PROCEEDINGS

OF THE

ILLINOIS MINING INSTITUTE

FOUNDED FEBRUARY, 1892

1994

Annual Meeting
Collinsville, Illinois
September 22-23, 1994

Illinois Mining Institute, Champaign, Illinois

Published by
Illinois Mining Institute, 615 E. Peabody Drive, Champaign, Illinois 61820
May 1995

Editing by Heinz H. Damberger and Phyllis Godwin
Typesetting by Phyllis Godwin

Printing by United Graphics, Inc., 2916 Marshall Avenue,
P. O. Box 559, Mattoon, Illinois 61938

Robert W. Shanks

PRESIDENT 1993-94

THE COAL MINER

TRUE – he plays no grandstand role in life
But his importance is vital, great and just:
For without his toil in earth's caverns deep,
Civilization would soon crumble into the dust.
AD 1964 From his poem – Vachel Davis

(Dedicated on State Capitol Lawn, Springfield , Illinois, October 16, 1964)

IN MEMORY

of

All Deceased Members

of the

ILLINOIS MINING INSTITUTE

Alex (Sandy) Brown
Thomas E. Caveney
J. W. MacDonald
Benjamin E. Wills

OFFICERS 1993-94

PRESIDENT
Robert W. Shanks
Arch of Illinois, Inc.
Percy, Illinois

FIRST VICE PRESIDENT
David L. Webb
Freeman United Coal Mining Co.
Virden, Illinois

SECOND VICE PRESIDENT
David M. Young
Old Ben Coal Co.
Benton, Illinois

SECRETARY–TREASURER
Heinz H. Damberger
Illinois State Geological Survey
615 East Peabody Drive
Champaign, Illinois 61820
(217) 333-5115

ADMINISTRATIVE ASSISTANT
Phyllis Godwin
P.O. Box 20
Pesotum, Illinois 61863
(217) 867-2791

EXECUTIVE BOARD

Thomas Austin ('94)
Fred Bowman, *ex officio*
Randy Britton ('94)
J. Robert Danko, *ex officio*
Robert Gullic ('94)
Bert Hall ('95)
Aaron D. Jackson ('95)
Donald W. Kinstler ('96)
John Lanzerotte ('95)
Ronnie Marcum ('96)
Neil Martin ('94)
William E. Noel, Jr. ('96)
Joseph S. Spivey, *ex officio*
George A. Woods ('96)
David M. Young ('95)

IMI COMMITTEE CHAIR PERSONS FOR 1993-94

ADVERTISING COMMITTEE
John Payne, *Co-Chairman*
Larry Steward, *Co-Chairman*

HONORARY MEMBERSHIP COMMITTEE
Bert Hall, *Chairman*

NOMINATING COMMITTEE
Don Arrowsmith, *Chairman*

SCHOLARSHIP COMMITTEE
David L. Webb, *Chairman*

AUDITING COMMITTEE
Neil Martin, *Chairman*

PROGRAM COMMITTEE
Ronnie Marcum, *Co-Chairman*
George Woods, *Co-Chairman*

OFFICERS 1994-95

PRESIDENT
David L. Webb
Freeman United Coal Mining Co.
Virden, Illinois

FIRST VICE PRESIDENT
Bert Hall
Cyprus AMAX Coal Co.
Keensburg, Illinois

SECOND VICE PRESIDENT
Aaron D. Jackson
Kerr-McGee Coal Corporation
Harrisburg, Illinois

SECRETARY–TREASURER
Heinz H. Damberger
Illinois State Geological Survey
615 East Peabody Drive
Champaign, Illinois 61820
(217) 333-5115

ADMINISTRATIVE ASSISTANT
Phyllis Godwin
P.O. Box 20
Pesotum, Illinois 61863
(217) 867-2791

EXECUTIVE BOARD

W. Doug Blackburn ('95)
Fred Bowman, *ex officio*
Mike Caldwell ('97)
John Devon ('97)
Jim Folkerts ('97)
Bert Hall ('95)
Aaron D. Jackson ('95)
Donald W. Kinstler ('96)
John Lanzerotte ('95)
Ronnie Marcum ('96)
William E. Noel, Jr. ('96)
Robert Shanks, *ex officio*
Joseph S. Spivey, *ex officio*
David Whitcomb ('97)
George A. Woods ('96)

IMI COMMITTEE CHAIR PERSONS FOR 1994-95

ADVERTISING COMMITTEE
Joe Pileggi, *Co-Chairman*
John Payne, *Co-Chairman*

HONORARY MEMBERSHIP COMMITTEE
Fred Bowman, *Chairman*

NOMINATING COMMITTEE
George Woods, *Chairman*

SCHOLARSHIP COMMITTEE
John Lanzerotte, *Chairman*

AUDITING COMMITTEE
Jeff Hayden, *Chairman*

PROGRAM COMMITTEE
Mike Caldwell, *Co-Chairman*
Bert Hall, *Co-Chairman*

PAST PRESIDENTS OF ILLINOIS MINING INSTITUTE*

Founded February, 1892

1892-93	JAMES C. SIMPSON, Consolidated Coal Co., St. Louis, MO
1893-94	JAMES C. SIMPSON, Consolidated Coal Co., St. Louis, MO
1894-95	WALTON RUTLEDGE, State Mine Inspector, Alton, IL
1895-1911	Institute Inactive
1912-13	JOHN P. REESE, Superior Coal Co., Gillespie, IL
1913-14	THOMAS MOSES, Bunsen Coal Co., Georgetown, IL
1914-15	J. W. STARKS, State Mine Inspector, Georgetown,IL
1915-16	WILLIAM BURTON, Illinois Miners, Springfield, IL
1916-17	FRED PFAHLER Superior Coal Co., Gillespie, IL
1917-18	PATRICK HOGAN, State Mine Inspector, Carbon, IL
1918-19	WILLIAM HALL, Miners Examining Board, Springfield, IL
1919-20	WILLIAM HALL, Miners Examining Board, Springfield, IL
1920-21	FRANK R. TIRRE, North Breese Coal & Mining Co., Breese, IL
1921-22	H. H. STOEK, Mining Dept., University of Illinois, Urbana, IL
1922-23	JOHN G. MILLHOUSE, State Mine Inspector, Litchfield, IL
1923-24	D. D. WILCOX, Superior Coal Co., Gillespie, IL
1924-25	H. E. SMITH, Union Fuel Co., Springfield, IL
1925-26	E. G. LEWIS, Chicago-Sandoval Coal Co., Sandoval, IL
1926-27	WILLIAM E. KIDD, State Mine Inspector, Peoria, IL
1927-28	JAMES S. ANDERSON, Madison Coal Corp., Glen Carbon, IL
1928-29	JOHN E. JONES, Old Ben Coal Corp., West Frankfort, IL
1929-30	A. C. CALLEN, University of Illinois, Urbana, IL
1930-31	JOSEPH D. ZOOK, Illnois Coal Operators Assn., Chicago, IL
1931-32	GEO. C. McFADDEN, Peabody Coal Co., Chicago, IL
1932-33	CHAS. F. HAMILTON, West Virginia Coal Co., St. Louis, MO
1933-34	HARRY A. TREADWELL, C.W. & F. Coal Co., Benton, IL
1934-35	C. J. SANDOE, West Virginia Coal Co., St. Louis, MO
1935-36	T. J. THOMAS, Valier Coal Co., Chicago, IL
1936-37	W. J. JENKINS, Consolidated Coal Co., St. Louis, MO
1937-38	H. H. TAYLOR, FR., Franklin County Coal Corp, Chicago, IL
1938-39	PAUL WEIR, Consulting Mining Engineer, Chicago, IL
1939-40	ROY L. ADAMS, Old Ben Coal Corp., West Frankfort, IL
1940-41	M. M. LEIGHTON, State Geological Survey, Urbana, IL
1941-42	J. A. JEFFERIS, Illinois Terminal Railroad Co., St. Louis, MO
1942-43	CARL T. HAYDEN, Sahara Coal Co., Chicago, IL
1943-44	BEN H. SCHULL, Binkley Mining Co., Chicago, IL
1944-45	GEORGE F. CAMPBELL, Old Ben Coal Corp., Chicago, IL
1945-46	JOSEPH E. HITT, Walter Bledsoe Co., St. Louis, MO
1946-47	ROBERT M. MEDILL, Dept. Mines & Minerals, Springfield, IL
1947-48	HARRY M. MOSES, H. C. Frick Coal Co., Pittsburgh, PA
1948-49	J. ROY BROWNING, Illinois Coal Operators Assn., Chicago, IL
1949-50	T. G. GEROW, Truax-Traer Coal Co., Chicago, IL
1950-51	G. S. JENKINS, Consolidated Coal Co., St. Louis, MO

1951-52 CLAYTON G. BALL, Paul Weir Co., Chicago, IL
1952-53 WILLIAM W. BOLT, Pawnee, IL
1953-54 HAROLD L. WALKER, University of Illinois, Urbana, IL
1954-55 J. W. MacDONALD, Old Ben Coal Corp., Benton, IL
1955-56 EARL SNARR, Freeman Coal Mining Corp., Hindsdale, IL
1956-57 PAUL HALBERSLEBEN, Sahara Coal Co., Harrisburg, IL
1957-58 H. C. LIVINGSTON, Truax-Traer Coal Co., Chicago, IL
1958-59 A. G. GOSSARD, Snow Hill Coal Corp., Terre Haute, IN
1959-60 H. C. McCOLLUM, Peabody Coal Company, St. Louis, MO
1960-61 STUART COLNON, Bell & Zoller Coal Co., Chicago, IL
1961-62 ROBERT J. HEPBURN, United Electric Coal Co., Chicago, IL
1962-63 JOHN P. WEIR, Paul Weir Co., Chicago, IL
1963-64 E. T. (Gene) MORONI, Old Ben Coal Corp., Benton, IL
1964-65 JOHN W. BROADWAY, Bell & Zoller Coal Co., Chicago, IL
1965-66 B. R. GEBHART, Freeman Coal Mining Corp., Chicago, IL
1966-67 C. A. BROECKER, Ayrshire Collieries Corp., Indianapolis, IN
1967-68 JOSEPH CRAGGS, Peabody Coal Co., Taylorville, IL
1968-69 CLAYTON F. SLACK, Sahara Coal Co., Inc., Chicago, IL
1969-70 JOSEPH Q. BERTA, Truax-Traer Coal Co., Pinckneyville, IL
1970-71 R. F. DONALDSON, United Electric Coal Co., Chicago, IL
1971-72 CECIL C. BAILIE, Old Ben Coal Corp., Benton, IL
1972-73 E. MINOR PACE, Inland Steel Co., Sesser, IL
1973-74 ARTHUR L. TOWLES, Zeigler Coal Co., Johnston City, IL
1974-75 DALE E. WALKER, Southwestern Illinois Coal Corp., Percy, IL
1975-76 M.V. (Doc) HARRELL, Freeman United Coal Mining Co., Chicago, IL
1976-77 JOHN J. SENSE, Tosco Mining Corp., Pittsburgh, PA
1977-78 BILL F. EADS, Monterey Coal Co., Collinsville, IL
1978-79 WILLIAM E. WILL, Peabody Coal Co., Evansville, IN
1979-80 CHARLES E. BOND, Consolidation Coal Co., Springfield, IL
1980-81 WALTER S. LUCAS, Sahara Coal Co., Inc., Harrisburg, IL
1981-82 JACK A. SIMON, Illinois State Geological Survey, Urbana, IL
1982-83 H. ELKINS PAYNE, AMAX Coal Co., Indianapolis, IN
1983-84 JAMES D. CHADY, Old Ben Coal Co., Benton, IL
1984-85 ROBERT M. IZARD, Midland Coal Co., Farmington, IL
1985-86 DAVID A. BEERBOWER, Freeman United Coal Mining Co., Mt. Vernon, IL
1986-87 MACK H. SHUMATE, Zeigler Coal Co., Fairview Heights, IL
1987-88 M. E. HOPKINS, Peabody Development Co., St. Louis, MO
1988-89 GEORGE L. MAY, Monterey Coal Co., Carlinville, IL
1989-90 RICHARD R. SHOCKLEY, Illinois Department of Mines & Minerals, Springfield, IL
1990-91 DAN G. WOOTON, White County Coal Corp., Carmi, IL
1991-92 MICHAEL K. REILLY, Zeigler Coal Co., Fairview Heights, IL
1992-93 J. ROBERT DANKO, Peabody Coal Co., Marissa, IL
1993-94 ROBERT W. SHANKS, Arch of Illinois, Inc., Percy, IL

