentiate -- in the case of initial skills training programs -- between those providing for on-the-job (o.j.t.) training only and those involving a combination of classroom training and o.j.t. The latter courses could be presumed to be part of a formal, or systematic, training program.

On-the-job training, defined as training during which the student actually performs operational tasks in the mine, may also be an acceptable method of systematic training if it is based on a structured program of instruction conducted by qualified instructors. However, in the absence of other information, training based entirely on o.j.t. methods was considered as less likely to be part of a formal training program.

3. Foreman Training -- Three types of foreman training courses were separately identified in the detailed company questionnaire: general supervisory training, which typically includes a broad range of subject matter relevant to the duties of a foreman, such as personnel supervision or human relations techniques, labor relations, management records and reports, and safety and health regulations; specialized courses in supervisory skills, which focus on one or more aspects of the foreman's duties; and training for foreman certification tests, designed to assist foremen, or potential foremen, to pass required state certification tests. In view of the observed pattern of offering the same general supervisory training and specialized courses to both newly-appointed and more experienced foremen, no attempt was made to differentiate between courses for these two categories of personnel.
4. Training and Educational Programs for Other Salaried Personnel -- Two additional categories of training were specified in the questionnaire: management training courses, for levels above chief foreman and for professional staff, and technician training, for such salaried positions as dust analyst or environmental technician. Supplemental information was also requested on types of educational assistance provided to managerial and staff personnel and on extent of participation in co-operative educational programs, with 2-year or 4-year colleges.

An abbreviated version of the above classification scheme was used in the abridged schedule, which was addressed to companies -- other than the largest 50 companies in terms of tonnage -- which had failed to respond to the more detailed questionnaire. The following categories of training were separately identified:

- Health and safety training
 - Orientation training for newly-hired miners
 - Refresher training
- Skills or task training
 - Mandated task training to comply with health/safety law
 - Other non-mandated training in miners' skills
 - For maintenance mechanics or electricians
 - For equipment operators or other hourly-paid workers
- Foreman or supervisory training
- All other training

Although the specification of types of courses in the abridged schedule was generally less detailed with respect to skills training and foreman courses, this classification differed from that followed in the original company questionnaire in differentiating, for skill-training programs, between "mandated task training" and other non-mandatory skills training courses. Under the Federal Mine Health and Safety Act of 1977, miners newly assigned to operate certain mining equipment or to blasting operations must receive training on the health and safety aspects of these tasks, including some supervised practice during non-production periods. Unlike other aspects of these regulations, the length and content of such training are not specified; hence, this may be accomplished in relatively brief on-site training sessions, provided that the training is given by a qualified person. In order to avoid possible confusion between this type of training and other (non-mandatory) skills training courses, task training was separately identified in the abridged questionnaire.

Although the original company questionnaire did not make this distinction, it did request respondents in companies which offered "no training for miners except the required health and safety training" to indicate the most important reason for not providing any non-mandatory training. A number of companies which had reported that they provided some skills training to their miners also responded to the latter question, thus implying that the skills training was limited to the required training in the health and safety aspects of these tasks.

EXTENT OF CURRENT INDUSTRY TRAINING PROGRAMS

Information on the extent of coal company training activities was provided by responses to two types of questions included in The Conference Board questionnaires. The first requested respondents to identify the types of training currently offered by their company to its employees, whether provided at a company mine or other company facility, or at a local school or other location. The second -- included only in the detailed company questionnaire -- requested the numbers and percentages of employees actually trained under these programs during the past year.

1. Types of Training Provided -- Table 5-3 shows the percentage of responding companies who reported that they were currently providing the various major types of training to their employees, by company-employment size group. Although summary percentages for all responding companies are shown in this and succeeding tables, it should be noted that these percentages are not necessarily representative of the coal mining industry as a whole because of the differential survey response rates by company size and because of the exclusion of small companies, with less than 300,000 tons, from The Board's survey coverage.

Table 5-3

PERCENTAGE OF COMPANIES PROVIDING SPECIFIED TYPES OF TRAINING, BY EMPLOYMENT SIZE GROUP

Type of Training	Total	2500 or More Employees	500 to 2499 Employees	200 to 499 Employees	Less than 200 Employees
Number of Companies Responding*	91	12	27	23	29
<u>Percent Providing Training</u>					
Mandatory Health & Safety Training:					
Miner Orientation**	95%	100%	93%	96%	93%
Refresher Training	100	100	100	100	100
Non-mandatory Training:					
Foreman Training	82	100	93	83	66
Miner Skills Training***	55	83	54	70	38
Management Training	54	92	56	57	34
Technician Training#	55	91	50	63	20

*Based on consolidated responses to detailed and abridged company questionnaires.

**Includes training for newly-hired experienced or inexperienced miners. All companies reported that new miner orientation was available to their newly-hired employees. However, five companies reported that this training was not offered directly by their company but was provided at local schools or other facilities.

***Based on responses to questions concerning provision of formal skills training for miners other than required health and safety training. (Q. 19, detailed company questionnaire; Q. 3, abridged questionnaire.)

#Based on responses to detailed company questionnaire only.

Source: U.S. Department of Energy from the Conference Board Survey

Since the regulations governing miner health and safety training under the Federal Mine Health and Safety Act of 1977 had been issued in October 1978, about one year before The Conference Board's survey, it was expected that all reporting companies would be providing the types of training mandated under this Act. These expectations were generally confirmed. However, although all respondents indicated that they were providing the 8-hour annual refresher training required for experienced miners, five of the 91 companies indicated that the orientation training required for newly-hired miners was not offered by the company directly, but was provided to applicants for mining jobs at local schools or other facilities. Miner orientation courses which conform to the MSHA training standards are now offered extensively by vocational or technical schools in mining communities in states such as West Virginia and Kentucky. Hence, a number of the smaller mining companies have been in a position to rely exclusively on this source of initial orientation for their newly hired miners.

Among the four major categories of non-mandatory training, foreman supervisory training courses were most frequently reported as being provided by the responding companies. Some type of foreman training was reported as being currently offered by over 80 percent of all responding companies, with frequencies ranging from 100 percent in the case of companies with 2500 or more employees, to 66 percent for companies with less than 200 employees. The relatively high proportion of companies currently providing some formal training to their foremen can be attributed to several related factors: the increased responsibilities of the mine foremen for such functions as compliance with health and safety regulations and for labor relations, in addition to their primary production-related tasks; the upgrading of many younger, less-experienced miners to foreman positions in recent years; and the need to provide training assistance to these

personnel for the certification tests now required in all coal mining states. It should be noted, too, that our reporting sample included a number of relatively new and expanding companies whose training programs for foremen were designed to provide skilled cadres for future mine expansion as well as for current operations.

2. Employee Participation in Training -- A second measure of the incidence of non-mandatory training is provided by the ratio of the number of employees who completed formal training courses, in each major occupational group, to the number of employees available for such training during the period of July 1978 -- June 1979. For this purpose, data were provided by 43 of the companies responding to the Board's detailed questionnaire on the number of personnel trained during this period, in each course category, as well as on the number of personnel who were on the companies' payrolls for all or part of this period. The latter, which we have defined as the companies' "work force," included both those employed on June 30, 1978, and those hired during the following 12-month period. These training ratios are shown in Table 4 for each of the major training program categories other than basic health and safety training. Since the same employee may have completed more than one formal training course during this 12-month period, the ratios shown are higher -- to some extent -- than the proportion of employees who received such training during this period. Nevertheless, these ratios probably provide a realistic indicator of the relative opportunities for formal training among employees in the major coal mining occupational groups.

Table 5-4

NUMBER OF EMPLOYEES COMPLETING SPECIFIED TRAINING COURSES
PER 100 IN WORK FORCE, BY OCCUPATIONAL CATEGORY: JULY 1978-JUNE 1979*

<u>Occupation/Course</u>	<u>All Responding Companies</u>	<u>Companies With 2500+ Employees</u>	<u>Companies With Less Than 2500 Employees</u>
<u>Managerial, Professional and Technical Employees</u>	13	13	14
<u>Foremen:</u>			
General Supervisory Training	31	23	51
Specialized Courses	21	20	24
Certification Test Courses	16	10	33
<u>Maintenance Mechanics/Electricians</u>			
Initial Skills Training**	10	8	13
Upgrade Training	25	23	28
Certification Test Courses	6	6	8
<u>Equipment Operators and Other Skilled Production Workers</u>			
Initial Skills Training**	4	2	10
Upgrade Training	6	5	10
Certification Test Courses	5	4	8

*Based on responses by 43 companies completing detailed company questionnaires. The work force available for training includes those employed at beginning of period and new hires during period. Since some employees completed more than one course during year, the ratios shown in this table are generally higher than the percentage of workers receiving training.

**Excludes on-the-job training only.

Source: U.S. Department of Energy

Based on these criteria, the greatest concentration of formal training effort has been in two occupational categories: mine foremen and skilled maintenance mechanics or electricians. For all responding companies, 31 per 100 foremen completed general supervisory training courses; 21 per 100 completed more specialized courses in supervisory skills; and 16 per 100 were provided with training to assist them in taking the foreman's certification test. Among maintenance mechanics and electricians, 25 per 100 received some upgrade training; 10 per 100 received initial skills training; and 6 per 100, certification courses. In contrast, much smaller ratios of miners (about 4 to 6 per 100) received any formal training courses in equipment operation or other mining skills during this period. These data thus tend to confirm that the typical practice followed by most mining companies continues to be to rely upon more informal on-the-job training methods in most of these less-technical occupations, except where more formal training may be required to meet state certification requirements.

Data were also requested on the number of salaried personnel who received training in any management or technical courses during the previous year. The incidence of such training was also found to be relatively low, corresponding to 13 per 100 employed in the salaried work force other than foremen or clerical personnel.

Training rates among responding companies were found to be consistently lower among the largest companies, those with 2500 or more employees, than among companies with fewer employees. These differences are due in part to the lower personnel turnover and hiring rates among responding companies in the largest-size group. Thus, as shown in Table 5-5, hiring rates of production workers for the

Table 5-5

WORK FORCE AVAILABLE FOR TRAINING AND HIRING RATES, IN RESPONDING COMPANIES
BY OCCUPATIONAL CATEGORY AND SIZE GROUP: JULY 1978-JUNE 1979*

	Occupational Category		
	Production Workers	Foremen	Managerial/Professional/ Technical Employees
<u>Total Responding Companies</u>			
Employment, 6/30/78	78,461	9,702	7,235
New Hires, 7/78-6/79	9,367	696	901
Work Force 7/78-6/79	87,828	10,398	8,136
Hiring Rate**	11.9%	7.2%	12.5%
<u>Companies With 2500 or More Employees</u>			
Employment, 6/30/78	59,107	7,250	5,566
New Hires, 7/78-6/79	6,243	376	663
Work Force 7/78-6/79	65,350	7,626	6,229
Hiring Rate**	10.6%	5.2%	11.9%
<u>Companies With Less Than 2500 Employees</u>			
Employment, 6/30/78	19,354	2,452	1,669
New Hires, 7/78-6/79	3,124	320	238
Work Force 7/78-6/79	22,478	2,772	1,907
Hiring Rate**	16.1%	13.1%	14.3%

*Based on responses by 43 companies, including 11 with 2500 or more employees and 32 with less than 2500 employees in June 1979.

**New hires as percent of employment on June 30, 1978.

Source: U.S. Department of Energy from the Conference Board Survey

latter companies average 10.6 percent in the period July 1978 -- June 1979, as compared to 16.1 percent among those with less than 2500 employees. This inverse relationship between company size and personnel turnover is a common pattern in most intra-industry comparisons and can be attributed in part to the fact that larger companies normally offer more opportunities for advancement and job shifting within the same firm than do smaller companies. In turn, companies with lower hiring rates have a correspondingly lower requirement for training of new or recently-hired personnel, who comprise a major component of the training load in most companies.

In interpreting these training ratios, it should be noted too that the 32 companies with less than 2500 employees who provided these detailed training statistics consisted mainly of relatively large or medium-sized companies with specialized training units or staff. These companies employed an average of about 750 employees in 1978, as contrasted to an average employment of about 500 in the 44 companies which returned the abridged questionnaires only. Hence, the training ratios in Table 5-4 are not representative of the extent of non-mandatory training being provided by most of the smaller companies in the industry.

3. Course Lengths -- Data on length of the training courses offered to miners and mine foremen were provided by 35 responding companies, with respect to 58 relatively large mines operated by these companies. With few exceptions, the course lengths reported for health and safety orientation of newly-hired miners and for annual refresher training of experienced miners corresponded to those mandated under the Mining Safety and Health Act of 1977, or under applicable State laws, if tougher. Among the exceptions noted were two mines which reported initial miner orientation course lengths of 120 hours and 96 hours, respectively,

as compared to the statutory requirement of 80 hours in the states where these mines were located. Such longer courses, however, normally combine some initial training in basic mining skills with the mandated health and safety curriculum content.

Of the total of 58 mines included in The Conference Board sample, 80 percent offered some formal training for foremen and skilled maintenance occupations. In contrast, only about 30 percent of these mines provided any formal skills training to equipment operators or other production workers, other than on-the-job training. The much lower frequency of formal skills training for these mine production workers is thus consistent with the data based on company-wide incidence of training shown in Table 5-4.

The median lengths of the various skills and supervisory training programs offered at the reporting mines are shown in Table 5-6. The extent of variability in course lengths for each category of training has been illustrated by the inter-quartile range, which measures the range in course length for reporting mines in the middle half of the frequency distribution. Based on these statistical measures, initial skills training courses for mine maintenance mechanics or electricians were both the longest in average duration, with a median length of 200 hours or five weeks, and the most varied in terms of course length as measured by an inter-quartile range of three days to 48 weeks for the 31 mines which provided such courses in the previous 12-month period.

These contrast with much shorter course lengths in all other categories of skills or supervisory training courses as illustrated by median course durations of only two days for initial skills training of equipment operators, about three

Table 5-6

MEDIAN COURSE LENGTHS FOR MINERS AND FOREMEN BY TYPE OF TRAINING COURSE

<u>Type of Training Course</u>	<u>Number of Reporting Mines Offering Course</u>	<u>Course Length (Hours)</u>	
		<u>Median</u>	<u>Inter-Quartile Range</u>
<u>Foreman Training</u>			
General Supervisory Training	44	19	10-40
Specialized Courses	37	40	16-60
Certification Test Courses	35	40	15-90
<u>Skills Training for Maintenance Mechanics/Electricians</u>			
Initial Skills (Classroom Combined with O-J-T)	31	200	24-1920
Upgrade Training	45	10	8-24
Certification Test Courses	36	80	40-80
<u>Skills Training for Equipment Operators/Other Hourly Workers</u>			
Initial Skills (Classroom Combined with O-J-T)	17	16	8-24
Upgrade Training	16	8	8-12
Certification Test Courses	17	11	8-48

Source: U.S. Department of Energy from The Conference Board Survey, Mine Questionnaire. Based on 58 responses to the mine questionnaires.

and one-half days for general supervisory training courses for foremen, and of two weeks for special training courses for maintenance mechanics designed to assist them in meeting state certification test requirements.