*Affiliations listed at time of presidency.

PAST SECRETARIES AND SECRETARY-TREASURERS

1892-95	JOHN S. LORD, Chicago and Kansas City Coal Co.
1895-11	Institute inactive
1912-23?	MARTIN BOLT, Illinois Department of Mines and Minerals
1923?-29	FRANK R. TIREE, St. Louis, MO
1929-54	B. E. SCHONTHAL, B. E. Schonthal & Co.
1954-63	GEORGE M. WILSON, Illinois State Geological Survey
1963-68	JACK A. SIMON, Illinois State Geological Survey
1968-75	M. E. HOPKINS, Illinois State Geological Survey
1976-78	HAROLD J. GLUSKOTER, Illinois State Geological Survey
1978-	HEINZ H. DAMBERGER, Illinois State Geological Survey

LIST OF HONORARY MEMBERS*

Listed are honorary members from the beginning of the Institute as far as our records revealed. Honorary members were not approved or elected every year. According to the IMI Constitution and Bylaws adopted June 24, 1913, Article II, Section 2: "*Any person of distinction in mining may be elected an honorary member of the Institute by two-thirds vote....*" In 1983, this section of the Constitution was amended to: "*Annually, one or more members recommended by a committee and approved by the Executive Board, who has rendered outstanding service to the Illinois Mining Institute, and thereby to the coal industry of the state, may be elected as an Honorary Member with dues being waived.*"

1928 A. J. Moorshead, La Jolla, CA
Hugh Murray, Equality, IL
John Rollo, North Breese Coal Mining Co., Breese, IL
1929 Frank Tirre, St. Louis, MO
1932 Thomas R. Stockett, Spring Canyon Coal Co., Spring Canyon, UT
1939 John F. Goally, Morris, IL
Eugene McAuliffe, Union Pacific Co., Omaha, NB
Thomas Moses, Bunson Coal Co., Danville, IL
1940 F. E. Weissenborn, IL Coal Operators Assoc., St. Louis, MO
1945 J. A. Jefferis, IL Terminal Railroad, St. Louis, MO
W. J. Jenkins, Consolidated Coal Co., St. Louis, MO
1948 J. W. Starks, IL Department of Mines & Minerals, Springfield, IL
L. E. Young, Mining Engineer, Pittsburgh, PA
1949 John E. Jones, Old Ben Coal Corp., West Frankfort, IL
F. S. Pfahler, Superior Coal Co., Chicago, IL
B. E. Schonthal, B. E. Schonthal Co., Inc., Chicago, IL
Paul Weir, Paul Weir Co., Chicago, IL
D. D. Wilcox, Superior Coal Co., Gillespie, IL
1955 George C. McFadden, Carmac Coal Co., Chicago, IL
1958 D. W. Buchanan, Jr., Old Ben Coal Corp., Chicago, IL
1961 Fred S. Wilkey, IL Coal Operators Assoc., Chicago, IL
1963 George M. Wilson, IL State Geological Survey, Urbana, IL
1965 M. M. Leighton, IL State Geological Survey, Urbana, IL
1966 Carl T. Hayden, Sahara Coal Co., Chicago, IL
1968 John W. Broadway, Ben & Zoller Coal Co., Chicago, IL
Jack A. Simon, IL State Geological Survey, Champaign, IL
1969 B. H. Schull, Benkilley Mining Co., Marion, IL
1970 J. W. MacDonald, Consultant, Benton, IL
1971 H. C. McCollum, Peabody Coal Co., St. Louis, MO
1972 Frank Nugent, Freeman United Coal Mining Co., Chicago, IL
1973 Paul Halbersleben Sahara Coal Co., Inc., Harrisburg, IL
1974 G. Clayton Ball, Paul Weir Co., Evanston, IL
1975 C. C. Conway, National Mine Service, Nashville, IL
M. E. Hopkins, IL State Geological Survey, Urbana, IL

Honorary Members, *continued*

1976 Nate G. Perrine, Peabody Coal Co., St. Louis, MO
1978 Cletus A. Broecker, Amax Coal Co., Indianapolis, IN
1979 Thomas L. Garwood, Freeman Coal Mining Co., Benton, IL
1980 George C. Lindsay, Coal Mining & Processing, Chicago, IL
1981 Joseph Schonthal, J. Schonthal & Assoc., Highland Park, IL
1982 J. A. Bottomley, Sahara Coal Co., Inc., Harrisburg, IL
1983 Betty Conerty, Illinois Mining Institute, Urbana, IL
Joe Craggs, Peabody Coal Co., Taylorville, IL
1984 E. T. Moroni, Old Ben Coal Co., Herrin, IL
1984 E. Minor Pace, Inland Steel Coal Co., Mt. Vernon, IL
1985 Russell T. Dawe, Inland Steel Coal Co., Valier, IL
1986 E. H. Roberts, Inland Steel Coal Co., Mt. Vernon, IL
1987 William E. Will, Peabody Coal Co., St. Louis, MO
1988 Lanny Bell, Roberts & Schaefer Co., Chicago, IL
1989 M. V. (Doc) Harrell, Freeman United Coal Mining Co., Chicago, IL
1990 John C. Bennett, Peabody Coal Co., Belleville, IL
1991 Richard R. Shockley, Center for Research on Sulfur in Coal, Carterville, IL
1992 Walter E. Brandlein, Roberts & Schaefer Co, Chicago, IL
Dayton McReaken, Zeigler Coal Co., Fairview Heights, IL
Thomas Sadler, Old Ben Coal Co., Benton, IL
Raymond C. Taucher, Consolidation Coal Co., Pinckneyville, IL
1993 Fred Rice, Peabody Coal Co.
1994 Walter S. Lucas, Sahara Coal Co., Harrisburg, IL

*Affiliations listed are at time of award.

CONTENTS

Page

ANNUAL MEETING

THURSDAY MORNING SESSION

LUNCHEON MEETING

FRIDAY MORNING

FRIDAY MORNING TECHNICAL SESSION

EXHIBITORS AND ADVERTISERS

PROCEEDINGS
OF THE
ILLINOIS MINING INSTITUTE

ANNUAL MEETING
102nd YEAR
Collinsville, Illinois
Thursday and Friday, September 22-23, 1994

The opening session of the 102nd Annual Meeting of the Illinois Mining Institute was convened at 10:00 A.M., Thursday, September 22, 1994, in the La Salle Room of the Gateway Center. Robert W. Shanks, President of the Institute, presided.

OPENING

Robert Shanks: Good morning. My name is Bob Shanks. This year I had the honor of serving as the president of the Illinois Mining Institute. I call this 102nd Annual Meeting to order and congratulate all of those that have made the IMI a success for more than a century. The longevity and success of this organization have only occurred through the dedication of time and the excellent efforts of many people. A great deal of planning and hard work has gone into preparation for this, our 102nd Annual Meeting. I hope you enjoy the program. A number of very capable people have worked hard to make this year's meeting the best ever. Without slighting anyone, I'd like to recognize just a few at this time. First and foremost, I'd like to thank Heinz Damberger and Phyllis Godwin for their hard work and outstanding support. Without their efforts, we could simply not be having this meeting. They have certainly kept me in line over the past year, and I know that they have provided a great deal of support for our committee chairmen. Next I would like to thank John Payne and Larry Steward, who are co-chairmen of the Advertising Committee, and everyone who served with them in their group. These men and women are directly responsible for the continued financial health of our organization. Through their successful efforts, the Institute continues to have the necessary funds to support its meetings and scholarship awards. Our special thanks also go to our exhibitors who have provided support for the Institute this year. Virtually all of the exhibit space has been taken, and I urge everyone to support these companies and organizations by taking the time to visit their displays throughout the Gateway Center.

Before we begin our first technical session, I need to make a few announcements. Our luncheon meeting today will begin at 12:30 in this same room. So we need to keep this morning's program moving along. Hopefully, the program can be completed by noon which will allow about a half an hour to set up this room for lunch. Unfortunately, our planned luncheon speaker, Governor Jim Edgar will be unable to join us. The Governor sends his regrets, but State business does not allow him to be in Collinsville today. However, we are very fortunate to have Dr. Ron McMahan filling the Governor's shoes. Dr. McMahan is founder and president of RDI and will speak to us today on the results of his firm's Illinois Basin market study. I'm sure everyone will want to hear what Ron has to say about this most important topic which affects everyone in our industry.

Tomorrow morning, the business session will begin in this same room at 9:00 A.M. We will also have a free continental breakfast in the exhibit hall beginning at 8:00 A.M. The second technical session will start here at 10:00 A.M. and will last until noon. Ronnie Marcum, vice president of Consol's Illinois operations will preside over the session. He has assembled an outstanding selection of papers dealing with new developments in mining technology in Illinois. I hope everyone can attend that session tomorrow morning.

Next I would like to request everyone's assistance in keeping our necrology list current. If you know of the death of any IMI member or former member during the past year, would you please inform either Heinz Damberger, Phyllis Godwin or anyone else at the registration desk.

I'd also like to mention that Zeigler's subsidiary, Americoal, has again donated two airline tickets for a trip to anywhere in the United States. These tickets will be drawn at noon on Friday in the lobby. Be sure you buy your raffle tickets before then in time for that drawing [Don Webb of Freeman United Coal Co., won the free airline tickets]. A door prize will also be given away at noon on Friday: a set of golf clubs donated by Jim Justice, President of DuQuoin Iron and Supply. Everyone who is registered for this IMI meeting will have a chance to win the golf clubs [John Stratton of DuQuoin Iron & Supply, won the golf clubs].

Please note that the guards at the entrance to this room and at the entrance to the exhibit hall have been instructed to refuse entry to anyone who is not wearing their IMI badge. So please make sure that you are properly registered and that you wear your badge at all times. I'd like to remind you that the trade exhibits will be open throughout the center from 1:00 P.M. to 7:00 P.M. today and from 8:00 A.M. to noon tomorrow. Also, you are invited to attend the fellowship between 5:00 and 7:00 this evening in the exhibit hall and drop by the hospitality rooms at the Gateway Center and next door at the Holiday Inn.

That concludes my announcements, and now it is my pleasure to introduce the chairman of this morning's technical session, George Woods. George is Dean of Mining Technology at John A. Logan College and Illinois

Eastern Community Colleges. The session this morning deals with the current regulatory climate for the coal industry in Illinois. George, I turn the program over to you.

TECHNICAL SESSION I: OPPORTUNITIES FOR ILLINOIS COAL IN CURRENT REGULATORY ENVIRONMENT

George Woods: Good morning and welcome to the first technical session during the meeting of the 102nd Illinois Mining Institute. Our session is titled "Opportunities for Illinois Coal in the Current Regulatory Environment." I think when you hear the words "opportunities for Illinois coal" used in the same sentence there is cause for a little enthusiasm. Our first speaker is Richard L. Kerch. He is the director of Air and Water Quality Activities at Consol, Inc., Pittsburgh, Pennsylvania. Dick has a Bachelor's and a Master's degree in physics from Purdue and SIU-E, respectively. He grew up a few miles west of here in Granite

George Woods

City where everyone knew what air pollution was about: prosperity. He began his career in environmental matters in 1971 here in Collinsville, shortly after the passage of the 1970 Clean Air Act, with the Illinois EPA in their division of public water supply before moving to air quality with the fledgling Iowa EQ as the regional air quality specialist. In 1974, he saw the light and began his twenty year employment in the coal industry, first with AMAX Coal in Indianapolis and since 1978 with Consol in Pittsburgh. During the last twenty years he has worked on numerous industry issues such as fugitive dust, the national industry ambient air quality standards and particulate matters emissions from coal thermal dryers and dispersion modeling which included participation in the National Committee on Air Quality. He devoted nearly a decade to understanding the scientific and political dimensions of acid rain, fought the good fight while debating the merits of acid rain controls, including testifying before Congress on several occasions. During the late 1980s, he served as chairman of the Environmental Matters Committee of the American Mining Congress; currently he serves on the Virginia State Advisory Board to the Air Pollution Control Board. In this capacity, he has just finished preparing an instructional manual for the regulating committee preparing the Virginia Title V permit applications. Dick's presentation is entitled "Impending Impacts of Title III and Title V of the Clean Air Act Amendments of 1990 on the Coal Industry."

Richard Kerch: Good morning. It is hard to believe that in November four years will have gone by since the passage of the 1990 Clean Air Act Amendments.

IMPENDING IMPACTS OF TITLE III AND TITLE V OF THE CLEAN AIR ACT AMENDMENTS OF 1990 ON THE COAL INDUSTRY

RICHARD L. KERCH
Consol, Inc.
Pittsburgh, Pennsylvania

INTRODUCTION

The coal industry has already begun to feel the affects of the acid deposition title, particularly here in Illinois. It has not been good. It has not been good in most of the midwestern states. But that is not what I'm going to be talking to you about today. I want to talk about two other areas that are going to provide fairly steep challenges to us as producers and sellers of coal; i.e., (1) Title III, Hazardous Air Pollutants and what is in store for our customers, and (2) Title V, Operating Permits, which may affect our production facilities.

TITLE V: OPERATING PERMITS

Title V deals with operating permits. The state of Illinois, as well as 47 other states, is awaiting final approval from the U.S. EPA on their operating permit program. The stack of forms that make up an application are well over an inch thick. Not all of them are going to have to be filled out by every source category. But if it applies to you, it is going to be a very, very detailed application.

Title V will apply if your preparation plant (or mine) emits more than ten tons of any single hazardous air pollutant (HAP) or 25 tons in aggregate of any HAPs, or if it emits 100 tons of any of the so-called criteria pollutants, e.g., particulate matter, sulfur dioxide, oxides of nitrogen, etc., or if it was a plant built since 1974 and subject to the New Source Performance Standards (NSPS) for coal cleaning plants, or if it is subject, and this is highly unlikely, to some regulation under the current HAP program. If any of these apply to your facility, then you'll will be required to get a Title V operating permit from the appropriate state, commencing sometime in 1995. In Illinois, I am told that they are going to inform you when your permit application is due by SIC code. I don't know when our SIC code will be called, but when it is, the Illinois EPA will direct you to submit an application.

You will have to provide a complete and comprehensive emission inventory. You will have to provide a list of all applicable emission limits or standards. If you do not have a thermal dryer, that list may be fairly small. There will be a great deal of new record keeping and reporting requirements. There are compliance schedules. On a periodic basis, you will have to show the state that you are in compliance. And if you are not, you are going to have to tell them about it. Failure to reveal noncompliance will be, in many instances, more serious than the noncompliance itself.

The enforcement title gives the state or the federal government a wide range of options in dealing with violations of the permit. They can issue compliance orders, probably the most severe of all the options. They can assess monetary penalties. It will be similar to a state trooper with a ticket book, issuing traffic citations. And you will be presumed guilty. The ability to appeal is fairly limited. The state can refer cases to the U. S. Department of Justice. And all of our neighbors can get into the act by filing citizen suits. Perhaps the most scary thing that is now in the Clean Air Act, is the possibility for implementation of federal sanctions. We have management's attention when we talk about executives going to jail. Today, any person, meaning an individual or an organization, that commits a knowing violation of any state implementation plan, administrative compliance order, or permit, or provision of the Act is subject, upon conviction, to fines of not more than $250,000, or imprisonment of not more than five years, or both. I don't know when enforcement people are going to pursue criminal sanctions, but I'll bet before the decade is out, we'll start to see individuals who take a fast and loose attitude towards compliance with this particular statute, going to jail.

To wind up on operating permits. In Illinois, 1995 is going to be the target. If you have to get a Title V operating permit, I would suggest that you seriously consider contracting for the expertise to guide you in preparing the permit applications. These are five-year permits. The possibility for making mistakes that could lock you into operating your facility in a way that cannot meet sudden changes in the market is very high. So you will want to think very carefully about how you permit your facility to give yourself maximum flexibility.

TITLE III: HAZARDOUS AIR POLLUTANTS

Most of the things that are in coal that we are concerned about occur in the 100 parts per billion concentration range. Just to give you an idea of what that equates to: 100 parts per billion in a standard lifetime corresponds to three minutes. I guess we wouldn't all be too terribly concerned if our lives were cut short by three minutes. In a flight from Pittsburgh to Tokyo, 100 parts per billion is four feet. That is not a big deal unless the airplane lands about four feet short of the runway when it gets to Tokyo–particularly on that new airport they built out in the ocean. Compared to the United States gross national product, it is equivalent to about $500. That is not too much, unless you happen to bet on the Cardinals to win the championship–football or baseball.

Mercury in a typical Consol coal is 100 parts per billion. Mercury that is emitted into the atmosphere from all U.S. coal in a typical year, amounts to approximately 75 tons per year. Is that a big number? Well, I have good news and bad news. The good news is you don't need to know the answer to that, because the bad news is the government is going to tell you very shortly.

Maximum Available Control Technology (MACT)

The 1990 Clean Air Act Title III deals with air toxics. There are 189 listed substances. If a source emits more than ten of any one or 25 altogether, then that source may have to apply what is called maximum available control technology (MACT). Utilities were exempted by statute until 1993, when a study was to be done. Obviously, since we are in the fall of 1994 and that study is still not complete, the exemption continues.

We find eleven hazardous air pollutants on the list of 189 that are common trace elements found in coal. They are: beryllium, antimony, chromium, lead, mercury, selenium, arsenic, cadmium, cobalt, manganese and nickel. You will also see that chlorine, many organics compounds and radionuclei appear on that list. But we think that what the coal industry ought to be concerned about are the trace metals that are found in coal.

There are three major EPA reports that are required by law. The draft report on the utility sector looks like it will be released in November of this year. The Clean Air Research Title required a separate study looking at mercury. That report is also due later on this year. And, finally, a third study required in the Clean Air Act, the Great Waters Study report, was due in May. The Great Waters Study draft was recently issued. It is a scary document in the sense that there were some twelve substances that the legislation directed EPA to study. Most of them were pesticides or herbicides. These are not of much interest to us or the utilities; but mercury was one of those twelve substances, and the administrator is not bound by the 10-ton per year or 25-ton per year thresholds if she decides to regulate any of them. Mercury looks like it will surely be nominated for control in the utility study or in the Great Waters report.

Maximum achievable control technology is defined in the statute, including the following phrase, "...including a prohibition on such emissions where achievable...." Congress has given the administrator the latitude in some instances to make zero emissions the regulatory scheme.

When evaluating emissions from a typical 500 megawatt power plant at 80 percent capacity, using a Pittsburgh seam coal, the uncontrolled emission of the eleven trace elements were calculated to be 270 tons per year.

What we found is that coal cleaning is a terrific way to reduce most of these trace elements. The reason is they are associated with the ash, and to the extent that you get good ash removal in your cleaning plant, you are also removing a considerable fraction of the eleven trace elements. However, they are not all removed with the same efficiency. One can achieve about a 78 percent reduction just by cleaning the coal. What we are trying to do is convince the EPA that maximum available control technology, in the first instance, ought to be just cleaning coal. The EPA shouldn't require the utility to do anything more. However, most power plants have electrostatic precipitators (ESP) which are capable of getting another 96 percent reduction off of the 78 percent. So, with an ESP unit and using a clean coal product, you can reduce the 270 tons per year going into that boiler to about 2.5 tons coming out of the stack. If you also have a fluegas desulfurization unit, you can get additional reduction.

Question: Is that the figure that is given after clean coal?

Richard Kerch: Yes, it is a combination of coals. For comparison, in our Illinois (No. 6) coal, some of the elements have somewhat more of these constituents than the Pittsburgh seam does. Beryllium, cadmium, manganese, nickel, lead and antimony are all significantly higher. By significant, I mean more than 50 percent higher and in some cases by maybe a factor of two or three. On a clean coal basis, the differences are not as much, but, in general, even a clean Illinois coal has a little bit more than a Pittsburgh seam coal does. Manganese has the largest trace element concentration. Out of the 270 tons of uncontrolled trace elements, manganese would count for 112 tons. Cleaning and an electrostatic precipitator, in most instances, with respect to these eleven trace elements is going to be below the 25-ton threshold.