Several factors have contributed to the much greater length and variability of the initial skills training programs provided for skilled maintenance workers:

(1) Skilled maintenance jobs -- which tend to be the most "technical" of the occupations performed by hourly-paid personnel -- require both a knowledge of basic electrical or mechanical principles and procedures, as well as practical "hands-on" training under actual or simulated operating conditions. Prior to enactment of the Federal Mine Safety and Health Act of 1969 and of subsequent certification requirements under the various state mining laws, most of this training had apparently been provided (often inadequately) by informal "buddy system" arrangements, under which a new worker assigned to a maintenance crew would be paired with an experienced mechanic with the expectation that the latter would teach him his trade over some period of time. However, the progressive shortage of experienced mechanics in the early 1970's, combined with the more stringent certification standards established by the 1969 Act and under subsequent state certification requirements, stimulated the development of more systematic training programs for these skills by many of the larger mining companies. Such programs (characteristic of the upper quartile of our course-length distribution) often provide for total training periods of one year or more and include carefully structured programs of formal classroom training, combined with closely supervised on-the-job training (6). The total length of the training programs, as reported by these companies, therefore includes both periods of formal classroom training, which typically range from two to four

months, and of supervised on-the-job training and work experience, while in an apprentice or "trainee" status.

(2) In contrast to these highly structured training programs, it is apparent that other mining companies continue to rely primarily either on recruitment of previously trained mechanics or on more informal job training methods for initial skills training, supplemented by relatively short training courses on specific equipment or procedures. The relatively short formal course lengths of one or two days reported by the lowest quartile of our mine sample are probably typical of the latter programs.

(3) In addition to these basic differences in training policy, the reported variations in training course lengths for initial maintenance skills training among the reporting mines has probably been affected by definitional differences: some company training officials apparently defined the length of their training program to include only the formal (classroom) training period, whereas others included the entire period in a "trainee" or apprenticeship status.

4. Employee-Hours of Training Provided -- A more comprehensive measure of the extent of training investment by coal mining companies is provided by the total employee-hours of training provided per year to various categories of employees. Such estimates were derived from the Board's mine survey data as the product of the number of personnel who received formal training in the previous year in these mines and the median course lengths for each course category. The use of the median, rather than the mean, was designed to reduce the effect of extreme variations in reported course lengths due to inclusion of lengthy periods of on-the-job training in some company reports, notably in the case of initial skills training for mechanics. These training employee-hours data are limited

to programs for production workers and foremen, excluding courses for managerial, professional, or other salaried personnel which are normally conducted on a company-wide or regional basis rather than at individual mines.

Despite the variety of training courses offered to coal mining employees, the summary data in Table 5-7 indicate that only about 1.5 percent of total available production worker hours was devoted to some form of company-sponsored training, of which nearly half was devoted to basic health and safety training. A very large proportion of the remaining production-worker training hours consisted of training courses provided to mine mechanics and electricians, including initial skills training and upgrade training courses as well as courses designed to prepare them to meet state certification requirements. The emphasis placed upon foreman training at these mines is indicated by the higher percentage of foreman working time (2.3%) devoted to supervisory training, including general supervisory training, specialized foreman training courses, and foreman certification test courses.

Regionally, the mine survey data indicate a much higher allocation of employee time to training activities among mines in the Central and Western Regions (combined) than among reporting mines in the Eastern, or Appalachian, coal mining region. The percentages of training time for production workers and mine foremen among mines west of the Appalachian Region were estimated as at least twice as great as among Eastern mines, primarily due to a much higher investment in maintenance skills training and in foreman training programs.

These regional differences are due in part to the fact that recent coal mine employment growth and hiring activity have been heavily concentrated in the

Table 5-7

ESTIMATED EMPLOYEE HOURS IN TRAINING STATUS, AS PERCENT OF AVAILABLE WORKING TIME, BY REGION,
MINE SURVEY: JULY 1978-JUNE 1979

	Total, U.S.		East		Rest of U.S.	
	Employee- Hours (000)	Percent	Employee- Hours (000)	Percent	Employee- Hours (000)	Percent
<u>Production Workers</u>						
Total Hours Available*	<u>35,902</u>	<u>100.0</u>	<u>24,672</u>	<u>100.0</u>	<u>11,231</u>	<u>100.0</u>
Training Hours**						
Health and Safety	253	0.7	162	0.7	91	0.8
Maintenance Skills	227	0.6	102	0.4	125	1.1
Equipment Operator Skills	43	0.1	13	0.1	29	0.3
TOTAL	<u>523</u>	<u>1.5</u>	<u>277</u>	<u>1.1</u>	<u>245</u>	<u>2.2</u>
<u>Foremen</u>						
Total Hours Available*	<u>4,482</u>	<u>100.0</u>	<u>3,144</u>	<u>100.0</u>	<u>1,338</u>	<u>100.0</u>
Training Hours**	103	2.3	49	1.6	54	4.0

Source: U.S. Department of Energy from The Conference Board Mine Survey.

*Estimated on basis of 1735 hours per employee in bituminous coal mining in 1979, as reported in Mine Injuries and Worktime, January-December 1979. U.S. Department of Labor, Mine Safety and Health Administration, Table 1.

**Estimated as product of number of employees trained and median course lengths in each course category.

Western regions. Thus during the 12-month period ending in June 1979, employment among surveyed mines in the Western regions (7) increased by 8.7 percent, as compared to a net reduction of 3.5 percent among reporting mines in the East. (Table 5-8.) During this period, the number of newly-hired miners and foremen corresponded to about 20 percent of average employment in the Western mines, as compared to a hiring rate of 9.5 percent in the East. Moreover, in view of the much more restricted supply of experienced miners in the former region, over two-thirds of all newly-hired personnel in Western coal mines had no previous coal mining experience, as compared to less than one-half of new accessions in the East. Hence, the expanding Western coal mining regions accounted for a disproportionately large share of the industry's total requirement for initial training of new personnel during this period.

Several other factors probably have contributed to this sharp inter-regional contrast in company training activity. First, a relatively large proportion of the mines in the Western coal mining industry is controlled by large corporations which have had well established corporate training capabilities, as well as a strong commitment to internalized training programs, in contrast to the more traditional attitudes toward training still found among many of the older and smaller companies in the Appalachian region. The much heavier capitalization of many of the large Western surface mining operations has also placed a premium on development of a highly skilled and versatile career work force, to minimize equipment down-time and to maintain high productivity rates. Finally, the external training resources available for training, including voc-tech schools and the extension services of university mining engineering departments, are much more extensive in the Eastern mining states, such as West Virginia, Pennsylvania, and Kentucky, than in many of the newer and more scattered Western mining communities.

Table 5-8

AVERAGE EMPLOYMENT AND PERSONNEL TURNOVER RATES BY REGION,
MINE SURVEY: JULY 1978-JUNE 1979

	<u>Total, U.S.</u>	<u>East</u>	<u>Rest of U.S.</u>
<u>Employment (Production Workers and Foremen):</u>			
June 30, 1978	21,146	14,730	6,416
June 30, 1979	<u>21,184</u>	<u>14,211</u>	<u>6,973</u>
Percent Change	0.2%	-3.5%	8.7%
<u>Accessions per 100 Employees*</u>			
Total Accessions	<u>12.8</u>	<u>9.5</u>	<u>20.1</u>
Inexperienced Miners	7.5	4.4	14.2
Experienced Miners and Foremen	5.3	5.2	5.9
<u>Separations per 100 Employees*</u>	<u>13.6</u>	<u>13.8</u>	<u>13.1</u>

Source: U.S. Department of Energy from The Conference Board Mine Survey.
Excludes four companies which did not report accessions or separation data.

*Based on average of employment in June 1978 and June 1979.

A more detailed distribution of training hours, by type of course, is presented in Table 5-9. Mandatory health and safety training, exclusive of task or hazards training, account for about 40 percent of total training hours in the surveyed mines. An additional 12 percent of training time was allocated to special training courses to assist miners and foremen to meet state certification test requirements. Thus, over one-half of total training time of mine-based personnel was directly related to meeting Federal or State health and safety standards. Of the remaining categories of training, initial skills training programs for mechanics and electricians, including a substantial component of on-the-job training, accounted for the greatest proportion of employee training hours, followed by supervisory training programs. Formal skills training courses for equipment operators and other mine production workers, other than those designed to meet certification test requirements, accounted for less than 5 percent of total training hours.

TRAINING FACILITIES AND RESOURCES

The recent growth of coal industry training requirements has been accompanied by a proliferation of training sources and providers designed to assist coal companies and their employees in meeting these training needs. Among external sources available to coal companies for this purpose have been community-based educational institutions, such as vocational high schools, community colleges, and university extension programs; Federal agencies, such as the Labor Department's Mining Safety and Health Administration and the Federal Mediation and Conciliation Service; State mining departments; mine-equipment manufacturers; and other companies providing special training programs or consultant

Table 5-9

ESTIMATED TRAINING EMPLOYEE-HOURS FOR PRODUCTION WORKERS AND FOREMEN IN RESPONDING MINES,
BY TYPE OF COURSE AND REGION: JULY 1978-JUNE 1979

Training Course	Total, U.S.		East		Rest of U.S.	
	Training Employee- Hours*(000)	Percent Distribution	Training Employee- Hours*(000)	Percent Distribution	Training Employee- Hours*(000)	Percent Distribution
<u>Health and Safety</u>						
New Inexperienced	59.0	9.4	28.6	8.8	30.4	10.1
New Experienced	8.1	1.3	5.5	1.7	2.6	0.9
Annual Refresher	186.4	29.8	128.2	39.3	58.2	19.4
TOTAL	253.5	40.5	162.3	49.8	91.2	30.4
<u>Mechanics/Electricians Skills</u>						
Initial	162.0	25.9	64.6	19.8	97.4	32.5
Upgrade Courses	28.2	4.5	12.8	3.9	15.4	5.1
Certification Courses	36.7	5.9	24.2	7.4	12.5	4.2
TOTAL	226.9	36.3	101.6	31.2	125.3	41.8
<u>Equipment Operators Skills</u>						
Initial	18.1	2.9	1.3	0.4	16.9	5.6
Upgrade Courses	10.8	1.7	5.5	1.7	5.2	1.7
Certification Courses	13.7	2.2	6.4	2.0	7.3	2.4
TOTAL	42.6	6.8	13.2	4.0	29.4	9.8
<u>Foreman</u>						
General Supervisory	32.4	5.2	18.2	5.6	14.2	4.7
Specialized Courses	45.8	7.3	17.3	5.3	28.5	9.6
Certification Courses	24.5	3.9	13.4	4.1	11.1	3.7
TOTAL	102.6	16.4	48.9	15.0	53.7	17.9
Total, production worker and foreman training	625.6	100.0	326.0	100.0	299.6	100.0

Source: U.S. Department of Energy from The Conference Board Survey Mine Questionnaire. Data based on responses by 58 mines in 35 companies.

*Estimated as product of number of employees trained and of median length of course in each category.

services; and coal industry trade associations. Some larger coal companies have also provided training or training materials to other coal mining companies or have engaged in joint training activities. Several questions in the Board's survey were designed to obtain information on the extent of use of these various resources, including data on the type and location of facilities used for training, instructional staff, and sources of the training materials used in company-operated training programs.

1. Training Facilities -- Data on types of facilities used for company-sponsored training programs were obtained from both the Company and Mine Surveys. Since the types of training facilities used are likely to vary among company mines, depending upon local conditions, respondents to the company survey were requested to identify all types of facilities used by their company for particular categories of training. As shown in Table 5-10, based on consolidated responses from both the detailed and abridged questionnaires, a large proportion of responding companies reported that they relied on their own company facilities for all, or part, of their training programs. Some use of local schools or other external facilities was also reported by about 40 percent of all reporting companies. However, based on supplemental data provided, it is evident that the latter sources have played a secondary, or specialized, role in most coal company training programs.

A breakdown by type of company facility used is available from responses to the detailed company questionnaire. (Table 5-11.) Among the various types of training facilities or locations listed, an above ground facility at the mine site is most frequently used for basic health and safety training courses. Miner skills training programs are most frequently conducted in actual sections of the mine.

Table 5-10

PERCENTAGE OF COMPANIES USING COMPANY FACILITIES OR
EXTERNAL TRAINING FACILITIES, BY TYPE OF TRAINING

<u>Type of Training</u>	<u>Number Reporting</u>	<u>Percentage Using</u>		
		<u>Company Facilities Only</u>	<u>External Facilities Only</u>	<u>Both Types of Facilities</u>
Health & Safety	88	68%	7%	25%
Miners Skills	81	72	0	28
Foreman	78	73	15	12
Technician*	24	46	29	25

Source: The U.S. Department of Energy from The Conference Board Company Survey.
Based on consolidated responses to detailed and abridged questionnaires.

*Included in detailed company questionnaire only.

Table 5-11

PERCENTAGE OF COMPANIES USING SPECIFIED TYPES OF
TRAINING FACILITIES, BY TYPE OF TRAINING PROGRAM*

<u>Type of Facility</u>	<u>Type of Training</u>		
	<u>Health & Safety</u>	<u>Miners' Skills</u>	<u>Foreman</u>
<u>Company Facilities:</u>			
Above ground, at mine	65%	58%	51%
Mine Section	21	73	24
Facility away from mine	47	24	59
<u>Local Educational Institution</u>	30	15	16
<u>Simulated Mine</u>	2	3	--

Source: U.S. Department of Energy from The Conference Board Survey.
Detailed questionnaire.

*Percentages add to more than 100 percent due to use of both types of
facilities in some companies.

reflecting the strong emphasis on practical training in such courses. Foreman training, on the other hand, is most frequently given at either a company facility away from the mine or in a surface facility at the mine site.

The pattern of primary reliance upon internal programs and facilities, reflected by these data, is characteristic of all company size groups covered by The Board's survey. However, smaller companies are somewhat more likely to rely on local schools for a portion of their maintenance skills training program.

2. Instructional Staff -- The types of personnel used as instructors in company training programs can be expected to vary, depending upon the scale of a company's training activities and the need for specialized competencies for certain types of training courses. The major options available to company training managers are: (1) use of full-time company instructors, (2) use of other company employees, such as foremen, as part-time instructors, or (3) use of non-staff personnel as instructors for particular courses, on either a full-time or part-time basis.

As shown in Table 5-12, based on responses to the detailed company questionnaire, nearly all responding companies utilize full-time instructional staff in their health and safety training courses, supplemented by use of other employees or outside instructors in some companies. The standardized content of health and safety or refresher courses, as well as the relatively large training loads, have made it feasible for nearly all large and medium-sized companies to employ at least one full-time instructor for this category of training.

Table 5-12

TYPES OF COMPANY INSTRUCTIONAL STAFF USED IN
COMPANY-PROVIDED TRAINING PROGRAMS

<u>Type of Instructor</u>	<u>Percent Utilizing Specified Type of Instructors in:*</u>		
	<u>Health and Safety Training</u>	<u>Skills Training</u>	<u>Foreman Training</u>
Full-time Company Instructors	95	59	76
Other Company Employees	43	73	49
Outside Instructors	26	24	41

Source: U.S. Department of Energy from The Conference Board Company survey. Based on responses to detailed questionnaire by 42 companies providing some training at own facilities.

*Percentages add to more than 100 percent since companies may use more than one type of instructor.

Skills training and supervisory training programs, however, have relied to a greater extent upon use of non-specialized instructional personnel or of outside instructors for all or part of the course. Thus about 70 percent of the companies providing formal skills training for their mechanics or mine operatives reported some use of other company employees, such as foremen, in this training, as compared to fewer than 60 percent which reported use of full-time instructors. Reliance on other employees or outside instructors was more typical of companies with less than 2000 employees than those in the largest size group.

Although about three-fourths of reporting companies reported that full-time instructors were used in their foreman training programs, nearly one-half also used other company employees in these courses, and 40 percent reported some use of outside instructors. From collateral data, it is probable that outside instructors were more likely to be used in company-sponsored courses designed to prepare foremen for the state certification tests, or for specialized technical subjects, than for general supervisory training.

3. Training Materials -- The types of instructional materials used in coal mine training can vary widely, from simple course outlines and related text materials in some classroom-based courses to elaborate systems of programmed instruction, supplemented with visual aids, films, mock-ups, and simulators in the more sophisticated and technical programs. Since development of these supporting materials can be a costly investment, most company managers rely to some extent upon external sources to supplement their in-house capabilities.

In response to the question: "Who produced the materials used in your programs?" over 80 percent of the companies responding to the Board's detailed company questionnaire indicated that these materials had been developed internally by the company for each of the major training program categories. However, supplemental use was also made of other, externally-developed training materials, by nearly all of these companies. Table 5-13.)

Materials prepared by government agencies, such as MSHA or state mining departments, were most frequently used by company training managers in their health and safety training courses, and -- to a lesser extent -- in foreman training. On the other hand, company skills training programs relied much more extensively upon materials developed by vendors or equipment manufacturers. About one-fourth of the companies reported that some of their health and safety and skills training materials were developed jointly with other firms in the industry. A smaller proportion reported use of materials recently developed by trade associations, such as the National Coal Association and the Bituminous Coal Operators Association. Relatively limited use has been made of outside consultants in development of company training materials, with the exception of foreman training, where over one-fourth of the responding companies reported some use of consultants' services.

As would be expected, the extent of reliance upon external training materials varies inversely with size in all training program categories. The smaller companies in the Board's responding sample report relatively greater utilization of available government materials, vendor-prepared materials, and

Table 13

SOURCES OF COMPANY TRAINING MATERIALS BY TYPE OF TRAINING PROGRAM

<u>Source</u>	<u>Percent of Companies Using Source*</u>		
	<u>Health & Safety</u>	<u>Miners' Skills</u>	<u>Foreman</u>
<u>Developed by Company:</u>			
By own staff	82%	81%	86%
Jointly with other firms	25	24	19
Consultant assistance	7	8	28
<u>Government Agency</u>	73	24	44
<u>Vendor/equipment manufacturer</u>	34	62	28
<u>Trade Association</u>	16	19	11

Source: U.S. Department of Energy from The Conference Survey. Detailed questionnaire.

*Percentages add to more than 100 percent due to use of multiple sources.

materials developed jointly with other firms than the larger companies, which more frequently are in a position to rely upon their internal resources to meet these needs.

COMPANY POLICIES ON SUPERVISORY TRAINING

In view of the general recognition of the importance of adequate supervisory training, as a key to both improved health and safety and productivity in the coal mining industry, the Board's survey included a number of additional questions designed to gauge the degree of company emphasis upon supervisory training. Specific criteria used were: (1) subjects covered in general supervisory training courses; (2) whether such courses were mandatory for newly-assigned foremen; and (3) whether the company directly subsidized foreman certification training.

As shown in Table 5-14, a large proportion of all companies responding to the Board's questionnaire had reported that they provide some formal training to their foremen. Of five specified subjects listed, the subject most frequently cited -- by nearly 90 percent of these companies -- was training in health and safety regulations, thus suggesting that compliance with the regulations was a primary concern in offering foreman training courses in many of these companies. Training in personnel supervision and labor relations was provided by about 70 percent of the companies, while procedures on management records and reports were covered in 60 percent. On the other hand, only about one-third of the companies included training in instructional methods as a part of their supervisor training program. Other subjects reported by some companies, although not

Table 5-14
PERCENTAGE OF COMPANIES INCLUDING SPECIFIED
SUBJECTS IN SUPERVISORY TRAINING COURSES

	<u>Percent</u>
Safety and Health Regulations	89
Personnel Supervision	73
Labor Relations	70
Management Records and Reports	61
Instructor Training	36

Source: U.S. Department of Energy from The Conference Board Company Questionnaire. Based on reports from 44 companies which provided some supervisory training.

separately itemized in the schedule, were communications and human relations training, training in technical/production-related subjects, and emergency medical technician (EMT) training.

Supervisory training, when available, is not necessarily required for all newly hired foremen. In response to the question: "Is there a company policy requiring that all newly selected foremen complete a supervisory training program?" less than half (45%) indicated that there was such a company policy. In all but a few companies with a foreman training requirement, this course could be taken either before or after assignment to supervisory duties. An additional one-fifth of the responding companies offered such training on a voluntary basis only, while about one-third of the respondents indicated that they did not offer a supervisory training course designed specifically for newly hired foremen, even though they offered some specialized foreman training.

Another useful indicator of company commitment to foreman training is the extent of support provided to their employees to prepare them for the State foreman certification tests. About three-fourths of the companies surveyed provided such training. However, a majority of these companies provided this training outside of regular working hours and -- with few exceptions -- did not provide any compensation to those attending these courses. The larger companies in the Board's sample, i.e., those with 2000 or more employees, were more likely to pay their employees attending this training than those with fewer employees. Over half of those in the largest size group offered this training during working hours, as compared to only about one-fourth of the responding companies with fewer than 500 employees.

TRAINING AND EDUCATIONAL ASSISTANCE FOR MANAGERIAL AND PROFESSIONAL EMPLOYEES

Company training for managerial and other personnel above the foreman rank may be provided in a number of ways -- through in-house training courses; through financial assistance for personnel attending specified courses at universities or other educational institutions; or through participation in cooperative educational programs, under which selected students enrolled in full-time mining engineering, mining technology, or similar degree programs are provided with periods of work experience by the company while receiving credit toward completion of their college-degree program. Since only very large companies could be expected to have specialized in-house training capabilities for managerial or professional-level staff, the Board's survey focused on some of the latter forms of educational or training assistance.

In response to a question concerning the types of educational assistance provided to managerial and staff personnel, the most common type of aid -- reported by about 80 percent of the companies -- was payment of tuition. Such aid was offered by nearly all of the large reporting companies (with 2000 or more employees). These results compare closely with those of The Conference Board's earlier 1975 survey of corporate training programs in all private industry, which found that well over 90 percent of corporations with 1000 or more employees and 82 percent of those with 500-999 employees had tuition-aid reimbursement programs. In contrast, more costly forms of educational assistance, such as time off for class attendance or paid educational leave for completion of degree programs were offered by much smaller percentages of the companies, 23 percent and 11 percent, respectively. In addition to the forms of educational aid specified in the survey questionnaire, some companies reported that they covered full costs for attendance

at professional seminars or conferences, or adjusted employee work schedules to facilitate course attendance.

Participation in cooperative educational programs, although not normally entailing direct educational outlays by the company, does involve a commitment to provide a meaningful work/training experience to students, typically in mining engineering programs, who combine periods of work experience (usually three to six months) with formal academic course work. Nearly all of the coal company personnel managers interviewed by project staff in the course of the project rated cooperative education programs highly as a method of screening and evaluation of potential recruits for their managerial staff. Over half (55%) of all companies surveyed reported that they participated in these programs and used them in management recruitment. This proportion varied directly with company size, from over 90 percent in the case of the large companies with 2000 or more employees to only one-fourth of those with fewer than 500 employees. Most of the participating companies reported that these students were assigned both to mine-level line positions and to staff positions in company offices.

METHODS OF EVALUATING TRAINING PROGRAMS

A variety of methods are available to managers of training programs to assess the effectiveness of the training process. These range from the traditional method of reliance on tests or completion of course-evaluation forms to performance-oriented criteria, such as performance evaluations of trainees by their supervisors and use of on-the-job demonstration check lists.

As shown in Table 5-15, the methods most frequently used vary significantly by type of training. Training programs which are typically classroom based, such as basic health and safety training courses or foreman training, are most likely to

Table 5-15

METHODS OF EVALUATING TRAINING PROGRAMS: PERCENTAGE OF COMPANIES
USING SPECIFIED METHOD, BY TYPE OF MINING

<u>Evaluation Method</u>	<u>Type of Training</u>		
	<u>Health & Safety</u>	<u>Miners' Skills</u>	<u>Foreman</u>
Oral/Written Tests	63%	54%	78%
Evaluation Forms:			
By Trainees	37	20	58
By Instructor	22	20	22
Performance Evaluation by Supervisor of Trainee	17	49	31
O-J-T Demonstration Check List	15	60	6

Source: U.S. Department of Energy from The Conference Board Survey.
Percentages add to more than 100 percent due to use of more than one
evaluation method by many reporting companies.

be evaluated through use of oral or written tests or through completion of a short evaluation form by the trainees. The latter is also a frequently used method in the case of foreman training programs. On the other hand, miners' skill training courses -- which include a much greater component of "hands-on" training -- are more frequently monitored through performance-oriented measures, such as demonstration check lists, in addition to use of pen and paper tests. Use of demonstration check lists was reported by 60 percent of all companies providing miner skills training and was particularly important in those skills for which "task training" is mandated under the current MSHA training regulations.

MANAGEMENT APPRAISALS OF TRAINING AND EDUCATION PROGRAMS

In addition to the specific course evaluation criteria described above, executives responsible for their companies' training programs normally have a variety of sources of information available to them on how well their own training programs, as well as external sources of training and education, are meeting their companies' needs. These include feedbacks from company operating officials, performance records such as trends in accident rates, productivity or "down-time," and the results of their own first-hand observations. Although training managers or other company personnel officials would not be expected to be completely unbiased observers of program performance, our interviews with the training managers of a number of the larger companies impressed us with their readiness to adopt a reasonably detached perspective in assessing the adequacy of their companies' current training activities.

Two questions were included in the Board's survey questionnaire to obtain these appraisals. The first question, included in both the detailed and abridged versions of the company questionnaire, asked respondents: "Overall, how satisfied

are you with each of the training programs below that are now available to your company's employees?" and requested ratings for each of the major types of training programs as "very satisfied," "satisfied," or "not satisfied." Similar ratings were also requested in the detailed company questionnaire with respect to each of a number of major external providers of training, such as vocational high schools, colleges and universities, federal or state agencies, and trade associations.

Based on the consolidated results of both the detailed and abridged questionnaire (Table 5-16), a majority of responding company officials indicated that they were either "satisfied" or "very satisfied" with each of the major categories of training offered by their company. However, whereas only 8 percent reported dissatisfaction with their company's health and safety training program, much higher proportions were dissatisfied with their various non-mandatory training activities. The percentages dissatisfied ranged from nearly one-half for foreman training to over 40 percent for management and technician and about one-third in the case of miner skills training programs.

A further perspective on the adequacy of current training programs as perceived by company training managers is provided by the comparison of responses to the detailed company questionnaire and to the abridged follow-up questionnaire. As shown in table 5-17, company training officials who responded to the Board's detailed questionnaire expressed much higher rates of dissatisfaction with all categories of non-mandatory training currently provided than did those responding to the follow-up abridged questionnaire. These differences in responses could not be accounted for by the objective characteristics of the training programs in these two groups of companies since the larger companies -- who accounted for a major proportion of the

Table 5-16

SATISFACTION WITH CURRENT COMPANY TRAINING PROGRAMS,
BY TYPE OF PROGRAM

<u>Training Program</u>	<u>Number of Responses*</u>	<u>Percent Distribution</u>		
		<u>Very Satisfied</u>	<u>Satisfied</u>	<u>Not Satisfied</u>
Health & Safety	89	31%	61%	8%
Skills	77	12	56	32
Foreman	76	16	36	49
Management	67	10	48	42
Technician**	25	4	52	44

Source: U.S. Department of Energy from The Conference Board Company Survey. Based on consolidated responses to detailed and abridged questionnaires.

*Excludes companies not providing specified type of training. Data on technician training limited to detailed company questionnaire.

Table 5-17

PERCENTAGE OF RESPONDENTS DISSATISFIED WITH SPECIFIED
COMPANY TRAINING PROGRAMS: DETAILED VS ABRIDGED QUESTIONNAIRES

<u>Training Program</u>	<u>Percent Dissatisfied</u>	
	<u>Detailed</u>	<u>Abridged</u>
Health and Safety	11%	4%
Skills	53	15
Foreman	70	25
Management	60	22

Source: U.S. Department of Energy from The Conference Board Company Survey.

*Based on 44 responses to detailed questionnaire and 45 to abridged questionnaire. Percent dissatisfied excludes companies not offering specified type of training.

respondents to the detailed questionnaire -- were much more likely to have systematic company-wide programs of training for supervisors, managers, and skilled mining occupations than were the smaller companies, which accounted for a large proportion of the respondents to the abridged questionnaire. It seems probable, rather, that the much higher dissatisfaction rates among the former respondents result from the fact that the latter consisted very largely of "training professionals" with full-time responsibility for their company's training activities, whereas the respondents to the abridged questionnaire were mainly either safety managers or persons in more general administrative or managerial positions -- rather than training specialists. Full-time training managers, understandably, are much more likely to have higher standards and expectations for their companies' training activities. Thus, the very high proportions of the latter expressing dissatisfaction with their current programs -- ranging from over 50 percent for miner skills training to 70 percent for foreman training -- suggest the existence of a wide gap between the current level of industry training activity and the levels of training considered desirable by training professionals. Despite the much lower overall levels of dissatisfaction reported in the abridged questionnaire, it is significant that between one-fifth and one-fourth of the latter respondents also expressed dissatisfaction with their current foreman and management training programs. The much higher levels of satisfaction with respect to basic health and safety training in both surveys can, in turn, be attributed to the fact that these programs are required to conform to uniform Federal or State standards and that an expression of dissatisfaction with the existing program by company officials might have been construed as a "vote" for still higher mandatory standards.

Since the available literature had highlighted the need for improved provision of managerial training in the industry, the Board's detailed questionnaire also

included a question designed to identify the skills or competencies which respondents considered most in need of strengthening among their companies' management or professional level employees. Four subject areas were listed: business management skills, labor relations skills, technical skills, and knowledge of mining laws and regulations. The subject most frequently listed, by over half of the respondents, was business management skills, with labor relations and related supervisory skills next in order of frequency. A large proportion of the respondents indicated, however, that their companies planned to introduce or increase training in all of the itemized management skill areas in the coming year.

Although no similar direct questions with respect to content in other types of training programs were included in the Board's questionnaire, an examination of the scope of current training activities of those companies whose training officials indicated dissatisfaction with the current program provided some insight as to the reason for such responses. For example, about one-half of those dissatisfied with current miner skills training programs also reported that their company either had no formal skills training program, or had a program limited to a few specialized mining skills. Similarly, nearly all of the companies whose respondents were dissatisfied with their managerial training activities had, in fact, trained very few, or no, management or professional personnel during the previous year.

In addition to rating their own company's training program, respondents were also asked to indicate their level of satisfaction with the various outside sources of training available to their company's employees. Of these external

resources, the most extensively used have been those provided by the Mine Safety and Health Administration of the Labor Department, formerly MESA, which -- since 1970 -- has provided educational assistance to coal mining companies through its published training films and other materials on various aspects of coal mining health and safety, through direct provision of safety training to safety specialists at its National Academy in Beckley, West Virginia, and through its field teams. Other forms of Federal government training assistance include the Department of Labor's CETA programs, designed to train unemployed workers in basic coal mining skills, as well as more specialized programs, such as the industrial relations courses provided by the Federal Mediation and Conciliation Service. Training assistance is also provided by State departments of mining or other State agencies in a number of coal mining states. These Federal or State government programs, however, received a relatively low overall rating by coal company training managers responding to the Board's survey. Only about one-half of the respondents whose companies utilized such programs indicated that they were "satisfied" or "very satisfied" with their results. (Table 5-18.) It is possible that the relatively high level of dissatisfaction with Federal or State governmental training assistance programs indicated by these responses stems, in part, from the dual role of government agencies, such as MSHA, as both enforcement or "policing" agencies and as providers of training assistance.