The problem is what the EPA is going to do with chlorine, i.e., HCl. Chlorine typically is in percent quantities in coal. You could end up with over 10 tons of chlorine, and then everything else kicks in. We don't know whether the EPA will regulate chlorine or not.

Consol's main concern is mercury. Our guess is that mercury will not escape regulation. A 500-megawatt power plant emits about a quarter of a ton of mercury emissions. You do not get quite as good removal rate in the cleaning process, and ESP does not do nearly as good a job. The primary reason for this is that mercury stays in the gas phase and is not a particulate. It does not condense even in the cool back end of the stack, and most of it is going to be emitted in the gas phase. Fluegas desulfurization units should be capable of removing more mercury, though.

The Great Waters Study's objective is to look at the impact of air emissions primarily on the Great Lakes, Chesapeake Bay and a couple of other coastal areas. The first report came out this past May. Basically, this report is showing that mercury persists in the environment; it accumulates in the food chain. The EPA believes that this is a significant human health effect and that "reasonable action," which is a term that is in the statute, is justified. This study is going on independently of the utility study, which is also looking at mercury along with the other 188 substances. Our concern is that it is plausible that the Administrator could decide not to do anything about mercury under the utility program, but use The Great Waters report as a means to regulate mercury. Since there are no thresholds specified in this part of the act, the 10-ton and 25-ton thresholds may not be applicable; i.e., they could be considerably smaller. Specific sources are not identified in the May report. However, deposition from air is believed to be a significant contributor to the amount of mercury that is finding its way into the biosphere. Fossil fuel power plants have been highlighted within this study.

There are some issues of technical concern. Trace elements are naturally variable. We've done enough analyses over the years to know that they vary in time within the same mine. We know that they vary within the seam. Two mines side by side may have different concentrations on average. There are also seam to seam differences. There are no coals that are low in all trace elements, so there is not going to be a case of a high-sulfur/low-sulfur marketing controversy with trace elements. Generally, the trace elements follow the ash content.

Stack sampling analysis and coal analysis can be inaccurate; particularly, in stack sampling we've seen errors as great as a factor of ten. If you try to measure all the streams, coal coming in, the flue gas, the bottom ash, the fly ash–you try to account for all of the mercury through a mass balance. The best closure we have seen is about 40 percent. These kinds of analyses are slow and expensive. We have done a couple of total power plant assessments for a couple of our customers in the last few years. The cost of such an assessment may be one million dollars, or more. Because stack sampling is so difficult to do and so expensive and slow, it is our opinion that the EPA is going to base its control regulations on coal analysis. They will simply take the hazardous air pollutant content of coal, multiply it by some emission factor, and insert the estimated emissions into some model which estimates health risk. This is the approach that will likely be used to regulate hazardous air pollutants.

My last point is the technical concern regarding residual risk. There is a second step to the MACT regulation. Ten or fifteen years down the line, after MACT is applied, the EPA will do a so-called residual risk assessment, which may further reduce the allowable emissions for many sources.

Finally, I would like to discuss some of the things Consol is doing. We've been running comprehensive coal analyses from 1982 to the present, and we've been doing trace element analyses annually on all the coals that we produce, as well as on certain exploration cores. We've looked at as many as 25 substances over the years. Occasionally we cut one back or add one, but we have information on all of the eleven mentioned above, for well over a decade. We did a major assessment of coal cleaning on eight of our preparation plants for Pittsburgh, Illinois Herrin (No. 6), Pocahontas 3 and 4 seams–looking at the raw versus clean coal concentrations. We have provided that information to an EPRI contractor in order to provide information which we think is more reliable than the data that the EPA has been using. Relying on in-situ coal quality data for trace elements is not a particularly valid way to do it. So, we provided some information to EPA on seams in which we have a strong interest. Some of the other coal companies have also been providing information on their coals.

We've also been looking at sampling methods development and have been involved in the Department of Energy's Air Toxics Assessment Program. We have been doing a lot of things in-house on emission control technology: combustor testing, pilot plant development, trying to better understand mercury emissions–where it goes and in what form it is being emitted. We are trying to demonstrate the benefits of coal cleaning so that policymakers understand that there are natural variabilities in trace elements and that there is a great deal of uncertainty in analytical methods. We have been trying to review the EPA study and, generally, participate in the regulatory process to the extent we can, as well as publish as much information as we can in the scientific literature.

SUMMARY

The utilities are temporarily exempted from Title III. The Great Waters report suggests that mercury will be regulated, and it looks like risk assessments will be based on coal analysis rather than on actual emission measurements. Stack sampling is difficult, expensive and slow. Coal cleaning is important in reducing trace elements. Electrostatic precipitators also remove trace elements. ESPs are less effective for mercury and selenium because they are emitted in the gas phase. FGD can remove hazardous air pollutants, but it is not well documented.

George Woods: Our next presentation will be given by Rolf Maurer. He is the Technical Support Manager/Coal Gasification for Destec Energy, Inc., Division of Dow Chemical. Mr. Maurer has Bachelor's and Master's degrees in aeronautical and astronomical engineering from the University of Illinois. He worked in the aerospace industry from 1966 to 1974. Since 1974, he has been in coal gasification energy systems. Mr. Maurer's career in the coal gasification energy systems began with the DOE's gasifier industry program as a project manager for the Deland-Jerry gasification project in Norton, Pennsylvania. Since the initial industrial coal gasification project in York, Pennsylvania, Mr. Maurer's activities have involved: Manager of the Mining Industrial Fuel Gas Project, jointly funded by the U. S. DOE and the U. S. Department of Interior Bureau of Mines that was in 1981-85 in Minneapolis, Minnesota. He has also been involved in the management, installation and the commissioning of the first two-stage industrial gasifiers in China, supplying fuel gas to continuous tunnel kilns. Mr. Maurer's responsibility with Destec Energy is to provide technical support to commercial development of Dectec's coal gasification combined cycle systems within both the utility sector and independent power generation markets. Mr. Maurer's presentation reviews the Wabash River Repowering Project which will utilize high sulfur Illinois Basin bituminous coal to generate 262 megawatts in an environmentally clean and efficient manner via Destec Energy's coal gasification process at PSI Energy's Wabash River Station near Terre Haute, Indiana. His presentation will also highlight the unique project structure and working relationship established by Destec Energy and PSI Energy to effect this clean coal repowering. Also with Rolf is Dan Rimstidt, Fuels Procurement Manager for PSI Energy. He will hopefully entertain a few questions once Mr. Maurer is finished.

Rolf Maurer: Thank you George. I am pleased to be here this morning. We are very excited about the Wabash Project. It provides a real opportunity for Illinois Basin high sulfur coal to be used cleanly and effectively for highly efficient power generation in this part of the country and beyond.

THE WABASH RIVER COAL GASIFICATION REPOWERING PROJECT AN INVESTMENT IN THE FUTURE

JIM J. COOK
PSI Energy, Inc.
Plainfield, Indiana

ROLF E. MAURER[1]
Destec Energy, Inc.
Houston, Texas

INTRODUCTION

The Wabash River Coal Gasification Repowering Project (the Project) is a joint venture of Destec Energy, Inc. (Destec) of Houston, Texas, and PSI Energy, Inc. (PSI) of Plainfield, Indiana. The goal is to develop, design, construct, own and operate a commercial coal gasification combined cycle (CGCC) power plant at PSI's Wabash River Generating Station in West Terre Haute, Indiana. PSI will be responsible for the new power generation facilities and modification of the existing unit, while Destec will own and operate the coal gasification plant.

With this Project, Destec and PSI are participating in the U. S. Department of Energy's (DOE) Clean Coal Technology Program to demonstrate the coal gasification repowering of an existing generating unit affected by the 1990 Clean Air Act Amendments (CAAA). The Project will repower one of the six units at PSI's Wabash River Generating Station. The CGCC power plant will produce a nominal 262 (net) megawatt (MW) of clean, energy-efficient capacity for PSI's customers. The Project will use locally-mined (Illinois Basin) high-sulfur coal and out-perform Phase II requirements of the CAAA. The net plant heat rate will be approximately 9,000 Btu/kWh (HHV) and SO_2 emissions are expected to be less than 0.02 lbs/MMBtu of fuel. Upon start up in 1995, the Project will be the largest operating, single-train coal gasification combined cycle plant in the United States.

The Project will dispatch as base load in PSI's system on the basis of both efficiency and environmental emissions and will be in operation as a PSI generating resource for at least 25 years. The Project is expected to produce

---

[1]Presented at the 102nd Annual Meeting by Rolf E. Maurer.

some of the lowest cost electricity on the PSI system. The DOE Clean Coal Program Demonstration Period will cover the first three years of operation. The DOE investment in the Project is essential to ensuring the success of the first fully integrated commercial CGCC repowering project in the United States. Ultimately, efficient and clean CGCC technology can meet both domestic and global energy and environmental needs.

BACKGROUND

The Destec Coal Gasification process was originally developed by The Dow Chemical Company during the 1970s in order to diversity its fuel base from natural gas to lignite and other coals. The technology being used at Wabash is an extension of the experience gained from that time through pilot plants and up to the Louisiana Gasification Technology, Inc. (LGTI) facility in Plaquemine, Louisiana. LGTI is a 160 MW coal gasification facility which has been operating since April 1987.

Using data and experience gained at LGTI, Destec approached PSI in 1990, and discussions concerning the Wabash Project were initiated. Subsequently, Destec and PSI formed a joint venture for the purpose of participating in the U. S. DOE's Clean Coal Technology Program. In September 1991, the Project was selected by the U. S. DOE as a Clean Coal Round IV project to demonstrate integration of an existing PSI steam turbine generator and auxiliaries, a new combustion turbine, a heat recovery steam generator (HRSG) and a coal gasification facility to achieve improved efficiency and reduced emissions. In July 1992, a Cooperative Agreement was signed with the U. S. DOE. Under the terms of this agreement, the Wabash River Coal Gasification Repowering Project Joint Venture will develop, construct and operate a coal gasification combined cycle (CGCC) facility, and the U. S. DOE will provide cost-sharing funds for construction and a three-year Demonstration Period.

PROJECT ORGANIZATION AND STRUCTURE

In general, Destec has responsibility for financing, construction and operation of the gasification portion of the Project, and PSI has responsibility for financing, construction and operation of the power generation portion of the Project. The Project will involve a construction period of approximately two years and an operating period of at least 25 years.

Two agreements establish the basis for the PSI and Destec relationship. The Joint Venture Agreement created the Wabash River Coal Gasification Repowering Project Joint Venture in order to administer the Project under the DOE Cooperative Agreement. The Gasification Services Agreement includes the commercial terms between PSI and Destec under which the Project will be developed and operated. The structure of the Gasification Services Agreement allows the Project to be integrated for higher efficiency and provides for the use of common facilities to eliminate duplication. The major provisions of the Gasification Services Agreement include:

PSI Responsibilities:

- Build and operate the power generation facility.
- Furnish Destec with a site, coal, electric power and other utilities.
- Pay a monthly fee to Destec for gasification services.