Training provided by educational institutions, such as vocational education courses and coal technology programs offered by community colleges or other institutions of higher education, received a much more positive rating by the respondents. About 80 percent indicated general satisfaction with these sources of training. However, very few of these respondents indicated that they were "very satisfied" with these academic-based programs.

Table 5-18

SATISFACTION WITH SPECIFIED EXTERNAL TRAINING SOURCES

<u>Training Source</u>	<u>Number of Responses*</u>	<u>Percent Distribution**</u>		
		<u>Very Satisfied</u>	<u>Satisfied</u>	<u>Not Satisfied</u>
Vocational High Schools	24	13%	63%	25%
Community Colleges	28	7	71	21
Other Colleges & Universities	28	7	79	14
Federal Programs	35	2	49	49
State Agencies	23	4	43	52
Trade Associations	17	--	59	41

Source: U.S. Department of Energy from The Conference Board Survey. Detailed questionnaire.

*Excludes companies reporting that specified training source is not available to their employees.

**Percentages do not always equal 100% due to rounding.

Training courses offered by trade associations, such as those jointly sponsored by the NCA and BCOA, received an intermediate rating in this survey. Of 18 responding companies reporting some use of these materials, 60 percent reported satisfaction with them -- a rating only moderately higher than that given to the government-sponsored programs.

Training managers in the largest companies -- those with 2000 or more employees -- tended to be somewhat more critical in their assessments of these external providers than did the respondents from smaller companies. Thus, one-half or more of the large company spokesmen expressed dissatisfaction with the training programs provided by trade associations and vocational high schools, as well as those of Federal or State agencies. These same respondents, however, were much more supportive (by ratios of 4 to 1) of programs offered by higher educational institutions, such as community colleges and universities.

THE ROLE OF THE FEDERAL GOVERNMENT

Although specialized training to meet industry needs is normally considered a primary responsibility of industry itself, there has been growing recognition that the Federal -- as well as State -- governments have an appropriate role in providing certain forms of training assistance to the coal industry. This has stemmed in part from the establishment of mandatory health and safety training standards for the industry and from the recognized need to provide special assistance, particularly to smaller coal mining companies, in implementing these standards. In addition, the need for greatly expanded coal production as a critical element of our national energy policy has highlighted the importance of assuring

an adequate supply of trained manpower for the industry, including provision of increased governmental support for training of coal personnel to the extent that this is necessary to supplement existing training resources.

National industry spokesmen have generally supported increased Federal funding for coal industry training assistance programs (8). There has been, however, less consensus as to the most effective way of providing such assistance. For this reason, the Board's survey solicited the opinions of respondents on the ways in which the Federal government "can most effectively support training and education efforts to serve the coal industry's training needs," by asking them to rate each of five listed options on a scale of 1 to 5, with "1" representing the "most effective" method and "5" the "least effective." The options listed included encouragement and funding of: (1) training programs run by educational institutions; (2) research on coal industry training programs; (3) establishment of cooperative training programs operated by mine companies, trade associations, etc.; (4) training programs run by Federal agencies; and (5) meetings among training professionals in the industry.

The most popular option among those listed was the provision of assistance which would facilitate cooperative training programs run by the participating companies themselves or by trade associations or similar employer organizations. Thirty percent of the respondents identified this approach as the "most effective," while only 14 percent indicated this to be "least effective." (Table 5-19.) Preference for this approach was particularly pronounced among respondents from companies in the largest size group (2000 or more employees) of whom half gave this their first priority. (It has been noted that the term "cooperative training" is used to refer to the work-study in this chapter. Thus the popularity of this option might be due, in part, to alternative definitions of this term.)

Table 5-19

RATINGS OF ALTERNATIVE APPROACHES TO FEDERAL GOVERNMENT AID
FOR COAL INDUSTRY TRAINING AND EDUCATION

<u>Type of Program</u>	<u>Percent of Respondents Rating</u>		
	<u>"Most Effective"</u>	<u>"Least Effective"</u>	<u>"Should Not be Supported"</u>
Cooperative Training by Mine Companies, Trade Assns., Etc.	30	14	11
Training by Federal Agencies	20	31	22
Training by Educational Institutions	19	21	15
Meetings of Training Professionals	18	19	13
Research on Coal Industry Training Programs	12	14	16

Source: U.S. Department of Energy from The Conference Board Company Survey. Based on 91 responses to detailed or abridged questionnaires.

Conversely, training programs operated directly by the Federal government received a much more negative overall rating. Although 20 percent of the respondents gave such programs their first priority, 31 percent considered them "least effective" among the options listed, and over one-fifth felt that such programs should not be funded at all. Large-company respondents were much more negative in their assessment of these programs, tending to rank them lowest in their preference list. On the other hand, the respondents from companies with less than 500 employees were much more supportive of the Federal government's training role in the industry. Among the latter group, 25 percent considered these programs to be the "most effective" among those listed as compared to 10 percent who ranked them as "least effective." These differences in assessments are probably related in part to the fact that direct assistance by the Mine Safety and Health Administration has been oriented to the needs of these smaller mining companies, whereas larger companies have relied to a much greater extent on their own training resources.

Attitudes toward the other types of possible training assistance listed were considerably more diffuse, as illustrated by the fact that about the same proportion of respondents in each case rated these options as "most effective" and "least effective." Thus, although research on coal industry training programs was identified as the "most effective" form of Federal aid by only 12 percent of the respondents and as "least effective" by 14 percent, about 32 percent assigned the intermediate, third-level priority to this form of assistance.

A LOOK AHEAD: COMPANY PLANS FOR EXPANSION OF TRAINING PROGRAMS

In order to provide an indicator of the short-term growth outlook for coal industry training programs, respondents to The Conference Board Survey were also requested to answer several questions concerning their company's training plans for the coming year. These were premised on the assumption that under typical company budgeting procedures, training officials would be in a position to provide realistic forecasts of plans for the following 12-month period, whereas longer-term forecasts were likely to be less reliable.

One question addressed to companies reporting that they were currently offering various categories of training to their employees was whether they planned to expand these programs. As shown in Table 5-20, a large proportion of companies reported plans to expand most of their training programs in the coming year. These percentages varied considerably, however, by type of program. Thus about one-half of all companies planned to expand health and safety training in 1980, either in anticipation of employment increases or because of the fact that some of this training had first been provided, or had been expanded earlier in 1979 in compliance with the new Federal health and safety training regulations. About two-thirds of the companies currently providing skills training or foreman training courses (other than certification training) reported plans for expansion of these programs. On the other hand, less than 30 percent of the companies currently offering management training courses reported plans for expansion of these courses.

Respondents not currently providing certain types of training were also asked whether they planned to offer such programs in the coming year. Since nearly

Table 5-20

COMPANY PLANS TO EXPAND TRAINING PROGRAMS, BY TYPE OF PROGRAM

<u>Type of Training</u>	<u>No. Currently Providing</u>	<u>Plan to Expand</u>		<u>Plan to Ini- tially Offer</u>	
		<u>No.</u>	<u>%*</u>	<u>No.</u>	<u>%*</u>
<u>Health & Safety</u>					
Orientation --					
New, Inexperienced	46	21	46%	1	2%
New, Experienced	46	22	48	-	-
Refresher	46	22	48	1	2
<u>Maintenance Skills</u>					
Initial	34	22	65	3	9
Upgrade	39	27	69	3	8
Certification	31	15	48	3	10
<u>Equipment Operator Skills</u>					
Initial	20	14	70	6	30
Upgrade	18	15	83	7	39
Certification	19	10	53	3	16
<u>Foreman</u>					
General Supervisory	38	26	68	3	8
Specialized Courses	27	18	67	7	26
Certification	29	12	41	3	10
<u>Management</u>	24	7	29	8	33
<u>Technician</u>	26	11	42	5	19

Source: U.S. Department of Energy from The Conference Board Company Survey.

*Percentage based on number currently providing each type of training.

all respondents were already directly providing the mandated health and safety training, the projected rate of introduction of new company programs in this category was very small. In contrast, a significantly larger number of respondents reported plans for offering new skills training to equipment operators (both initial and upgrade), specialized foreman courses, and management or technician training programs.

Companies planning to expand their training or to offer new programs were further asked to indicate the major factors leading to this decision. The most frequently cited factors, noted by 33 of the companies, was "to improve quality and scope of training." Compliance with federal and state mandatory requirements was second in frequency, having been listed by 26 companies. In contrast, only 16 respondents indicated that work force expansion was a major factor in their plans for increased training -- a ranking consistent with the modest overall employment growth experienced by coal mining companies during this period.

Training expansion plans were reported by companies in all size groups covered by the survey. However, respondents from the larger companies more frequently reported desire for qualitative improvements in training as the major motivating factor, whereas smaller companies with fewer than 500 employees gave equal emphasis to the need to comply with federal or state mandatory requirements.

REFERENCES

1. Keystone Coal Industry Manual, U.S. Coal Production by Company, 1977, New York: McGraw-Hill, 1978, Table 1.
2. U.S. Department of Labor. Mine Safety and Health Administration. Washington, D.C., 1977, Table 28.
3. Seymour Lusterman. Education in Industry. New York: The Conference Board, 1977, p. 92.
4. U.S. Department of Commerce. Bureau of Census. 1977 Census of Mineral Industries, Bituminous Coal and Lignite. Preliminary Report, November 1979, Table 1.
5. Bendix Energy, Environment and Technology Office. Review and Evaluation of Current Training Programs Found in Various Mining Environments, Volume 1, Summary. Final Report 4186, prepared for U.S. Department of Interior, Bureau of Mines, 1975, p. 8.
6. For descriptions of some of these programs, see: Coal Age, October 1975, pp. 206-214; TRAM Proceedings, 1977, pp. 95-106; etc.
7. "Western regions" are broadly defined here to include all coal mining regions other than the Eastern, or Appalachian, Region.
8. See, for example, testimony by Robert H. Quenon, on behalf of coal industry trade associations, at Congressional hearings on the Coal Mine Health and Safety Act of 1969. Hearings Before the Subcommittee on Labor Standards of the Committee on Education and Labor. Washington, D.C.: House of Representatives, 95th Congress, First Session, June 1977, p. 328.

Chapter 6

THE COAL INDUSTRY TRAINING OUTLOOK

INTRODUCTION

One of the tasks of this report is to develop projections of coal industry training requirements as a guide for effective planning of training resources. Under existing standards for health and safety training, the amount of mandatory training which will be required can be directly derived from projections of coal mine employment and related personnel turnover estimates. However, the outlook for discretionary training, such as miner skills and supervisory training programs, is inherently much more uncertain. The wide divergence in existing training practices reflected in our survey findings suggests that the industry's training system is still in an early developmental phase. The future demand for occupational training for coal mine personnel will therefore depend, not only on future employment and hiring trends, but also on the extent to which coal company managers will be willing to commit increased resources to various categories of non-mandatory training, based on their perceptions of the potential returns from this investment. This chapter, therefore, reviews some of the key issues which may affect the future development of training within the industry as well as presents projections of possible growth trends. It concludes with a discussion of some implications for planning of training and educational programs to meet these anticipated needs.

MAJOR TRAINING ISSUES

Our review of the available training literature, as well as our survey results, has indicated a considerable divergence of practice and opinion on a number of key industry training issues, including:

- Specific training objectives
- Relative advantages of internal vs. external training programs
- Training methods

These issues and their relevance to the coal industry training outlook are discussed below.

1. Training Objectives -- Although most coal industry training officials tend to agree on generalized formulations which stress the dual objectives of improving coal miner health and safety and of improving productivity, a closer review reveals a much wider variation in company training philosophies. At one end of the spectrum, a considerable proportion of employers still regard their training activities as designed largely for compliance with federal or state laws or union contract obligations. Thus, in a survey conducted by the Bendix Corporation in 1975, the survey team "gained a distinct impression that mandatory training for miners is being treated as a legal ritual which both the operators and MESA are compelled to conform, i.e., compliance assumes more importance than the goal of reducing accidents (1)." At the other end of the spectrum are a number of larger companies that consider training as an integral part of a comprehensive career development program which -- in addition to specific safety and skill training objectives -- is designed to develop a

versatile, productive, and upwardly mobile work force. Most companies probably fall between these extremes. Formal skills training, when provided, may vary from short courses designed to provide initial orientation for persons entering apprentice-level jobs to much more comprehensive training designed to qualify personnel for a number of related skills and for progression to supervisory and technician-level positions.

These differences in objectives are reflected in course lengths and contents, irrespective of whether such courses are provided directly by the coal companies or at local educational institutions. Thus, the typical community college or university extension department which offers mine technology training provides a diversified set of courses, ranging from short health and safety indoctrination courses for new miners and specialized courses designed to assist personnel in qualifying for certified skills such as mine electrician or foreman, to courses which are part of comprehensive two-year programs leading to an associate degree. From available data, it is evident that full-time enrollees in the latter programs currently account for a modest proportion of total enrollments in mine technology and related fields. One deterrent to expanded enrollments by full-time students prior to employment in the industry is the fact that completion of these courses does not provide any assured entry into higher-level jobs, since such graduates must still meet the minimum experience requirements as miners specified in state certification laws, and must compete for these jobs with other eligible miners under existing job-bidding procedures in union mines.

2. Internal Vs. External Training -- Our survey results, as well as our field interviews, indicated a general preference on the part of officials of large and medium-sized companies for internal training programs, conducted -- to the extent practicable -- at their own facilities and with their own instructional

staff. This preference is understandable since company-operated courses provide them with direct control over course contents and instructional staff and permit tailoring of course contents to their own equipment configurations, operating conditions, and management practices. Well-designed company skills training courses also permit a close integration of classroom work with periods of on-the-job training under actual or simulated operating conditions.

Another major advantage of in-house training is that it provides direct control over trainee selection and course scheduling, so that there can be a close linkage between training and subsequent work assignments. The rewards for successful completion of the training, as well as the penalties of failure, are thus well defined for both participants in the course and for the training staff. Finally, an important cost consideration is that company-provided training at the mine site can eliminate the costs which might otherwise be entailed in travel to schools at some distance from the mine location.

Despite these advantages, external courses provided by voc-tech schools, colleges, or other training institutions have played -- and are likely to continue to play -- a significant role in the coal industry training scheme. They often offer the only practicable option for providing either mandatory training or non-mandatory training for small companies, e.g., those with fewer than 100 employees because of the obvious inefficiencies of establishing specialized training units staffed by qualified instructors in such firms. Economies of scale are also a practical consideration for many larger companies which may choose to rely on local colleges or other providers for specialized courses, such as foreman certification, where the number of trainees at any time would not be sufficient to warrant scheduling in-house courses. In addition, these

- schools offer the only opportunity for obtaining pre-employment training to students interested in a mining career or to current employees interested in qualifying for more skilled jobs, either with their current employer or other companies, but who do not have in-house training courses available to them. These institutional training programs have normally been encouraged by local coal mining companies since they increase the supply of at least partially trained applicants for coal mining jobs. However, the recent proliferation of these schools in some coal mining areas, combined with slowdowns in hiring, have -- as noted in Chapter 4 -- resulted in poor placement rates and some cutbacks in enrollments, thus highlighting the need for much more systematic planning of these programs on a regional basis in relation to anticipated personnel requirements.

3. Classroom Vs. On-The-Job Training -- Certain types of training courses, by their nature must be conducted largely or entirely in a classroom environment, using a combination of instructional methods, such as lectures, films, video tapes, slides, and mock-ups. This applies, for example, to orientation courses for newly hired (or prospective) miners, as well as to courses with considerable lecture or theoretical contents, such as those for mine foremen or technicians. In contrast, most miner skills training courses place considerable emphasis on direct "hands-on" training under actual or simulated operating conditions. This is particularly true of equipment operator courses which -- when provided -- are likely to entail only a few days of classroom work followed by a longer period of on-the-job training. Courses for mine electricians and mechanics, because of their more technical nature, normally entail much longer

periods of classroom work, which may be staggered with periods of supervised on-the-job training.

As indicated by our survey results, a large proportion of companies still offer no formal training in equipment operator skills, relying entirely on on-the-job instruction for these occupations. Although formal training in maintenance skills is much more frequent, these courses vary widely in the proportion of training time devoted to formal classroom instruction as compared to o.j.t. Moreover, the term "o.j.t." is often used loosely to refer to the entire period that personnel are required to be in a "trainee" job classification under the union agreement, rather than to the time actually spent in a systematic, job-training program.

One indication of continuing reservations on the part of many coal companies concerning the need for more formalized instruction in mining skills was provided by responses to the following question included in our detailed company questionnaires: "If your company offers no training for miners except the required health and safety training, please check below the most important reason for this." The most frequently cited reason, noted by most of the companies responding to this item, was that "informal on-the-job training satisfies our needs." Thus, the prevailing practice, for equipment operator skills, still corresponds closely to that described in the 1976 Bendix study of mine training programs:

"Operation of mining equipment is taught in both underground training units and in school or mine company above-ground mine mock-ups. However, these programs are relatively few in number. Most miners learn by observing other miners. When they feel ready to try a new job themselves they will bid for the assignment when open. In some

instances, these new work assignments come from the supervisor to meet a need that is filled by the most available miner (usually new) and not as the result of any planned sequence of job progression from helper to operator. When two men are needed to operate a single machine the progression from helper to operator can work for informal on-the-job training methods (2)."

Such informal training procedures have the obvious advantage to the coal operators of placing the newly assigned worker immediately into a productive operation, thus minimizing the downtime associated with acquiring of a new set of skills. They have been justified, too, on the grounds that the skills involved in operating mining equipment can best be learned in an actual operating situation. However, this approach has certain inherent limitations, stemming in part from the need to rely on operating personnel as trainers and the tendency to perpetuate unsafe or inefficient work practices which may be transmitted by the experienced miners or foremen to the trainee. Moreover, under operating conditions, the demands and exigencies of production schedules are likely to be given first priority, thus often limiting the amount of systematic training provided to the new worker. Studies indicating a high correlation between recency of assignment to new tasks and accident rates have further been cited to illustrate the risks associated with this practice (3).

For these reasons a number of companies now conduct part or all of their mining skills training in separate sections of mines set aside for training purposes. Under one such program, trainees are initially instructed by separately-assigned foreman instructors who describe the functioning of each machine, the pre-shift checks and maintenance, and the standard operating procedures. After assignment to a production unit the new miner must also demonstrate his qualification to the unit foreman before starting out on a new equipment assignment. Thus, this approach includes a closely supervised integration of formal training and actual on-the-job production work.

The use of sections of operating mines for training purposes has also, however, been subject to criticism on the grounds that training still tends to be subordinated to production, in these circumstances, resulting in undesirable safety risks for the inexperienced miner. One alternative is the construction of a simulated coal mine, at the surface, which provides the same layout and equipment of an operating underground mine, and which simulates many of its operating conditions (e.g., darkness, ventilation changes, and confinement in limited work space). Such facilities have been constructed by a few large companies, such as U.S. Steel at its regional training center near Waynesburg, Pennsylvania, and American Coal Company at Huntington, Utah (4). They have also been developed as regional training facilities, with Federal funding, at Florence, Pennsylvania, and Clarington, Ohio (5). The facilities are normally designed to be used in a range of training courses, from initial miner orientation to specialized courses for equipment operators, maintenance technicians, and supervisors. The major advantages claimed for such facilities have been the elimination of safety hazards associated with use of operating mine sections and the greater overall efficiency of training (6). However, these facilities are relatively costly, and some company training officials have questioned whether the training or safety benefits to be derived are sufficient to warrant investments of \$3 million or more for such centers.

PROJECTIONS OF TRAINING REQUIREMENTS

Projections of training requirements are shown in Table 6-1 through 6-3 for three categories of training: new miner orientation training courses and initial skills training for maintenance and equipment operator occupations, and foreman training courses. The methods and assumptions used are summarized below:

1. New Miner Orientation Training -- As described in Chapter 4, certain minimum standards of training for new miners are specified in the Mine Safety and Health Act of 1977 and in accompanying regulations. All newly-hired experienced miners require eight hours of orientation training; however, the number of hours of required training for inexperienced miners varies by type of mining (40 hours for deep miners, 32 hours for surface occupations). Hence, the total number of training hours required depends on the following factors: (1) the total number of miner accessions for each type of mining, and (2) the proportions of experienced and inexperienced miners among these accessions. In addition, the mining laws of some states, such as West Virginia, prescribe longer training periods than required under the Federal law. In order to account for these variables, our point of departure was a regression analysis, based on The Conference Board mine sample, in which the number of annual orientation training hours actually provided per production worker, in deep mines and surface mines, respectively, were related to the reported hiring rate in these mines in the preceding 12-month period. This resulted in the following derived equations:

$$\text{Deep Mines: } OT_{PW} = .32 A_{PW}$$

$$\text{Surface Mines: } OT_{PW} = .26 A_{PW}$$

where OT_{PW} represents the number of orientation training hours per production

Table 6-1

PROJECTED NEW MINER ORIENTATION TRAINING REQUIREMENTS: 1977-95

	<u>Total, U.S.</u>			<u>East</u>			<u>Other Regions</u>		
	<u>Total</u>	<u>Deep</u>	<u>Surface</u>	<u>Total</u>	<u>Deep</u>	<u>Surface</u>	<u>Total</u>	<u>Deep</u>	<u>Surface</u>
<u>Employees Hours of Training (000)</u>									
1977	1188	683	505	886	556	330	302	127	175
1985	1404	920	484	748	422	326	656	498	158
1990	1965	1485	480	1066	890	176	899	595	304
1995	2532	1893	639	1258	1053	205	1274	840	434
<u>Index (1977 = 100)</u>									
1977	100	100	100	100	100	100	100	100	100
1985	118	135	96	84	76	99	217	392	90
1990	165	217	95	120	160	53	298	469	173
1995	213	277	127	142	189	62	422	661	248

Source: U.S. Department of Energy from The Conference Board Survey.

worker and A represents the number of annual accessions per 100 production workers in the base period, July 1978 -- June 1979. The use of an accessions rate in this formula, rather than a direct ratio of training hours per number of accessions, is based on the assumption that higher accessions rates will be accompanied by a higher proportion of inexperienced miners among these accessions, as was observed in our inter-regional comparisons based on the mine survey sample (Table 5-8).

Projections of miner accessions rates, for these projections, were in turn derived using actual personnel separation rates in the period 1976-78 as reported by John Short and Associates, based on a field survey of 78 mines. * These rates averaged 14.4 percent for underground mines and 15.1 percent for surface mines (7). Further allowance was made for the additional accessions required by employment growth during the period 1977-95. Thus, total accession rates for each projection period were basically derived as the sum of the base separation rate and of the annual rate of employment growth, adjusted for the higher rate of separations among newly hired miners. The estimated requirements for 1977 -- the base year in our employment projections -- represent the number of employee hours of training which would have been required if the existing orientation training standards had been fully operative in that year.

The resulting projections indicate a mixed pattern of growth in requirements for miner orientation training, by region and type of mining. Based on the production and employment projections presented in Chapters 1 and 2, nearly all of the projected increase in new miner orientation training will be

*The separation rates cited include employee transfers to other coal mining companies as well as those leaving the industry. Interindustry separation and accession rates would have been preferable as a base for computing training requirements, but these were not available for periods after 1974.

concentrated in the deep mining sector of the industry, and primarily in the Central and Western coal regions. In the latter regions, requirements for orientation training of new underground miners are expected to increase more than six-fold between 1977 and 1995, reflecting the anticipated rapid growth and continued high accessions rates projected for these regions. In contrast, orientation training needs in the East are projected to decline between 1977 and 1985 as a result of reduced hiring in that region, and to increase only moderately in the following ten-year period, to a 1995 level less than twice that estimated for 1977. Orientation training requirements for surface miners are projected to decline in the East as a result of the projected decline in surface mining in that region, but to increase moderately in other regions, between 1985 and 1995.

2. Skills Training -- The projections of skills training requirements have been limited to initial skills training for maintenance occupations and equipment operators, since initial training accounts for the largest proportion of total skills training loads and can be more directly related to projected employment and hiring trends. Such projections are inherently much less reliable than are projected requirements for mandatory health and safety training because of wide variations in existing company training policies with respect to non-mandatory training. For the present purpose, we have adopted as a norm the relationships between employee hours of training and accessions rates among those mines which provided formal skills training to their employees during the period 1978-79, as reflected in our mine survey data. (Table 6-2.) The projected training hours thus represent the volume of training in each of the selected years between 1977 and 1995 which would be required if all employers in the industry

Table 6-2

PROJECTED REQUIREMENTS FOR INITIAL SKILLS TRAINING: 1977-95

	Total, U.S.			East			Other Regions		
	<u>Total</u>	<u>Mainte- nance</u>	<u>Equip. Oper.</u>	<u>Total</u>	<u>Mainte- nance</u>	<u>Equip. Oper.</u>	<u>Total</u>	<u>Mainte- nance</u>	<u>Equip. Oper.</u>
<u>Employees Hours of Training (000)</u>									
1977	2967	2342	625	2079	1594	485	888	748	140
1985	2953	2417	536	1593	1259	334	1360	1158	202
1990	4257	3581	676	2206	1811	395	2051	1770	281
1995	5938	5065	873	2824	2335	489	3114	2730	384
<u>Index (1977 = 100)</u>									
1977	100	100	100	100	100	100	100	100	100
1985	99	103	86	77	79	69	153	155	144
1990	143	153	108	106	114	81	231	237	201
1995	200	216	140	136	146	101	351	365	274

Source: U.S. Department of Energy from The Conference Board.

were to adopt the same training policies, with respect to assignment to training and duration of training as those in effect among responding companies who provided such training in 1978-79. The base estimates of training requirements in 1977, under this procedure, clearly exceed the amount of initial skills training actually provided by the industry in 1977, since our sample data reflect the training practices of the larger companies and mines, but may be more indicative of future industry training needs to the extent that existing training practices of these larger companies become more generally adopted on an industry-wide basis in the coming 15-year period.

Based on our analysis of the mine survey data, the number of initial skill training hours per skilled maintenance worker or equipment operator were estimated as a function of their respective accessions rates as follows:

$$\text{Mechanics:} \quad IT_M = 2.142 A_M$$

$$\text{Equipment Operators:} \quad IT_{EO} = .328 A_{EO}$$

where IT represents number of initial training hours of mechanics or equipment operators and A represents their respective accessions rates.

As in the case of miner orientation training, these projections indicate that overall requirements for initial skills training will approximately double between 1977 and 1995. Training for mine maintenance occupations will account for most of this growth, both because of the much greater length of training required for these skills and because of the more rapid employment growth projected for these occupations. Regionally, the increase in skill training requirements will be greatest in the Central and Western coal regions. In the East, initial skills training needs are projected to decline between 1977 and

1985, but to grow significantly in the period 1985-1995 as a result of the projected growth in Eastern deep coal mining during the latter period.

3. Foreman Training -- Our analysis of the mine survey data indicated that there was no significant correlation between the rate of accessions of foremen and the number of foremen receiving either general supervisory training or special courses, other than certification training, thus suggesting that much of the supervisory training provided during this period, averaging 40 hours per foreman, was designed to upgrade the skills of the supervisory work force as a whole, rather than being limited to newly appointed foremen. Since many of these supervisory courses were initiated in the past few years, it is possible that this ratio may overstate the requirement for continuing training of the experienced supervisory work force. However, in view of the fact that a large proportion of company training officials expressed dissatisfaction with the adequacy of their current supervisory training programs, we have assumed a continuing requirement of an average of 40 hours, or one week, of training per year per foreman during the period 1977-1995.

The resulting projections, in Table 6-3, thus reflect the projected growth in the foreman work force between 1977 and 1995. They indicate that overall training requirements for foremen will increase more than five-fold in the Central and Western regions between 1977 and 1995 and will nearly double in the East, as a result of both overall employment growth and because of a projected requirement for a higher proportion of foremen in the mine work force during this period.

Table 6-3

PROJECTED FOREMAN TRAINING REQUIREMENTS BY REGION: 1977-95

	Total, U.S.		East		Other Regions	
	Employee Hours (000)	Index (1977=100)	Employee Hours (000)	Index (1977=100)	Employee Hours (000)	Index (1977=100)
1977	684	100	536	100	148	100
1985	924	135	604	113	320	216
1990	1304	191	792	148	512	346
1995	1808	264	1025	191	784	530

Source: U.S. Department of Energy from The Conference Board Survey.

of hiring -- and of training needs -- in the Eastern, or Appalachian, coal regions. The slackening in employment growth, combined with a poorly coordinated proliferation of miner training programs, has apparently resulted in a large surplus of partially-trained applicants for coal mining jobs in Appalachian coal mining states such as West Virginia and Kentucky. A moderate growth in training requirements is expected in this region during the 1985-1995 period. However, it is likely that the existing training infrastructure in states such as West Virginia, Kentucky, and Pennsylvania, will be adequate to accommodate this growth. On the other hand, the sharp projected growth in all categories of training in the Western and Central regions will probably require a substantial expansion in existing training resources and facilities in these regions, particularly in many of the more isolated coal mining communities. These projections therefore highlight the need for carefully coordinated planning of industry training needs and resources on a regional and local basis.

Finally, there is a need to evaluate the respective roles of the private sector and of public agencies and educational institutions in meeting the industry's requirements for trained personnel. Our survey findings, as well as collateral research, have highlighted some of the limitations of both existing company training programs and of those provided by schools or similar training institutions. The larger coal companies, which are likely to account for an increasing share of total coal output and jobs, have indicated a general preference for conducting their own internal training programs, with limited supplemental use of external training resources. On the other hand, it is clear that most of the smaller and medium-sized companies -- including many which fell within the scope of our survey -- have not found it practicable to extend their training beyond the mandated courses and, in some areas, have relied on local schools for their miner

TRAINING PROGRAM IMPLICATIONS

The preceding projections, in conjunction with our survey findings on the current status of coal industry training, have a number of important implications for the planning of training resources for this key industry. First, it is evident that the coming 15-year period will witness a substantial increase in the industry's overall training needs. Between 1977 and 1995, the expansion of the coal industry's work force and accompanying shifts in occupational requirements will alone result in an increase of more than 100 percent in the amount of training which will be required. These projections, moreover, make no allowance for any further intensification of training effort, particularly by companies which are still limiting their current training to mandated health and safety training courses, or which provide only limited "non-mandatory" training in mining and supervisory skills. Since respondents to our survey indicated both considerable dissatisfaction with current company training efforts in these areas and plans to expand these programs in the coming year, actual growth in non-mandatory training programs is likely to be considerably greater than implied by the projected growth in the industry's work force during this period. Hence, there will be a continued need for the industry to plan for an adequate development of required training resources for the industry.