Destec Responsibilities:

- Build and operate the coal gasification facility.
- Guarantee performance of the coal gasification facility.
- Deliver syngas and steam to the power generation facility.

TECHNICAL DESCRIPTION OF PROJECT

Design

The Destec gasification process features an oxygen-blown, two-stage entrained flow gasifier. A process block flow diagram is shown in figure 1.

In the Destec coal gasification process, coal is ground with water to form a slurry. It is then pumped into a gasification vessel where oxygen is added to form a hot, raw gas through partial oxidation. Most of the noncarbon material in the coal melts and flows out of the bottom of the vessel forming slag – a black, glassy, nonleaching, sand-like material. The hot, raw gas is then cooled in a heat exchanger which produces high pressure steam. Particulates, sulfur and other impurities are removed from the gas before combustion to make it an acceptable fuel for the gas turbine.

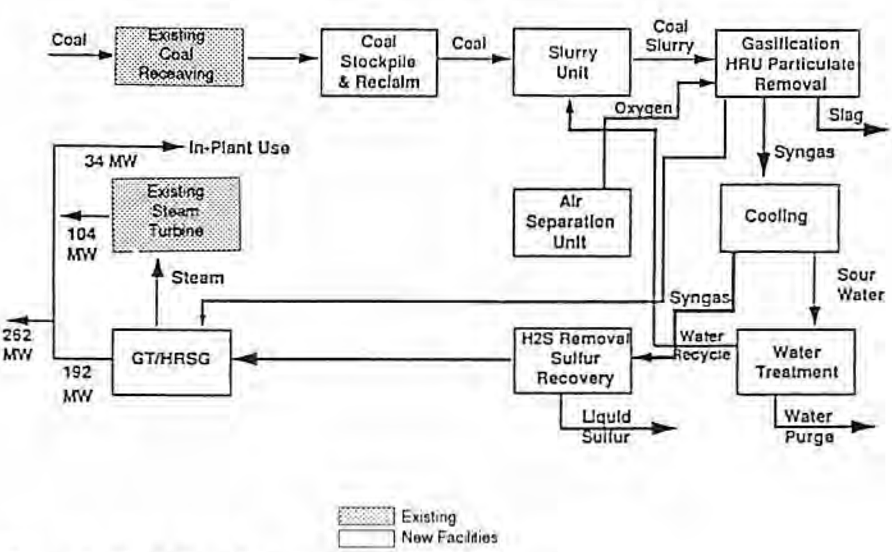


Figure 1. Block flow diagram.

The syngas is piped to a General Electric 7FA high-temperature combustion turbine generator which produces approximately 192 MW of electricity with syngas fuel. The Project is the first application of advanced gas turbine technology for syngas fuel. A heat recovery steam generator recovers gas turbine exhaust heat to produce high pressure steam. This steam and the steam generated in the gasification process supply an existing steam turbine generator in PSI's plant to produce an additional 104 MW. Plant auxiliaries in the power generation and coal gasification areas consume approximately 34 MW, for a nominal net power generation for export of 262 MW.

Several novel technology applications are included in the Project:

- *Hot/Dry Particulate Removal* will be demonstrated at full commercial scale.
- *Syngas Recycle* will provide fuel and process flexibility while maintaining high efficiency.
- *A High Pressure Boiler* will cool the hot, raw gas by producing steam at a pressure of 1,600 psia.
- *A Dedicated Advanced Design Oxygen Plant* will produce 95 percent pure oxygen for use by the Project.
- *Integration between the Heat Recovery Steam Generator and the Gasification Facility* has been optimized to yield higher efficiency and lower operating costs.

The new power generation facility will also include additional water treatment systems. The combustion turbine has steam injection for NO_x control. The amount of this injection flow is reduced compared to conventional systems because the syngas burned in the combustion turbine is moisturized at the gasification facility, making use of low level heat in the process. This flow is continuously made up at the power block by clarification and treatment of river water.

The CGCC plant will have two commercial byproducts during operation. Elemental sulfur removed via the gas clean-up systems will be marketed to sulfur users. Slag, a sand-like byproduct from the gasifier, will be available for use as a construction material.

Operations

Destec and PSI will independently operate their respective gasification and power generation facilities. Operating interface parameters and other key data will be interchanged continuously between the gasification and power generation control rooms. In normal operation, syngas production will follow combustion turbine fuel demand. Thermal balance between the facilities is flexible to a certain extent, utilizing the heat recovery steam generator and gasification facility heat exchangers, and will follow the syngas production.

Operation of the facilities will be closely coordinated during startup and shutdown. The combustion turbine operates on auxiliary fuel (oil) at low loads during startup and shutdown. A "flying switch" will be made to syngas and the combustion turbine will ramp up to full load at its normal rates.

Cost and Efficiency

Integration of the new and existing power generation facilities and the new gasification facility have resulted in lower installed cost and better efficiency than other "environmentally equivalent" coal-based power generating projects. Reduced development effort and a shorter schedule have also resulted from choosing to repower an existing station rather than developing a greenfield installation. This advantage is evident from the rapid development and construction progress to date.

The net plant heat rate for the entire new and repowered unit is expected to be approximately 9,000 Btu/kWh, representing an approximate 20-percent improvement over the existing unit. Certain major component manufacturer margins and guarantees (combustion turbine, HRSG, HTHRU, etc.) are included in this energy balance calculation; actual operation is expected to be slightly better. This heat rate will be among the lowest of commercially operated coal-fired facilities in the United States. The Project is expected to produce some of the lowest cost electricity on the PSI system.

Repowering the existing unit and utilizing the existing site facilities, in addition to the existing steam turbine generator, auxiliaries and electrical interconnections, represent an installed cost savings of approximately $30 to $40 million as opposed to an entirely new greenfield installation.

The total estimated installed cost for the Project is $362 million. This estimated figure includes escalation through 1995, environmental and permitting costs and startup costs. On this basis, the total estimated installed cost of the project is approximately $1,380 per kW of net generation. The U.S. DOE's Clean Coal Technology Program (Round IV) provides partial funding for the project ($198 million for construction and a three-year demonstration period). PSI and Destec will provide the balance of the funds for their respective portions of the job. The DOE funding reduces the estimated installation cost to less than $900 per kW of net generation.

Environmental Benefits

The plant will be designed to substantially out-perform the standards established in the 1990 Clean Air Act Amendments (CAAA) for the year 2000. The Destec gasification technology to be employed will remove at least 98 percent of the sulfur in the coal. Expected SO_2 emissions will be less than 0.02 lb/MMBtu of fuel. NO_x emissions from both the gasification block andthe power block are expected to be less than 0.7 lb/MWh. CO_2 emissions will also be reduced approximately 20 percent on a per-kilowatt-hour basis by virtue of the increased system efficiency. Figure 2 compares emissions of current Wabash Unit 1 with expected emissions from the Project. By providing an efficient, reliable and environmentally superior alternative to utilities for achieving compliance with the CAAA requirements, the Wabash Project will represent a significant demonstration of Clean Coal Technology.

A. EXPECTED PROJECT EMISSIONS

CGCC EMISSIONS	SO_2	NO_X	CO	PM	PM-10	VOC
Gasification Block Tons/Yr.	23	18	124	25	20	12
Power Block Tons/Yr.	204	774	374	46	42	13
Total CGCC Tons/Yr. (note 1)	227	792	498	71	62	25

B. COMPARISON TO EXISTING UNIT

EMISSIONS, LBS/MWH	SO_2	NO_X	CO	PM	PM-10	VOC
Unit 1 Boiler	38.2	9.3	0.64	0.85	0.85	0.03
CGCC	0.21	0.75	0.47	0.07	0.06	0.02
EMISSIONS, LBS/MMBtu						
Unit 1 Boiler	3.1	0.8	0.05	0.07	0.07	0.003
CGCC	0.02	0.08	0.05	0.01	0.01	0.003

Note: 1) Based on 2,065,600 MW/hr estimated annual generation (262 MW at 90% capacity factor)

Figure 2. Environmental emissions.

ACTIVITIES TO DATE

Site Selection and Preparation

Early site feasibility studies resulted in locating the new coal gasification repowering facilities northwest of PSI's existing Wabash River Generating Station (fig. 3). The land for the Project was donated by the Peabody Coal Company. This property was formerly the Viking Mine, which once supplied the existing station with coal.

The cost of expensive steam piping to connect the existing Unit 1 steam turbine and the new heat recovery steam generator was minimized by locating the Project adjacent to the existing Wabash Generating Station. Other existing facilities to be used by the Project include the railroad, coal unloading facilities, steam turbine, condenser and auxiliaries, and the ash pond. Although the integration of the coal gasification project with the existing station provides efficiency and cost advantages, the limitations of space have presented challenges during construction. Among these is the challenge of managing a construction manpower peak of over 400 people for two jobs on a small site.

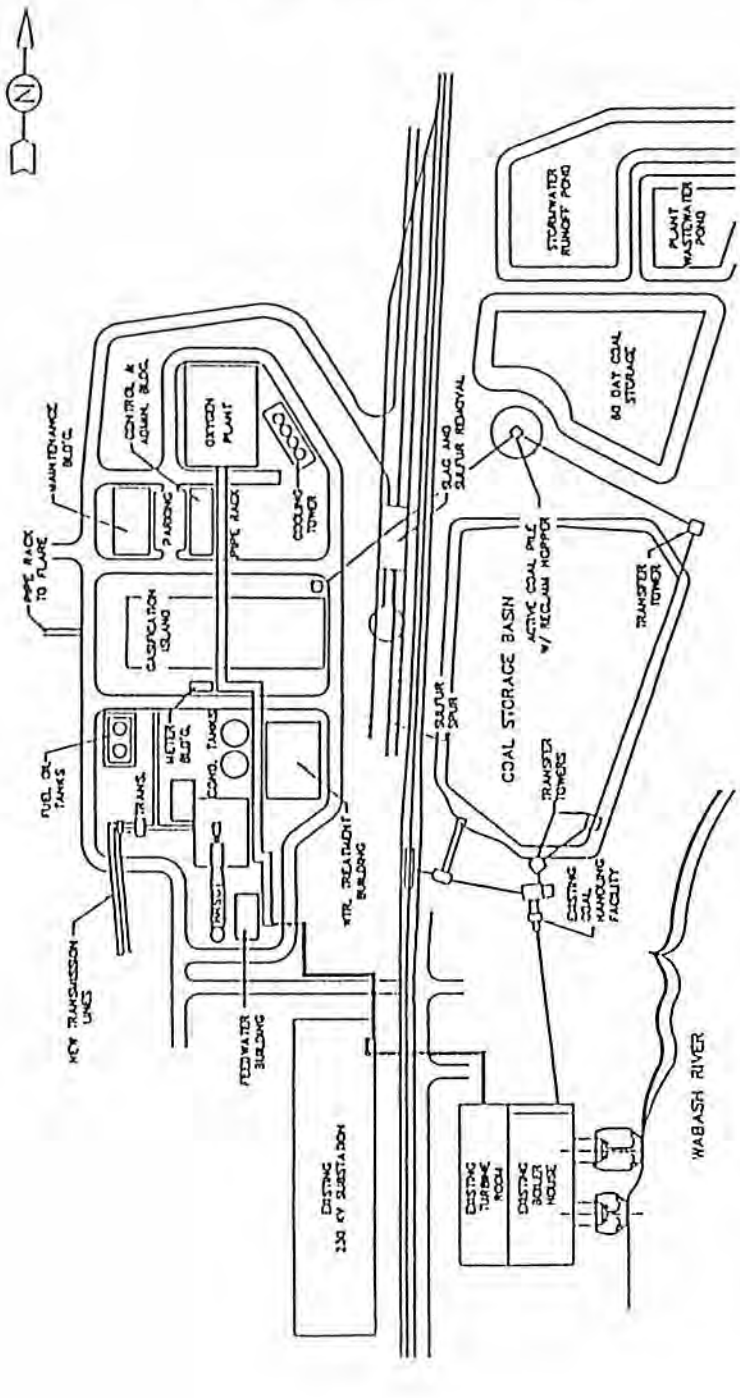


Figure 3. Wabash River coal gasification repowering project site.