Secondly, the rate of growth in training requirements -- as well as the possible need for expanding the existing training infrastructure -- can be expected to vary widely among the major coal producing regions. Based on our projections, the most rapid growth is expected in the major deep coal mining areas of the Central and Western regions, which will experience the most rapid employment increases. Conversely, the near-term outlook, to 1985, is for a reduced rate

orientation training as well. Thus, one rationale for continued, or increased, public support of specialized training programs for the industry is to assist these companies in meeting their regulatory training requirements. In addition, it may be contended that, in view of the considerable intra-industry turnover among skilled mining personnel and the favorable long-term employment outlook, it is in the public interest to contribute to the overall cost of development of skilled manpower resources for this key industry.

One proposal recently advanced in the report by John Short and Associates would provide for establishment of a Mining Extension Service, patterned after the Agricultural Extension Service, to provide technical assistance in the development, implementation, and evaluation of training and productivity improvement programs, at the local mine level, with funding provided by federal, state, and local agencies. However, this proposal would not, of itself, address one of the most critical needs in the current training structure of the industry, i.e., that of providing a cost-effective system of meeting the skilled manpower needs of many of the companies in the industry, which cannot economically operate their own training programs.

One alternative, suggested in a recent planning paper on vocational education prepared for the National Institute of Education, warrants consideration in this context. This paper proposes that, in the interests of economies of scale and of quality control, most vocational training be performed in institutions which are separate from the work place. However, this training would be under the financial and administrative control of local or regional consortia of employers, who would be in the best position to assure that the training met their

requirements in terms of numbers and quality. Moreover, if this training were funded -- at least in part -- by a payroll (or tonnage) tax on participating companies, these companies would have a direct financial stake in the cost-effectiveness of the system (8).

The NIE study cites a number of precedents for institutional arrangements of this type in several foreign vocational education systems, notably in France, England, and some Latin American countries. More specifically, the miner training program in effect in the Federal Republic of Germany appears to provide a possible prototype for an industry-managed vocational training system. This is a long-established institutional arrangement under which all mine operators are required by law to pay tonnage royalties to an industry mining fund used for purposes, such as mining research and health and safety improvement as well as for training of mining personnel at all levels -- from basic miners to mine technicians, engineers, and managers. The training provided is conducted in a network of mining schools and facilities which offer programs ranging from 20-days of orientation training of new miners, or 10 days for miners changing assignments (i.e., "task training"), to comprehensive three-year programs for training of mine mechanics, including a combination of classroom and practical training, at state training schools, shop facilities, and simulated mine training centers. A key feature of this plan is the fact that the mining fund's regional operations are governed by boards elected by the member companies, thus providing direct industry input and control over the fund's training programs and related activities (9).

Although any plan to adopt this or similar models would have to take account of the unique characteristics of our own mining industry and our highly decentralized vocational education system, it is noteworthy that coal company training

officials responding to our survey, when queried as to alternative approaches for Federal assistance to coal industry training and education programs, indicated a strong preference for use of this aid in operation of cooperative training programs, to be conducted by the industry itself, as compared to other listed alternatives.

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Appendix A

COAL INDUSTRY MANPOWER DATA REQUIREMENTS

One of the tasks included under the present project is the development of recommendations on needed improvements in existing Federal statistical reports or data systems, which will permit a continuing assessment of the adequacy of labor resources for the coal industry and provide a factual basis for plans to expand these supplies -- through training programs or other means -- if such actions appear necessary. This task entails: (1) a systematic categorization of major data needs for coal industry manpower analysis and planning; (2) an assessment of the adequacy of existing Federal statistical reports for this purpose; and (3) recommendations for improving existing reports or for development of new data.

This analysis is designed to supplement -- for the coal-mining industry -- the broader and more general analysis made by Kramer Associates in their recent study for DOE, A Plan for Developing a Comprehensive Energy Manpower Information System (1).

Our point of departure is the premise that the U.S. Department of Energy has a responsibility, in cooperation with other appropriate Federal agencies, for assessing the adequacy of current and prospective manpower resources -- as well as of other factor resources -- to meet our nation's expanding needs for coal production and to initiate any appropriate policies or programs if there

is evidence that manpower constraints may hinder advancement of national goals for this critical energy-producing industry.

The sponsorship of this study and of a number of related manpower reports for other energy industries by a component of the U.S. Department of Energy evidences some awareness of the need to consider labor availability and employment impacts in overall energy planning within the Department. However, as noted in Chapter 1 of the report done by Kramer, the present organizational structure of the Department appears to lack a clear focal point of responsibility and leadership for development of a comprehensive energy manpower information system. This, we believe, may in turn reflect a more basic need, i.e., for assuring that labor factors and employment impacts are systematically considered in development of national energy policies, whether within DOE or in other cognizant agencies, such as the newly established U.S. Synthetic Fuel Corporation. The more specific recommendations included below are, therefore, conditioned on the assumption that appropriate actions will be taken to provide a better integration of labor resource considerations into the energy planning process. In fact, in the absence of such a commitment, any DOE investment in improved manpower data systems, for coal mining or other energy industries, would be difficult to justify.

MAJOR ELEMENTS OF A COAL INDUSTRY MANPOWER INFORMATION SYSTEM

A comprehensive manpower information system logically requires the development of systematic data on labor supply and labor demand, as well as measures of imbalance between these two variables. It requires accurate data on past trends as well as projections of future developments. Such data must be sufficiently

detailed, in terms of occupations, geographical areas, and other characteristics, to be operationally relevant in development of appropriate plans and programs.

A useful point of departure in categorizing manpower data needs is the distinction between the types of data needed for current analysis of labor market conditions and those needed for projecting future labor demand and supply conditions. For purposes of current analysis, a further distinction can be made between data describing current levels of labor supply and demand and data describing worker flows, or the components of change in these aggregates, as reflected in statistics on labor turnover, worker mobility, and training rates. Since shortages or surpluses of workers may be concentrated in particular regions and occupations, a disaggregation of these statistics based on key worker or job characteristics is also essential for meaningful analysis. These data requirements may be broadly classified as follows:

- I. Employment and job characteristics (by region, industry sector, occupation).
 - A. Aggregate employment trends.
 - B. Job characteristics (e.g., wages, benefits, hours, accident rates).
 - C. Job vacancies.
- II. Labor supply and worker characteristics.
 - A. Experienced civilian labor force in industry -- employed plus experienced unemployed workers.
 - B. Unemployment rates.
 - C. Worker characteristics -- personal characteristics (age, sex, race/ethnic background); occupation; experience level; education and training; unionization.

III. Labor turnover and worker mobility.

- A. Labor turnover statistics -- hiring and separation rates (inter-industry; intra-industry).
- B. Worker mobility -- characteristics of workers entering, or separating, from coal mine employment.

IV. Training data.

- A. Characteristics of training programs and courses -- internal; external.
- B. Enrollments and course completions.
- C. Placement rates.
- D. Evaluative studies -- impacts on safety and productivity

A projection of future labor supply and demand conditions in the industry, including estimates of recruitment and training needs, requires estimates of most of the above major data categories. In addition, such assessment requires inputs on the major exogenous determinants of labor supply and demand within the framework of a comprehensive model of the future structure of the nation's economy and labor force. Thus, a projection of future coal industry labor requirements requires systematic projections of coal industry output and productivity, by region and type of mining, as well as assumptions on days/hours worked per miner. Similarly, the projected labor supply for the industry will depend in part on the future growth and composition of the labor force in coal mining regions, on competing demands for this labor force from other industry sectors, and the degree of shifting of workers into and out of coal mining occupations. These relationships, moreover, should logically be developed as part of a dynamic flow model, which will identify potential imbalances and serves as a framework for suggesting appropriate adjustments in supply/demand conditions (2).

The full development of a comprehensive manpower information system thus logically calls for the close integration of data requirements for specific energy industries, such as coal mining, with those for other energy sectors and for the economy as a whole. For the present report, our assessment of data sources and of statistical gaps is devoted to those directly related to the coal industry itself.

SOURCES OF COAL INDUSTRY MANPOWER DATA

The major statistical data sources available for analysis of coal industry labor needs and resources may be broadly classified as including: (1) data collected as part of broad, general-purpose statistical programs by agencies such as the Bureau of Labor Statistics and the Census Bureau, and (2) industry-specific data, based on reports to agencies such as the Department of Energy or the Labor Department's Mine Safety and Health Administration. The major relevant statistical series, available from these sources, are listed below:

Bureau of Labor Statistics.

- Monthly statistics on employment, hours and earnings -- Available nationally and for major coal mining states, based on a large sample of reporting establishments. Separate data on total employees and production worker employment. Separate data on women employees.
- Monthly labor turnover statistics -- Based on smaller sample than the employment series. State data generally not available, except through special tabulations.
- Labor force and unemployment statistics -- National statistics on the total experienced civilian labor force in the coal mining industry and on unemployment among coal mining workers, based on the monthly Current Population Survey (CPS) are not routinely published, due to sample size limitations, but are available from unpublished BLS annual summary tabulations. These data are, however, subject to relatively large sampling error.

- Occupational employment -- Statistics on the occupational distribution of employed workers in the bituminous coal mining industry are available from the triennial surveys of occupational employment in non-manufacturing industries -- most recently, for 1978. Sample coverage in some coal mining states is still inadequate, however.
- Industry wage surveys -- Detailed statistics on wages by occupation, and on various fringe benefits, are provided by special industry wage surveys conducted by BLS at periodical intervals. The most recent such surveys were in 1976 and 1967.
- Industrial relations -- Data on work stoppages, including statistics on man-days lost in the coal industry, are compiled annually. Comparable data, by state or region, are not, however, routinely available.
- Productivity and unit labor costs -- Indexes on productivity and trends in unit labor costs are maintained by BLS, using data available from a variety of government statistical sources.
- Economic projections -- Projections of employment in coal mining, by occupation, are developed periodically as part of the BLS system of labor force and economic projections.

Census Bureau

- Decennial Census of Population -- Provides separate data on employed and unemployed workers in the coal mining industry, nationally and by state, as well as various worker characteristics (occupation, age, sex, race, educational attainment). Additional tabulations may be derived from public-use samples.
- Census of Mineral Industries -- Provides detailed statistics on coal mining production, employment, and payrolls, by state, for major components of the industry, at five-year intervals.

National Center for Education Statistics

- Mining engineering graduates -- Data on number of graduates (degrees conferred), by degree level, in mining and mineral engineering are included in the statistics on higher education published each year by the NCES.

- Vocational education statistics data systems -- Provides data on enrollments and course completions in various categories of public vocational education, but does not include a separate breakdown for courses in coal mining occupations.

Department of Energy

- Minerals Yearbook (formerly Bureau of Mines) -- Detailed annual data on output, employment, productivity, and days worked, by type of mining, have been published in the Minerals Yearbook, based on comprehensive, industry-wide coverage.
- Energy Projections -- Projections of U.S. energy demand and production, including separate forecasts for the coal industry, for short-term, midterm, and long-term periods, are published annually by the Energy Information Administration in its annual reports to the Congress.

Mine Safety and Health Administration

- Quarterly and annual statistics on employment, manhours, and work injuries, by type of mining and state, based on comprehensive mandatory reporting by all operating coal mines.

Equal Employment Opportunity Commission

- Annual tabulations on employment in bituminous coal mining by major occupational group, minority group affiliation and sex, for larger companies (100 or more employees). However, although data are compiled annually, most recent available tabulations for the coal mining industry, at time of preparation of this report, were for the year 1975.

Despite the large number of Federal agencies which produce some relevant manpower data on the coal industry, our detailed examination of these data sources, in the course of several years of intensive research, has identified a number of major data gaps and limitations. Certain types of statistics, which were needed for our assessment of current and prospective manpower and training needs, were

not available from any existing series and could only be partially provided through special surveys or ad hoc tabulations from available data files. Other types of data were only available in broad summary form, at the national level, and could not be disaggregated by region, by type of mining, or other relevant characteristics. In still other cases, the statistical series and data-collection methods were not adequately documented and could not be reconciled with other available data sources.

RECOMMENDATIONS

Since any attempt to correct all of the inadequacies of the existing data base would be extremely costly and time consuming, we have listed below what we consider to be the most serious of these limitations, together with suggested approaches for filling these data gaps.

1. Training and Education Data -- With the exception of graduates of mining or mineral engineering programs, there are no periodic data available at the national level on the number of persons enrolled or completing various types of coal mining occupational training courses. This data need has only been partially met by recent special, one-time surveys, such as that of coal company training programs conducted by The Conference Board for this report.

There are several possible approaches to providing these data on a periodic basis. In the case of mandated miner health and safety training, the Mine Safety and Health Administration could appropriately request such data from coal companies, on an annual basis, as part of its responsibility for monitoring enforcement of its regulations. Data on publically-funded coal mine technology and vocational training could similarly be obtained by providing for separate identification of these course

categories in reports to the National Center for Education Statistics, under its recently established Vocational Education Data System. An additional option would be to sample establishment surveys of coal company training programs -- similar to that conducted for this report -- on a recurring basis, such as at three-year or five-year intervals.

An even more basic need in any systematic planning to meet the industry's future training requirements is for evaluative research which can assist in assessing the effectiveness of alternative approaches to occupational training and education, based on such criteria as their contributions to improved safety and worker performance. The only substantial research of this type which we have located in the literature is a Bendix Corporation study, funded by the Bureau of Mines, which attempted to evaluate the effectiveness of mine health and safety training programs in reducing accident rates (3). Although this study produced many helpful insights, its evaluative aspects were flawed by inadequacies in the available data base. The study, moreover, was conducted in 1974-75 and did not attempt any systematic analysis of the non-mandatory categories of training. Such evaluative studies are inherently difficult and costly because of the need to isolate the effects of investment in different modes of training, upon either accident rates or productivity, from all the other factors which may influence the latter variables. Nevertheless, our meetings with industry training specialists have indicated a broad consensus that research of this type, if properly designed, could make an important contribution in assessing both the costs and benefits of alternative training strategies for the industry.

2. Labor Turnover and Worker Mobility Data -- Data on separation and hiring rates, and on the characteristics of workers entering or leaving the industry, are

essential for any projection of future coal industry training needs, since labor turnover is likely to account for a major portion of the industry's total hiring and training requirement in the coming decade. The BLS labor turnover series provides separate data for the bituminous coal mining industry. However, this establishment-based report does not differentiate between inter and intra-industry job transfers, nor does it provide data for individual states or regions. Such data have been derived, in two recent studies, from special tabulations of longitudinal samples of social security records of workers with earnings in the bituminous coal mining industry. One of these studies, conducted by The Conference Board, was based on a 10 percent sample of social security continuous work history records, for the years 1971, 1973, and 1975, maintained by the Bureau of Economic Analysis of the Department of Commerce. This provided the basis for an analysis of industry-wide separation and accession rates for the periods 1971-73 and 1973-75 by age and region, as well as analysis of geographical and inter-industry job shifting of workers. It does not, however, include any data on occupational characteristics of employees and is also subject to certain technical limitations, resulting from changes in company reporting practices. Despite these limitations, the social security data base probably provides the only viable source for any detailed analysis of worker mobility and turnover, on a continuing basis, particularly in view of the fact that data on occupational mobility of workers -- included in the 1970 decennial Census -- was not included in the 1980 Census schedule.

3. Labor Force and Unemployment Statistics -- Recent coal industry employment trends, as well as our projections to 1985, indicate a very mixed short-term labor market outlook for the industry with the possibility of continued significant unemployment in some Appalachian coal regions, concurrent with

continued rapid expansion in other areas. These divergent trends have obvious implications for state and regional planning of coal mining training and education programs as well as for other labor market programs, such as improved inter-area placement and relocation assistance for miners. The available data for measuring these trends is, however, very spotty. The only periodic statistical data on unemployment among coal miners currently available are from unpublished annual CPS tabulations -- and these clearly are not capable of regional disaggregation. One supplemental source which should be explored for this purpose consists of data available from sample tabulations of state unemployment insurance claimants by occupation and industry, collected by the Department of Labor on a quarterly and annual basis. Although such data are not now disaggregated below the 1-digit SIC level, i.e., for all mining industries, it should be feasible to obtain a separate breakdown for the bituminous coal industry (SIC 12) for the major coal mining states (4).

Another possible, but more costly, approach would be to supplement the regular CPS area samples to include greater representation of important coal mining areas at some periodic interval (e.g., quarterly or annually) thus permitting tabulation of more detailed and reliable data for the industry at both the national and regional levels.

4. Job Vacancy Statistics -- Job vacancies are defined as the stock of unfilled job openings for which firms are actively trying to recruit new workers. Job vacancy data have long been recognized by economists as a logical counterpart, on the demand side to the unemployment rate, as an indicator of labor market disequilibrium. These data are particularly relevant in analysis of manpower

trends in an expanding industry, such as coal mining, where there are some grounds for concern regarding possible development of labor shortage problems in particular areas and occupations. However, with the exception of a short-lived experiment by BLS in collecting such data in the period 1969-73, there has been no regular comprehensive system of data collection on job vacancies in this country.

The systematic collection of job vacancy statistics entails a number of conceptual and technical difficulties. Because of these difficulties, and because of the high costs of attempting to collect such data for local areas, the National Commission on Employment and Unemployment Statistics recommended against establishment of a national job vacancy statistics program (5). Although we do not recommend that any separate job vacancy statistics program be instituted for the bituminous coal mining industry, at this time, we do believe that standby procedures for such reports be developed so that such a system could be implemented (at least for selected coal mining areas) if there is substantial evidence of emerging labor shortages for the industry. One possible indicator of such manpower shortage problems might be provided by analysis of responses to a question included in the schedule addressed each year by DOE to bituminous coal operators, on which they report their annual coal production, shipments, employment, and other aspects of their operations (EIA 7, 10/77). Item 18 on this schedule, "Mine Operating Constraints," requests operators of mines which operated at less than practical potential to rank the most important reasons and includes "manpower shortage" as one of these possible reasons. To our knowledge, these responses have never been reported by DOE. A systematic analysis of these responses should be provided each year, and -- in the event of a significant increase in reports of manpower shortage difficulties -- could serve as a triggering mechanism for initiation of a more systematic survey

designed to pinpoint the extent, location, and occupational characteristics of such shortages.

5. Additional Recommendations -- In addition to the major gaps in available statistical series, described above, there are a number of improvements in existing data programs which would significantly improve the usefulness of these data as a part of a comprehensive manpower information system for the coal industry:

- BLS employment statistics -- The present standard industrial classification (SIC) coding system, used by BLS and other major statistical agencies, does not differentiate among major categories of bituminous coal mining operations, such as underground mines, surface mines, and separate coal preparation plants or other auxiliary activities. Such distinctions are included in the DOE (formerly Bureau of Mines) annual statistical reports, in the reports of work injuries issued by the Mine Safety and Health Administration, and in the BLS wage surveys for the industry. In view of the major differences in staffing requirements for these various activities, we recommend that both the current monthly data on employment, hours and earnings, and the Occupational Employment Survey data be separately reported for deep and surface mining operations. In the absence of this classification, the OES data, included in this report, was classified by major type of mining establishment by the Conference Board staff, based on an elaborate coding procedure, using presence or absence of certain key occupations as a criterion.

- Productivity statistics -- The DOE annual survey on Bituminous Coal and Lignite Production and Mine Operation is the primary source of productivity data for the industry. Although this survey includes a wide range of relevant mine characteristics, such as seam thickness, coal mining method, and equipment used, only summary data on productivity by type of mining and state are tabulated and released by DOE. In view of the critical importance of productivity trends in analysis of current and prospective labor requirements for the industry, it is recommended that a much more extensive program of cross-tabulations and related analyses of these data be initiated by DOE.

- EEOC data -- The annual reports submitted to EEOC by firms with more than specified numbers of employees are of considerable potential use in manpower data analysis because they provide annual data on employment in major occupational groups for each industry, by sex, various minority groups, and state. However, the usefulness of these data, for analytical purposes, has been seriously impaired by the serious lags in tabulating and publishing these data and because of their uncertain quality. In view of the potential for considerably increased employment of both women and minorities in the coal mining industry consideration should be given to development of appropriate tabulations from this data base on a timely basis, for use by DOE in its manpower assessment program, provided that an evaluation of the OEEC procedures and data indicates that the reports are sufficiently reliable for this purpose.

REFERENCES

1. U.S. Department of Energy, A Plan for Developing a Comprehensive Energy Manpower Information System. DOE/IR-10233, September 1979; available from: National Technical Information Service, Springfield, Virginia.
2. A schematic model describing these relationships is included in the Kramer Associates report, op. cit., Chapter IV.
3. Review and Evaluation of Current Training Programs Found in Various Mining Environments. Ann Arbor, Michigan: Bendix Energy, Environment and Technology Office, Final Report 4186.
4. A discussion of this source and related data on occupational unemployment, appears in Harold Wool, The Adequacy of Occupational Data in Employed and Unemployed Workers for Analyzing Labor Market Behavior. Washington, D.C.: National Commission on Employment and Unemployment Statistics, Background Paper No. 18, June 1978.
5. National Commission on Employment and Unemployment Statistics. Counting the Labor Force. Washington, D.C.: GPO, 1979, pp. 118-122.

Appendix B

**SURVEY QUESTIONNAIRES
FOR COAL INDUSTRY TRAINING PROGRAMS**

Please return to:
Harold Wool
Program Director, Energy Manpower Research
THE CONFERENCE BOARD
845 Third Avenue
New York, New York 10022
(212) 759-0900

CONFIDENTIAL
No information that you
submit will be identified
with you or your company.

A CONFERENCE BOARD SURVEY OF COAL INDUSTRY TRAINING PROGRAMS COAL COMPANY QUESTIONNAIRE

(This is a voluntary survey to be completed at coal company headquarters)

About this Survey

This survey is about the training and educational assistance made available by coal companies to their employees. The survey questionnaire was developed with the advice of leading coal industry training officials. It is designed to provide, for the first time, comprehensive nationwide information about all coal industry training programs, including miner skills training, supervisory and management training as well as the safety training required under federal and state laws. Its findings will assist in planning for any further improvement in training facilities or resources which may be needed to enhance the productivity and safety of coal industry personnel or to improve employee relations. The survey is being funded by the U.S. Department of Energy. It is a voluntary survey, and, while you are not required to respond, your cooperation is very important to helping plan for our nation's energy future. As stated above, information given will be treated confidentially.

Who Should Report

This questionnaire is being addressed to the corporate headquarters of all operating bituminous coal companies which, according to available information, produce 300,000 or more tons of coal per year. We suggest that it be referred to the appropriate official in your company who is responsible for supervising your training activities. PLEASE COMPLETE THE RELEVANT SECTIONS OF THIS QUESTIONNAIRE EVEN IF YOUR COMPANY'S TRAINING ACTIVITIES ARE LIMITED TO MANDATORY SAFETY AND HEALTH TRAINING.

How to Report

This study consists of two parts: *The Coal Company Questionnaire* requests information about your company-wide training activities. You also may have received one or more copies of *The Mine Questionnaire*, for supplemental information about the training conducted at one or more of the individual mines operated by your company. Each supplementary questionnaire is identified by a label indicating the specific mine selected for our sample. The sample was constructed to provide a representative cross section of mines above a certain minimum tonnage, by location and type of mine. If you have also received mine questionnaire(s) and it is necessary for your company to substitute a different mine because of unavailability of information on one of those designated, please indicate the name and address of the substitute mine below the current label.

Note: Some of the questions request numbers or percentages. If exact figures are not available, please provide your best estimate.

About The Conference Board

The Conference Board is an independent, nonprofit business research organization. Its sole purpose, over more than 60 years, has been to promote prosperity and security by assisting in the effective operation and sound development of voluntary, productive enterprise. The enclosed brochure includes a list of its Board of Trustees.

How to Obtain a Copy of the Report

If you wish the U.S. Department of Energy to provide you a copy of the published summary report, please indicate the appropriate mailing address below.

Send a copy of the report on Coal Industry Training to:

COAL COMPANY QUESTIONNAIRE

1. Please list all states in which your company operates coal mines. _____

10
11-12
13-14
15-16
17-18
19-20
21-22
23-24

2. Please indicate the total number of each of the following types of coal mines that your company operates (within the United States).

_____ number of deep mines (shaft, drift, slope)

25-26

_____ number of surface mines (strip, auger, strip/auger)

27-28

_____ number of other types of mine (please describe) _____

29-30

3. Please give the annual total coal production of your company? _____ short tons

31-35

4. Please check the item below that best describes the union status of your company:

☐ 1 miners represented by UMWA in all mines

☐ 2 miners represented by another union in all mines (identify): _____

☐ 3 miners represented by UMWA or other union in some mines and not unionized in others

(Identify unions): _____

☐ 4 not unionized

5. In the appropriate spaces below, please give the total employment figures for your entire company in each of the classes listed.

	<u>June, 1978</u>	<u>June, 1979</u>
Hourly wage employees (Non-supervisory workers engaged in production, maintenance and repair, development, surface shops, cleaning plants, etc.)	37-41	42-46
Clerical employees	47-50	51-54
Foremen	55-58	59-62
Other management, professional, and technical employees	63-66	67-70
Total number of employees	71-75	76-80

6. Please give the total number of new hires and separations for each group during the period July 1, 1978 through June 30, 1979.

	<u>Hourly-Wage Employees</u>	<u>Salaried Employees</u>		
		<u>Clerical</u>	<u>Foremen</u>	<u>Other management and Professional</u>
New Hires:	<u>10-13</u>	<u>14-16</u>	<u>17-18</u>	<u>19-22</u>
Separations:	<u>23-26</u>	<u>27-29</u>	<u>30-31</u>	<u>32-35</u>

7. Is there a separate staff function or unit at the company level whose primary responsibility is training and education?

36-1 ☐ Yes

2 ☐ No

8. If there is a separate training staff, please give the following information for the unit:

Title of unit head 37-38

Total staff size of unit: 39-40 persons

Location of unit:

41. ☐ Parent company headquarters
 42. ☐ Coal company headquarters
 43. ☐ Regional or divisional headquarters
 44. ☐ Mine site

9. In what year was this unit or function first established? 45-46

10. If there is no separate training unit, who, at the company level, has responsibility and to whom does the person report?

Responsible for training (title only):

47-48

Reports to (title only):

49-50

11. Please check in the left hand column all of the following types of training that are offered by your company, whether the programs are run at headquarters, in regional centers, at local mine sites or at facilities separate from company facilities.
12. For each type of training offered, how many employees received such company-sponsored training during the past year?
13. For each type currently offered, please check in the next column those programs that your company has plans to expand within the next year.
14. Among those types of training *not now offered* by your company, please check in the last column those which you are planning to offer within the next year.

	<u>Number of Employees Receiving Training (past 12 months)</u>	<u>Currently Offer, Plan to Expand Program(s)</u>	<u>Not Now Offered, Plan to Offer</u>
Basic Health and Safety Training			
51- ☐ Health and safety training to orient <i>new, inexperienced</i> miners	52-55 _____	56- ☐	57- ☐
58- ☐ Health and safety training to orient new miners who have previous experience	59-62 _____	63- ☐	64- ☐
65- ☐ Health and safety refresher training offered annually to experienced miners	66-69 _____	70- ☐	71- ☐
Mining Skills Training for Maintenance Mechanics/Electricians			
Initial skills training:			
10- ☐ On-the-job training only	11-14 _____	15- ☐	16- ☐
17- ☐ Classroom training, combined with o.j.t.	18-21 _____	22- ☐	23- ☐
24- ☐ Courses to upgrade the skills of maintenance mechanics and electricians	25-28 _____	29- ☐	30- ☐
31- ☐ Training specifically for certification tests	32-35 _____	36- ☐	37- ☐
Skills Training for Equipment Operators/Other Hourly Workers			
Initial skills training:			
38- ☐ On-the-job training only	39-42 _____	43- ☐	44- ☐
45- ☐ Classroom training, combined with o.j.t.	46-49 _____	50- ☐	51- ☐
52- ☐ Courses to upgrade the skills of equipment operators and other hourly workers	53-56 _____	57- ☐	58- ☐
59- ☐ Training specifically for certification tests	60-63 _____	64- ☐	65- ☐
66- ☐ Any Other Skills Training for Miners (describe) _____	67-70 _____	71- ☐	72- ☐

Foreman Training

Number of Employees
Receiving Training
(past 12 months)

Currently Offer,
Plan to Expand
Program(s)

Not Now Offered,
Plan to Offer

10 ☐ General supervisory training

11-14

15 ☐

16 ☐

17 ☐ Specialized courses in supervisory skills

18-21

22 ☐

23 ☐

24 ☐ Training for specific foremen certification tests

25-28

29 ☐

30 ☐

31 ☐ Management training (for levels above chief foreman and for professional staff)

32-35

36 ☐

37 ☐

38 ☐ Technician training (e.g., dust analyst, environmental technician)

39-42

43 ☐

44 ☐

15. If your company plans to expand its training programs or to offer new programs, please indicate below the major factors leading to this decision (check all that apply).

45 ☐ To comply with federal or state mandatory requirements

46 ☐ To meet the needs for workforce expansion (e.g., opening of new mines)

47 ☐ To improve quality and scope of training for existing personnel and/or new hires

48 ☐ To train personnel in new equipment or processes

49 ☐ Other (specify) _____

16. About what percentage of miners hired within the past 12 months had previous experience in coal mining?

50-52 _____ %

17. If your company hired inexperienced miners within the past 12 months, about what percentage of these miners had already received some health and safety orientation training before being employed?

53-55 _____ %

18. If any of your new miners had already received such pre-employment training, what were the sources of this training? (check all that apply)

56 ☐ High school/vocational school

59 ☐ Other _____

57 ☐ Junior/Community college

60 ☐ _____

58 ☐ Four-year college/university

19. What percentage of all your miners received formal company-sponsored skills training in the period July 1, 1978 through June 30, 1979 (other than health and safety training or informal on-the-job training)?

61 ☐ Do not offer formal skills training _____ %

20. If your company offers no training for miners except the required health and safety training, please check below the most important reason for this. (Check only one.)

64-1 ☐ Locally available institutional training meets our needs

2 ☐ Informal on-the-job training satisfies our needs

3 ☐ We do not have the resources or capability to provide formal training

4 ☐ We would quickly lose employees we trained to other companies

5 ☐ Other reason: _____

21. What percentage of all your foremen received supervisory training during the past 12 months? _____ %

65-67 ☐ No foremen received such training within past 12 months

22. Is there a company policy *requiring* that all newly selected foremen complete a supervisory training program?

1 ☐ Yes, before assignment

3 ☐ Offered but not required

2 ☐ Yes, before or after assignment

4 ☐ Not offered

23. If you provide *foreman certification training*, is this offered mainly during or outside of regular working hours?

70-1 ☐ Provided during work hours

2 ☐ Provided after work hours

3 ☐ Not provided

24. If some or all of this training is provided after working hours, are employees paid for time spent in a foremen certification training program?

71-1 ☐ Yes

2 ☐ No

25. Which of the following subjects are covered in supervisory training offered by your company? (Check all that apply.)

72 ☐ Personnel supervision

73 ☐ Safety and health regulations

74 ☐ Labor relations

75 ☐ Instructor training

76 ☐ Management records and reports

77 ☐ Other: _____

Please complete the information requested on this page for any of the formal programs of health and safety training, skills training or training for first-line supervisors, provided by your company.