Additional site challenges encountered include: 1) the need to re-orient the physical layout of the gasification plant to protect against potential subsidence (based on site-specific data obtained during the engineering phase); and 2) unstable mine spoils that made planned construction laydown and parking areas unsuitable for use.

Permitting and Regulatory Approval

Obtaining environmental permits and regulatory approvals were two major challenges to the development of the Project. As a DOE-sponsored project, the Project was subject to the requirements o the National Environmental Policy Act (NEPA). PSI, Destec and two environmental consulting firms were involved in the preparation of a detailed environmental information volume which was the basis for DOE's development of an Environmental Assessment of the impact of the Project. Because of the favorable NEPA assessment, DOE issued a Finding of No Significant Impact (FONSI) in May 1993. Although the DOE supported the joint venture's efforts by expediting the review process, the FONSI was received approximately six months after the milestone date for this activity established in the original Project schedule. The Project was the first of its scope under the DOE Clean Coal Technology Program to obtain this status. The FONSI also reflects the advantage of a repowering application over greenfield construction.

Other environmental permits were also required for the Project. The most significant of these was the air permit. Because Destec has responsibility for the gasification plant and PSI has responsibility for the power generation portion of the Project, they each had to obtain separate permits. However, for consistency and expediency, air quality modeling studies were performed on a combined basis. The total project was considered a modification to the PSI Wabash River Generating Station, and environmental impact information was provided in combined form when possible. Communications between PSI, Destec, environmental consultants and the state and federal permitting agencies were accomplished through a multitude of face-to-face meetings. Both Destec and PSI received the requisite air permits in May 1993.

In addition to the challenge of permitting a joint venture-type project, the Project faced the additional challenge to educate the permitting agencies about CGCC. Destec was specifically concerned about the protection of proprietary technology and with establishing a reasonable permitting precedent for future CGCC plants. PSI was concerned about obtaining credit for sulfur emission reductions. After diligent work by all, these goals were reached; another example of a CGCC precedent set by the Wabash Project, including a new emission credit methodology for CGCC technology.

Finally, to include its portion of the Project in its ratebase, PSI had to secure a Certificate of Need from the Indiana Utility Regulatory Commission (IURC). PSI and Destec each prepared testimony for the IURC, which allowed a Certificate of Need to be issued to the Project in May 1993. This activity opened the Project to additional review. However, the aspects of the Project that make it attractive – innovative technology, applied in a commercial setting, at a large scale and supported by DOE funding – were the very aspects that required careful and precedent-setting, regulatory review.

Again, careful coordination between PSI and Destec, combined with clear communication between PSI and the IURC allowed the Project to receive a Certificate of Need despite opposition from others who wanted to supply capacity to PSI's system and despite IURC's unfamiliarity with CGCC. The Gasification Services Agreement between PSI and Destec provided careful structuring of the commercial arrangements, especially with regard to risk, and was essential to developing a project that could obtain regulatory approval. PSI received the required Certificate of Need in May 1993.

Construction Activities

Extensive pre-construction work was required to level the Project site. Over one million yards of dirt was moved in 1993 prior to mobilization of construction contractors. Although construction work is now approximately 50 percent complete, these activities have been hampered by unusual weather conditions. The summer of 1993 was the wettest summer in Indiana history (rains reached a 500-year flood level). This was followed by the wettest November since 1888 and snow from Halloween through Easter of 1994. In addition, Indiana experienced the coldest January on record, and ice storms shut down construction work in February. To stay on schedule, both PSI and Destec selectively employed seven-day construction plans while trying to balance budget and schedule needs. Given the weather and schedule constraints, the size of the small site and the complexity of the job, communication and coordination were invaluable.

During the past year, the following major milestones have been achieved:

- Full mobilization of construction crews to the site.
- Gas turbine received and set.
- Heat recovery steam generator field erection begun.
- Water and wastewater treatment facility constructed.
- Air separation unit column constructed and compressors set.
- Gasifier vessels field erected and set in structure.
- Control buildings constructed.

Peak construction activity is occurring now: over 400 workers are on site daily working for a host of contractors and subcontractors, all ultimately reporting to either Destec or PSI. Project management expertise and coordination with, and support from, the local labor unions and contractors has been critical to maintaining the Project schedule.

Other construction challenges encountered include:

- Transport of large equipment to the site (some shipments had less than two-inch clearance) despite flooded rivers, transportation strikes and cross-country transport logistics.

- Coordination of timing for interconnection responsibilities between the Destec and PSI portions of the Project; this challenge became critical as permitting and weather delays compressed the original construction schedule.

- The need to carry out a complex construction job with minimal impact to the existing PSI generating station.

- The need to make several heavy equipment lifts (up to 600,000 lbs.) in a short period of time without disrupting other site activities.

To date, all these challenges have been met successfully.

Startup and Commissioning Activities

Startup and commissioning activities have been initiated. The Project will create approximately 100 new operations and support jobs. During 1993, staffing philosophies were finalized, and, by early 1994, hiring was in progress. Training activities are now the major priority. For PSI, which has limited experience with gas-fired turbines, new training activities have been developed. Among these is a full-scale power block simulator developed with funding from EPRI. This simulator is being used as a training tool for the Project, but, in abbreviated form, can also be used for future CGCC projects.

Detailed commissioning packages are being developed jointly between construction and operating personnel. In addition, coordination activities between Destec and PSI have been a major area of activity.

FUTURE CHALLENGES

The major challenges facing the Project over the next year are to complete construction activities on schedule and achieve a smooth startup. Although construction activities are on track at this point in time, the abnormal weather and transportation difficulties have taken much of the slack out of the schedule.

Coal selection activities are also in progress at this time. Efforts are ongoing to optimize both the cost of coal and the gasification plant performance for startup activities.

Commissioning activities for equipment will begin as early as the fourth quarter of 1994. By mid-August 1995, the Project is expected to be in commercial operation. Training will continue to be a priority for the remainder of 1994. Coordination between construction and operations, and PSI and Destec, will be critical in 1995.

And now Dan Rimstidt will give you an update on what may interest you more than this and that is the purchase of coal.

Dan Rimstidt: Thank you, Rolf. Just briefly, I will update you on our activities to date on the coal procurement for this project. First of all, let me say that at PSI Energy we are also very excited about this project. The first coal will be on site in probably March or April of next year. That will just be the test coal to go through some shake down procedures. We will take first regular delivery in the middle of the summer. Initially, we are starting out with lower volumes and hope to build in over three years from as much as 750,000 tons to maybe 900,000 tons a year for this particular gasification process.

The important factors that we are looking at are really the same as for any other coal purchases. Coal quality is extremely important, especially in this project on the initial phases. Cost and the economics are extremely important as well. But one factor that we always look for is flexibility. The flexibility in this demonstration project is probably one of the things that we really need to have, not only when working together with our partner, Destec, but also with our partners, the coal suppliers for these units. If you have any questions maybe Rolf or I could answer them.

Question: Do you know anything about those hazardous air pollutants (HAPs) or trace metals in this project?

Rolf Maurer: Yes. We haven't gasified any Illinois Basin coal yet, but at the LGTI facility, we have monitored the slag that comes out (that is the ash that is melted and quenched; it is a glassy, thread-type material totally encapsulated). It contains the majority of the heavy metals with the exception of mercury and selenium. This process is no different than combustion in the sense that it is high temperature and mercury is in a vapor state. At LGTI. we are working with both EPRI and the U. S. DOE, and actually in about a month's time, we plan to conduct the first monitoring of LGTI from a HAPs standpoint. We want to understand how the mercury behaves in the process. If it does come out, we want to know where it comes out and how it comes out. Keep in mind we are cooling the gas down to about 120° F before we recover the sulfur. We do see the selenium dropping out in the sulfur removal process. We want to understand it fully. So, we are working with EPRI and DOE to get a better handle on HAPs and heavy metals. Any other questions?

Question: What is the sensitivity of this system to variations of sulfur content?

Rolf Maurer: I want to say zero, but that is not exactly true. You have to design your sulfur plant to handle a maximum amount of sulfur that is going to manifest itself in the coal. The Wabash site is designed, I believe, to handle up to 6 percent sulfur, and I think it is at 4.5 percent nominal. Any other questions?

Question: Do you expect these types of plants to be the plants of the future, say ten years from now?

Rolf Maurer: Again, I want to say yes. But at the end of the day, economics will dictate. You can see what this technology costs. Nominally, it costs $1,300 to $1,400 per kW, for IGCC repowering. You could repower the same site with natural gas and it would cost a whole lot less. Now, is natural gas available? What is it going to cost in the future? Do you want to hang your hats on that? You can also approach it from a phase standpoint. You could put in the combustion turbine and the HRSG and repower the plant on natural gas and keep your design open for gasification in the future. It truly depends on economics. What we are doing and what the DOE is helping to do, is to get these plants operating at full scale, demonstrate the technology, work out the bugs so that when economics dictate, we are ready to roll. Thank you.

George Woods: Our next paper is entitled "Development of Coal Water Slurry Combustion," by Tony Litka. He is Program Manager for Tecogen, Incorporated, a company that specializes in coal utilization and combustion. Tony has a Master's degree from the U.S. Merchant Marine Academy and a Master's from MIT. He has worked for twelve years in the development of advanced energy systems. Tony Litka.

Anthony Litka: Thank you. I'm going to switch gears here and go to a much smaller scale equipment.

DEVELOPMENT OF COAL WATER SLURRY COMBUSTION TECHNOLOGIES

ANTHONY F. LITKA

Tecogen
A Division of Thermo Power Corporation
Waltham, Massachusetts

INTRODUCTION

Coal is the most plentiful energy resource in the United States, but, since the 1950s, its use has been largely restricted to utility power generation for environmental and economic reasons. Oil and natural gas are the pre-dominant fuels used within the residential, commercial and industrial market sectors. Tecogen, under sponsorship of the U. S. Department of Energy and the Illinois Department of Energy and Natural Resources, has been involved in the development of technologies aimed at making coal a technically, environmentally and economically viable fuel capable of meeting the space-heating needs of homes, schools, office buildings, apartment complexes and other similar structures.

An important consideration in meeting this objective is the fuel form to be utilized. In attempting to restore coal to the relatively small markets, it is important to recognize ease of handling and storage as important criteria. Coal water slurry (CWS) fuel, which consists of finely pulverized coal suspended in water, provides coal with many of the handling and storage advantages of fuel oil. Coal water slurry eliminates the need to use dry pulverized coal with its attendant handling, metering and dusting problems, as well as its explosive potential. Equally important in selecting a fuel form is the impact on emission levels and pollution control equipment requirements. Coal water slurry is amenable to coal washing since coal cleaning technologies are generally water-based processes requiring fine grinding of the coal.

APPROACH

In developing coal water slurry based heating systems for the small market sectors, it was recognized that the systems must provide the same ease of operation and reliability of premium fuel, natural gas and oil systems. To meet this objective and to remain economically competitive, commercially available equipment and technologies must be utilized wherever practicable. Therefore, many of the system components such as heat exchangers, pumps, controls, etc., are "off the shelf" items requiring little or no modification.

One piece of equipment which is obviously not commercially available is the combustor itself. To burn coal water slurry with its inherently lower heating value than the parent coal, special combustion technologies are required. Tecogen has developed a combustion technology specifically designed for the combustion of coal water fuels. The combustor, which can be generally described as a inertial reactor with internal separation (IRIS), has demonstrated combustion efficiencies of over 99 percent using coal water slurry fuels without the need for preheated air or fine atomization. The combustor concept (fig. 1) employs centrifugal forces combined with a staged combustion process to achieve high carbon conversion efficiencies. The combustion chamber is divided into multiple zones by partitions to retard the axial flow of unburned coal particles over a given size. In this fashion, the residence time for combustion of the CWS fuel is significantly increased to enable nearly complete carbon conversions for a wide range of particle droplet sizes. Once the particles are small enough to pass through all the partitions, they enter a secondary combustion chamber where the char burnout is completed. In conjunction with the combustor technology, Tecogen has also developed slurry atomizer technologies ideally suited for providing the atomization and spray patterns required in the combustors that are wear and plug free allowing for extended trouble free operation.

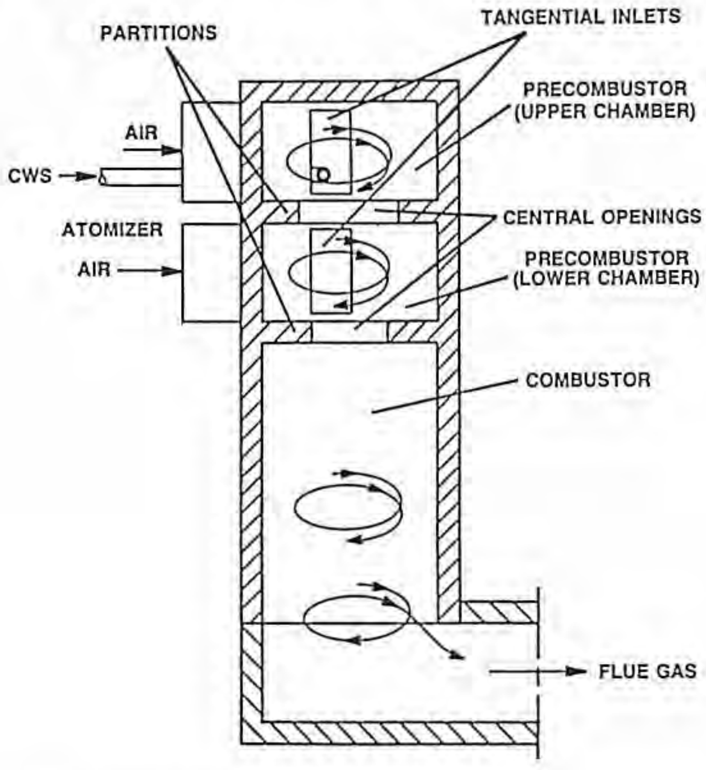


Fig. 1. Combustor principle of operation.

Crucial to the introduction of new technologies into well established markets, such as the residential and commercial heating appliance market, is a suitable demonstration of the operation of such equipment. As part of the technology development, a field test of a commercial scale coal water slurry fired system was conducted at the Illinois Coal Development Park (ICDP). The ICDP is operated under a cooperative research and development agreement between Southern Illinois University at Carbondale and the Illinois Department of Energy and Natural Resources (IDENR). A four MMBtu/hr system was installed to service the High Bay Building at the ICDP.

System Design

A process schematic of the CWS fired space heating system is shown in figure 2. As discussed above, an IRIS combustor is utilized for combustion of the coal water slurry fuel. The commercial scale unit has an internal diameter of approximately 24 inches and an overall length of 60 inches. Inlet areas are sized for an inlet velocity of 150 ft/sec. Several different combustor internal wall configurations were investigated to eliminate ash accumulation in the combustor. The combustor design evolution was influenced strongly by the need to burn progressively higher ash coals with changing ash properties. The final combustor configuration (fig. 3) results from a thorough investigation of design and operating parameters including: combustor wall material, partition location and size, atomizer spray angle and combustion air staging.

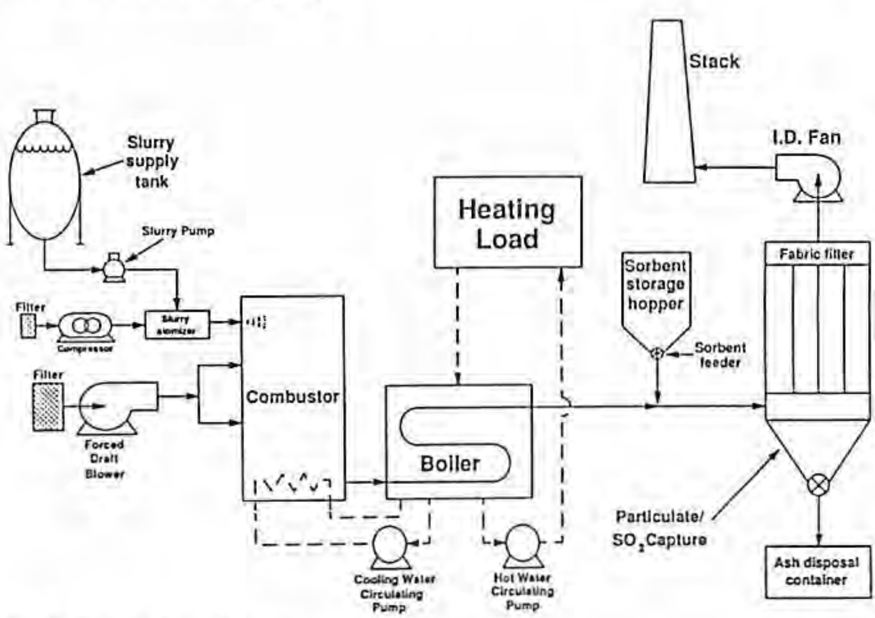


Fig. 2. Process flow diagram.

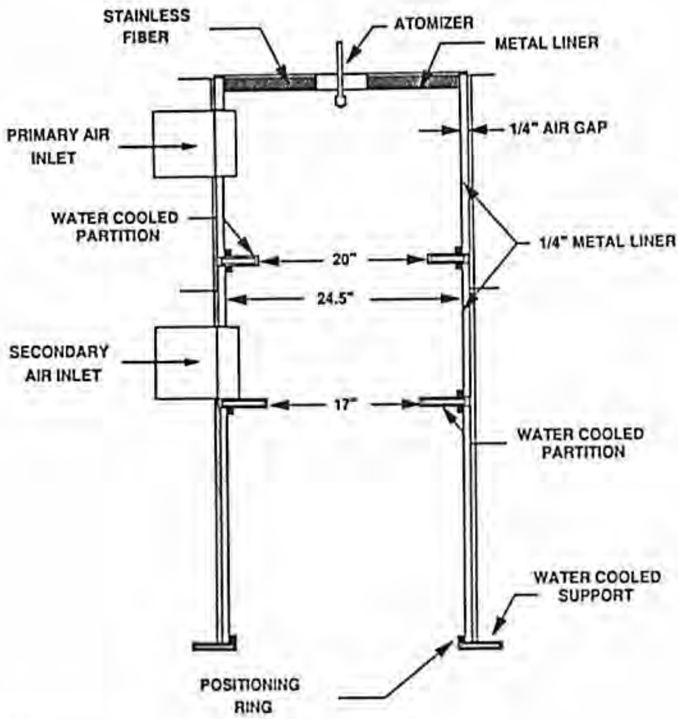


Fig. 3. Combustor geometry.

Although refractory surfaces could be used in the combustor when burning high ash fusion temperature coals, ash attachment to the refractory surfaces was problematic for low ash fusion temperature Illinois coals. Best results were obtained with metal liners and water cooled partitions making up the combustor internal surfaces. Various arrangements were investigated to control metal liner temperatures while at the same time controlling heat extraction from the combustor and allowing for liner growth. The final arrangement as shown in figure 3, is to allow the liners to operate as floating shields. In this configuration, rather than having a refractory material between the liner and water-cooled shell and controlling liner temperature through conduction, the liner is offset from the water-cooled shell by a quarter-inch air gap and is allowed to radiate back to the shell. This configuration allows for unrestrained circumferential expansion of the liner and eliminates the possibility of hot spots which can develop if the liner separates away from the refractory. The combustor outer shell is water-cooled.

The combustor is oriented in a downward firing mode, and a transition chamber is utilized to connect to the heat recovery boiler and provide for large particle ash collection. The transition chamber has an inner diameter of 42 inches and an overall length of 48 inches. It is also water cooled and has a three-inch thick refractory lining. Boiler water is utilized as cooling water for the combustor and transition chamber.

The combustor is integrated with a York-Shipley waste heat recovery fire tube boiler. The boiler is a conventional three pass unit and has been fitted with particulate drop-out hoppers at the turning boxes and a compressed air soot blowing system.

A variable spray angle externally mixed twin fluid atomizer is used for slurry atomization. The atomizer operating conditions can be set to provide the wide cone angle required of the radial top-center-firing configuration of the commercial-scale system. This atomizer is illustrated in figure 4. The atomizer uses two perpendicular atomizing streams to shear the CWS into a thin, unstable ligament sheet that breaks up into small droplets external to the atomizer.