Types of Training Offered		
Health and Safety Training	Miner's Skills Training	Supervisory Training for Foremen

26. What type(s) of training facilities are used for the program(s) you offer? (Check all that apply.)

An above-ground facility at the mine location (including mobile training units)

10 ☐

11 ☐

12 ☐

A section of mine

13 ☐

14 ☐

15 ☐

A company facility away from the mine site

16 ☐

17 ☐

18 ☐

A local educational institution's facility

19 ☐

20 ☐

21 ☐

A simulated mine facility at or near mine site

22 ☐

23 ☐

24 ☐

27. For training programs offered at any of your own facilities, where does your company get instructors? (Check all that apply.)

Use company-employed full-time instructors

25 ☐

26 ☐

27 ☐

Use part-time services of other company employees for instruction (such as foremen)

28 ☐

29 ☐

30 ☐

Use outside instructors

31 ☐

32 ☐

33 ☐

28. Who produced the materials used in your program(s)? (Check all that apply.)

Developed internally by company

34 ☐

35 ☐

36 ☐

Developed in cooperation with one or more other firms

37 ☐

38 ☐

39 ☐

Company developed with assistance of a consultant

40 ☐

41 ☐

42 ☐

Trade association

43 ☐

44 ☐

45 ☐

Government agency

46 ☐

47 ☐

48 ☐

Vendor or equipment manufacturer

49 ☐

50 ☐

51 ☐

Other: _____

52 ☐

53 ☐

54 ☐

Types of Training Offered		
Health and Safety Training	Miner's Skills Training	Supervisory Training for Foremen

29. How does your company evaluate each type of program you sponsor?

Oral or written tests of students/trainees	55- ☐	56- ☐	57- ☐
Evaluation form filled out by students/trainees	58- ☐	59- ☐	60- ☐
Evaluation form or written evaluation of course or program by instructor	61- ☐	62- ☐	63- ☐
Performance evaluation by trainee's supervisor	64- ☐	65- ☐	66- ☐
On-the-job training demonstration checklist	67- ☐	68- ☐	69- ☐
Other: _____	70- ☐	71- ☐	72- ☐

30. In recruiting personnel for management positions above the level of first-line supervisors, does your company use cooperative educational programs with 2-year or 4-year colleges (that is, student interns)?

10-1 ☐ Yes 2 ☐ No

If yes, in what types of assignments are these individuals placed?

- 11-☐ Line assignments (mine-based)
12-☐ Staff assignments (company or division-based)

31. What type(s) of assistance does your company provide to managerial and staff personnel for education?

- 13-☐ Tuition assistance
14-☐ Time off for class attendance
15-☐ Full or partial salary with leaves of absence to complete specified degree programs
16-☐ Other: _____

32. A. In which of the subject areas listed below do you feel the greatest need exists for improved training of management and professional level employees?

B. Check any subject in which your company is planning to introduce or increase coverage in company-sponsored training programs over the next 12 months.

	A. Greatest Need For Improved Training (Check only one)	B. Plan to Introduce or Increase Training In This Area
Business management skills	17- ☐	18- ☐
Labor relations skills	19- ☐	20- ☐
Technical skills	21- ☐	22- ☐
Federal/state mining laws and regulations	23- ☐	24- ☐
Other: _____	25- ☐	26- ☐

33. If your company sponsors training programs for technicians, where are these programs located?

- 27-☐ A company facility at or near the mine site
28-☐ A college or university facility
29-☐ Other: _____

34. Do you provide financial assistance beyond salary to employees in cooperative engineering technology programs?

1 ☐ Yes

2 ☐ No

35. Overall, how satisfied are you with each of the training programs below that are now available to your company's employees?

	<u>Very Satisfied</u>	<u>Satisfied</u>	<u>Not Satisfied</u>	<u>Not Now Available</u>
Health and safety training for miners	31-1 ☐	2 ☐	3 ☐	4 ☐
Skills training for miners	32-1 ☐	2 ☐	3 ☐	4 ☐
Training for first-line supervisors	33-1 ☐	2 ☐	3 ☐	4 ☐
Training for other management employees	34-1 ☐	2 ☐	3 ☐	4 ☐
Training programs for technicians	35-1 ☐	2 ☐	3 ☐	4 ☐

36. Now considering only programs provided by, or partially sponsored by, outside institutions and used by your company's employees, please indicate your satisfaction with each outside training source you use.

	<u>Very Satisfied</u>	<u>Satisfied</u>	<u>Not Satisfied</u>	<u>Do Not Have Programs In This Area</u>
Vocational high schools	36-1 ☐	2 ☐	3 ☐	4 ☐
Community colleges	37-1 ☐	2 ☐	3 ☐	4 ☐
Other colleges and universities	38-1 ☐	2 ☐	3 ☐	4 ☐
Federal training programs (e.g., MSHA,* FMCS**)	39-1 ☐	2 ☐	3 ☐	4 ☐
State agencies	40-1 ☐	2 ☐	3 ☐	4 ☐
Trade associations	41-1 ☐	2 ☐	3 ☐	4 ☐
Other: _____	42-1 ☐	2 ☐	3 ☐	4 ☐

37. Please indicate which of the following ways you feel the federal government can most effectively support training and education efforts to serve the coal industry's needs by rating the items 1 (most effective) to 5 (least effective).

To serve our training needs effectively, the federal government should encourage and fund ...

	<u>Rate, 1-5</u>	<u>Should Not Be Supported (Check)</u>
Training programs run by educational institutions	43-_____	☐
Research on coal industry training programs	44-_____	☐
Establishment of cooperative training program operated by mine companies, trade associations, etc.	45-_____	☐
Training programs run by federal agencies such as the Mine Safety and Health Administration, or the Federal Mediation and Conciliation Service	46-_____	☐
Meetings among training professionals in the industry	47-_____	☐

*Mine Safety and Health Administration of the U.S. Department of Labor (formerly MESA)

**Federal Mediation and Conciliation Service

THANK YOU

THE CONFERENCE BOARD

Please return to:
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A CONFERENCE BOARD SURVEY OF COAL INDUSTRY TRAINING PROGRAMS MINE QUESTIONNAIRE

(This is a voluntary survey to be completed by a company headquarters or mine site official)

Name and address of reporting unit, if different from above:

1. a. Is this an underground or a surface mine?

17-1 ☐ Underground

2 ☐ Surface

3 ☐ Other type

(If other, please describe.) _____

b. Please give the annual total coal production of this mine. _____ (short tons)

18-21

2. a. Does your company operate other coal mines at this address?

22-1 ☐ Yes

2 ☐ No

b. If yes, please indicate the total number of each of the following types of mines your company operates at this address.

_____ number of deep mines

23-24

_____ number of surface mines

25-26

_____ number of other types (please describe) _____

27-28

3. In the spaces below, please give the total number of employees in each of four classes who were employed at this site in June, 1978. Then give the corresponding figures for June, 1979.

	<u>Salaried Employees</u>				<u>Total Number of Employees</u>
	<u>Hourly Wage Employees</u>	<u>Clerical Employees</u>	<u>Foremen</u>	<u>Other Management Employees</u>	
June, 1978:	_____	_____	_____	_____	_____
	29-32	33-34	35-36	37-38	39-42
June, 1979:	_____	_____	_____	_____	_____
	43-46	47-48	49-51	52-53	54-57

4. For that 12-month period, please give the total number of new hires and separations that occurred in each of the four classes.

	<u>Hourly Wage Employees</u>	<u>Clerical</u>	<u>Foremen</u>	<u>Other Management</u>
New Hires:	(Experienced)	_____	_____	_____
		58-60		
	(Inexperienced)	_____	_____	_____
		61-63	64-65	66-67
Separations:		_____	_____	_____
		70-72	73-74	75-76
				77-78

5. Please check in the left-hand column all the types of training described below that are available to employees of your mine, regardless of where the training is provided.
6. For each type checked, how many of your miners received such training *during the period July 1, 1978 through June 30, 1979?*
7. For each type of training available, please indicate the length of the program by giving the *average number of hours per trainee.*
8. Now please check boxes to the right of each program that is available to your employees to indicate who provides that type of training.

	<u>Number Trained in Past 12 mos.</u>	<u>Length of Program (Avg. No. Hours per Trainee)</u>	<u>Your Company</u>	<u>Yours and Other Companies Jointly</u>	<u>High Schl/ Vocat. School</u>	<u>Junior/ Community College</u>	<u>Federal Training Program (MSHA,* FMCS,** etc.)</u>	<u>Union Sponsored</u>	<u>Other</u>
Basic Health and Safety Training									
10 ☐ Health and safety training to orient <i>new inexperienced</i> miners	11-14	15-18	19 ☐	20 ☐	21 ☐	22 ☐	23 ☐	24 ☐	25 ☐
26 ☐ Health and safety training to orient new miners who have previous experience	27-30	31-34	35 ☐	36 ☐	37 ☐	38 ☐	39 ☐	40 ☐	41 ☐
42 ☐ Health and safety refresher training offered annually to experienced miners	43-46	47-50	51 ☐	52 ☐	53 ☐	54 ☐	55 ☐	56 ☐	57 ☐
Mining Skills Training for Maintenance Mechanics/Electricians									
Initial skills training for <i>new</i> maintenance workers:									
10 ☐ On-the-job training only	11-14	15-18	19 ☐	20 ☐	21 ☐	22 ☐	23 ☐	24 ☐	25 ☐
26 ☐ Classroom training combined with on-the-job training	27-30	31-34	35 ☐	36 ☐	37 ☐	38 ☐	39 ☐	40 ☐	41 ☐
42 ☐ Courses to upgrade the skills of maintenance mechanics and electricians	43-46	47-50	51 ☐	52 ☐	53 ☐	54 ☐	55 ☐	56 ☐	57 ☐
58 ☐ Training specifically for certification tests as a maintenance mechanic/electrician	59-62	63-66	67 ☐	68 ☐	69 ☐	70 ☐	71 ☐	72 ☐	73 ☐

* Mine Safety and Health Administration of the U.S. Department of Labor (formerly MESA)

** Federal Mediation and Conciliation Service

Skills Training for Equipment Operators/Other Hourly Employees

	<u>Number Trained in Past 12 mos.</u>	<u>Length of Program (Avg. No. Hours per Trainee)</u>	<u>Your Company</u>	<u>Yours and Other Companies Jointly</u>	<u>High Sch/ Vocat. School</u>	<u>Junior/ Community College</u>	<u>Federal Training Program (MSHA,* FMCS,** etc.)</u>	<u>Union Sponsored</u>	<u>Other</u>
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Initial skills training for new hourly employees:

10 ☐ On-the-job training only	11-14	15-18	19 ☐	20 ☐	21 ☐	22 ☐	23 ☐	24 ☐	25 ☐
26 ☐ Classroom training combined with on-the-job training	27-30	31-34	35 ☐	36 ☐	37 ☐	38 ☐	39 ☐	40 ☐	41 ☐
42 ☐ Courses to upgrade the skills of equipment operators and other hourly employees	43-46	47-50	51 ☐	52 ☐	53 ☐	54 ☐	55 ☐	56 ☐	57 ☐
58 ☐ Training specifically for certification tests	59-62	63-66	67 ☐	68 ☐	69 ☐	70 ☐	71 ☐	72 ☐	73 ☐

Any Other Skills Training for Miners (describe)

10 ☐ _____	11-14	15-18	19 ☐	20 ☐	21 ☐	22 ☐	23 ☐	24 ☐	25 ☐
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Foreman Training

26 ☐ General supervisory training	27-30	31-34	35 ☐	36 ☐	37 ☐	38 ☐	39 ☐	40 ☐	41 ☐
42 ☐ Specialized courses in supervisory skills	43-46	47-50	51 ☐	52 ☐	53 ☐	54 ☐	55 ☐	56 ☐	57 ☐
58 ☐ Training for specific foreman certification tests	59-62	63-66	67 ☐	68 ☐	69 ☐	70 ☐	71 ☐	72 ☐	73 ☐

* Mine Safety and Health Administration of the U.S. Department of Labor (formerly MESA)

** Federal Mediation and Conciliation Service

THANK YOU

THE CONFERENCE BOARD

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A CONFERENCE BOARD SURVEY OF COAL INDUSTRY TRAINING PROGRAMS

- For each type of training which is currently offered by your company to its employees, please indicate in Column A or B where this training is provided. (Check all that apply)
- If this type of training is not currently offered by your company but is available from another local source, such as a vocational school or community college, please check in column C.

	Training Currently Offered By Your Company		Training not offered by company but provided at local school or other facility
	At company mine or other company facility A	At local school or other external facility B	
Health and Safety Training			
Introductory training to orient newly-hired miners	10-1 ☐	2 ☐	3 ☐
Refresher training	11-1 ☐	2 ☐	3 ☐
Skills or Task Training			
Mandated task training to comply with health/safety law	12-1 ☐	2 ☐	3 ☐
Other, non-mandated training in miner skills:			
For maintenance mechanics or electricians	13-1 ☐	2 ☐	3 ☐
For equipment operators or other hourly-paid workers	14-1 ☐	2 ☐	3 ☐
Foreman or Supervisory Training	15-1 ☐	2 ☐	3 ☐
Other Training (Please specify)			
	16-1 ☐	2 ☐	3 ☐

- If your company does not offer formal training for miners except the required health and safety training or mandated task training, please check the most important reason for this. (Check only one)

- 17-1 ☐ Local institutional training meets our needs
- 2 ☐ Informal on-the-job training satisfies our needs
- 3 ☐ We do not have the resources or capability to provide formal training
- 4 ☐ We would quickly lose employees we trained to other companies
- 5 ☐ Other reason _____

- Overall, how satisfied are you with each of the training programs below that are now available to your company's employees.

	Very Satisfied	Satisfied	Not Satisfied	Not Now Available
Health and safety training (including task training)	18-1 ☐	2 ☐	3 ☐	4 ☐
Skills training for miners	19-1 ☐	2 ☐	3 ☐	4 ☐
Training for first line supervisors	20-1 ☐	2 ☐	3 ☐	4 ☐
Training for management or other employees	21-1 ☐	2 ☐	3 ☐	4 ☐

5. Please indicate which of the following ways you feel the federal government can most effectively support training and education efforts to serve the coal industry's needs by rating the items 1 (most effective) to 5 (least effective).

To serve our training needs effectively, the federal government should encourage and fund . . .

	Rate (1-5)	Should Not Be Supported (Check)
Training programs run by educational institutions	2- _____	0 ☐
Research on coal industry training programs	2- _____	0 ☐
Establishment of cooperative training programs operated by mine companies, trade associations, etc.	2- _____	0 ☐
Training programs run by federal agencies such as the Mine Safety and Health Administration, or the Federal Mediation and Conciliation Service	2- _____	0 ☐
Meetings among training professionals in the industry	2- _____	0 ☐

6. Please enter below the total employment figures for your entire company, as of June 1979.

Hourly wage employees _____ 27-32
Other employees _____ 33-38

7. Type of coal mining operation:

1 ☐ Deep mines only 2 ☐ Surface mines only 3 ☐ Deep and surface mines
4 ☐ Other _____

8. Please give the annual total coal production of your company:

_____ short tons
49-50

Name and title of individual responding:

Name: _____

Title: _____ Telephone: _____
(Area Code)

If you wish the U.S. Department of Energy to provide you a copy of the published summary report, please indicate the appropriate mailing address below:

_____ 47-48
_____ 49-50
_____ 51-52
_____ 53-54

THANK YOU

1-3
4-6
6-7
8-8

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