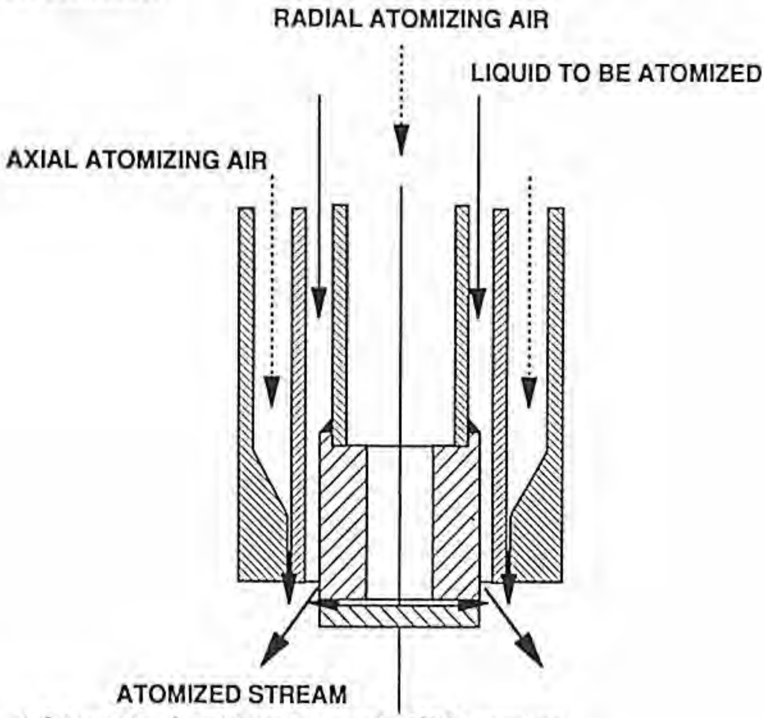


Fig. 4. Schematic of variable spray angle (VSA) atomizer.

The external atomization feature of this nozzle prevents erosion and allows for a large CWS passageway, which minimizes the head that the CWS pump must produce and the likelihood of pluggage. In addition to providing fine atomization due to the high shear that is imparted by the two perpendicular atomizing streams, by varying the flow rate of each of these streams, the spray angle can be changed on-line without any mechanical modification to the atomizer.

To meet the targeted emissions goals of no more than 1.2 lbs of SO_2 and 0.03 lbs of particulate per million Btu, a dry duct injection flue gas desulfurization system working in conjunction with a fabric filter is utilized. Sodium bicarbonate is injected into the exhaust duct between the boiler exit and baghouse inlet. The sorbent is fed by a screw feeder and is pneumatically conveyed to the exhaust duct. The baghouse, manufactured by Flex-Kleen, is a pulse jet unit with a cloth area of 457 square feet. The filter bag material is 16 ounce P84, a thermostable organic fiber of synthetic origin characterized by a copolyimide structure. Staged combustion is utilized to meet the NO_x emissions requirement of 0.3 pounds per million Btu.

The CWS fired space heating system has been designed to match the automatic nature of gas and oil systems. System light-off and warm-up is with fuel oil, with the system purge and ignition verification of a standard oil fired system. Once the combustor reaches a pre-selected temperature, automatic switch over to CWS is initiated. The control system consists of a General Electric Fanuc Series 90-30 Programmable Logic Controller for ladder logic sequencing and PID control. The controller provides for complete automatic or manual control of the system including push button start and stop, load following safety interlocks, automatic fuel changeover and alarm messages. Operator interface is through CRT-based operator interface terminal. This terminal has flow schematics which display key process variables and setpoints and programmed function keys to allow complete control of the system including selection and manipulation of all proportional control loops in manual mode.

Slurry Production

Although CWS has great potential as an alternative fuel form for the smaller scale applications, CWS fuel is not currently easily obtained or widely produced. To ensure a supply of CWS for the demonstration and also to provide both an engineering and economic data base for slurry production at larger scales, a slurry preparation facility was set up to produce CWS for the program.

A process flow diagram for the system is given in figure 5. Crushed coal (three inches by zero inches) is received in one-ton supersacks and fed to a hammermill via a variable speed screw feeder. From the classifier, the coal is conveyed to a series arrangement of primary and secondary cyclones and discharged into a mixing tank via rotary valves. In the mixing tank, the pulverized coal is fully wetted with the help of tank mixers and a fluid circulation loop which takes suction from the bottom of the mixing tank and discharges the coal/water mixture onto the surface.

The system is operated in a batch mode by pre-filling the mixing tank with the necessary water and additives and running the pulverizer until the coal/water mixture reaches a pre-determined starting point. The density of the slurry has proven to be a key process control variable in that it is an indirect measurement of slurry loading. Coalmaster A23, manufactured by Henkel Corporation, is used as a dispersant, and Flocon C, manufactured by Pfizer Chemical, is used as a stabilizer.

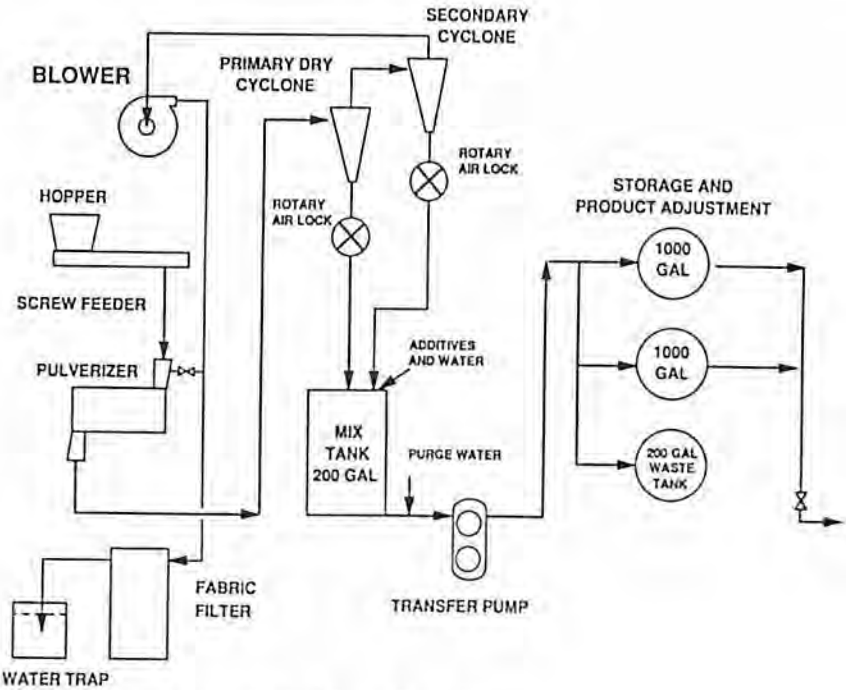


Fig. 5. Slurry production facility flow schematic.

During the course of the demonstration program, upwards of 130 tons of coal have been processed into approximately 50,000 gallons of slurry. Three coals have been processed: Eastern Kentucky, Hazard Prince Mine, Illinois (No. 5), Wabash Mine and Illinois (No. 6), Delta Mine. Table 1 gives the proximate and ultimate analysis for the three coals. These are run-of-mine coals without any additional washing or beneficiation other than that performed at the mine to ensure consistent quality.

Table 2 gives the typical slurry properties for the three coals. As can be seen in the table, coal loadings were between 55 percent and 60 percent. For each of the coals, the maximum coal loading, while maintaining a viscosity of 200 cp at 60 reciprocal seconds, was utilized.

Demonstration Site Configuration

The High Bay Building at the ICDP is a multi-use facility housing classrooms, laboratories, combustion equipment and offices. The building has a floor plan of 12,400 square feet and an enclosed volume of approximately 330,000 cubic feet. The high bay area is 36 feet by 122 feet with a 36-foot roof height. The high bay area was previously heated exclusively with electric unit heaters. Figures 6 and 7 show the equipment configuration at the demonstration site. A load dump radiator was included with the equipment to permit operation of the system during periods when the building load is low and to base load the system for full load operation.

Table 1. Coal proximate and ultimate analysis.

KENTUCKY HAZARD PRINCE MINE					
Proximate Analysis			Ultimate Analysis		
	As Received	Dry Basis		As Received	Dry Basis
% Moisture	2.69	xxxxx	% Moisture	2.69	xxxxx
% Ash	3.62	3.72	% Carbon	78.91	81.09
% Volatile	35.93	36.92	% Hydrogen	5.25	5.39
% Fixed Carbon	57.76	59.36	% Nitrogen	1.63	1.67
	100.00	100.00	% Sulfur	0.74	0.76
			% Ash	3.62	3.72
Btu/lb (HHV)	14144	14535	% Oxygen (diff.)	7.16	7.37
% Sulfur	0.74	0.76		100.00	100.00
MAF Btu		15097			

ILLINOIS NO. 5 WABASH MINE					
Proximate Analysis			Ultimate Analysis		
	As Received	Dry Basis		As Received	Dry Basis
% Moisture	14.94	xxxxx	% Moisture	14.94	xxxxx
% Ash	6.17	7.25	% Carbon	64.30	75.60
% Volatile	33.25	39.09	% Hydrogen	4.24	4.98
% Fixed Carbon	45.64	53.66	% Nitrogen	1.43	1.68
	100.00	100.00	% Chlorine	0.15	0.18
			% Sulfur	1.36	1.60
Btu/lb (HHV)	11439	13450	% Ash	6.17	7.25
% Sulfur	1.36	1.60	% Oxygen (diff.)	7.41	8.71
MAF Btu		14501		100.00	100.00

ILLINOIS NO. 6 DELTA MINE					
Proximate Analysis			Ultimate Analysis		
	As Received	Dry Basis		As Received	Dry Basis
% Moisture	9.44	xxxxx	% Moisture	9.44	xxxxx
% Ash	10.65	11.76	% Carbon	64.42	71.13
% Volatile	33.14	36.60	% Hydrogen	4.31	4.76
% Fixed Carbon	46.77	51.64	% Nitrogen	1.34	1.48
	100.00	100.00	% Chlorine	0.09	0.10
			% Sulfur	2.84	3.14
Btu/lb (HHV)	11592	12800	% Ash	10.65	11.76
% Sulfur	2.84	3.14	% Oxygen (diff.)	6.91	7.63
MAF Btu		14506		100.00	100.00

Table 2. Typical slurry properties.

Coal	Kentucky	Illinois No. 5	Illinois No. 6
Coal Loading	59%	55%	57%
Particle Size (mmd)	30 µm	20 µm	18 µm
Specific Gravity	1.15	1.17	1.20
A23(dry mass coal)	10,000 ppm	15,000 ppm	15,000 ppm
Flocon	700 ppm	700 ppm	700 ppm
Viscosity at 80 1/sec	200 cP	200 cP	200 cP
Heating Value	8,500 Btu/lb	7,400 Btu/lb	7,300 Btu/lb

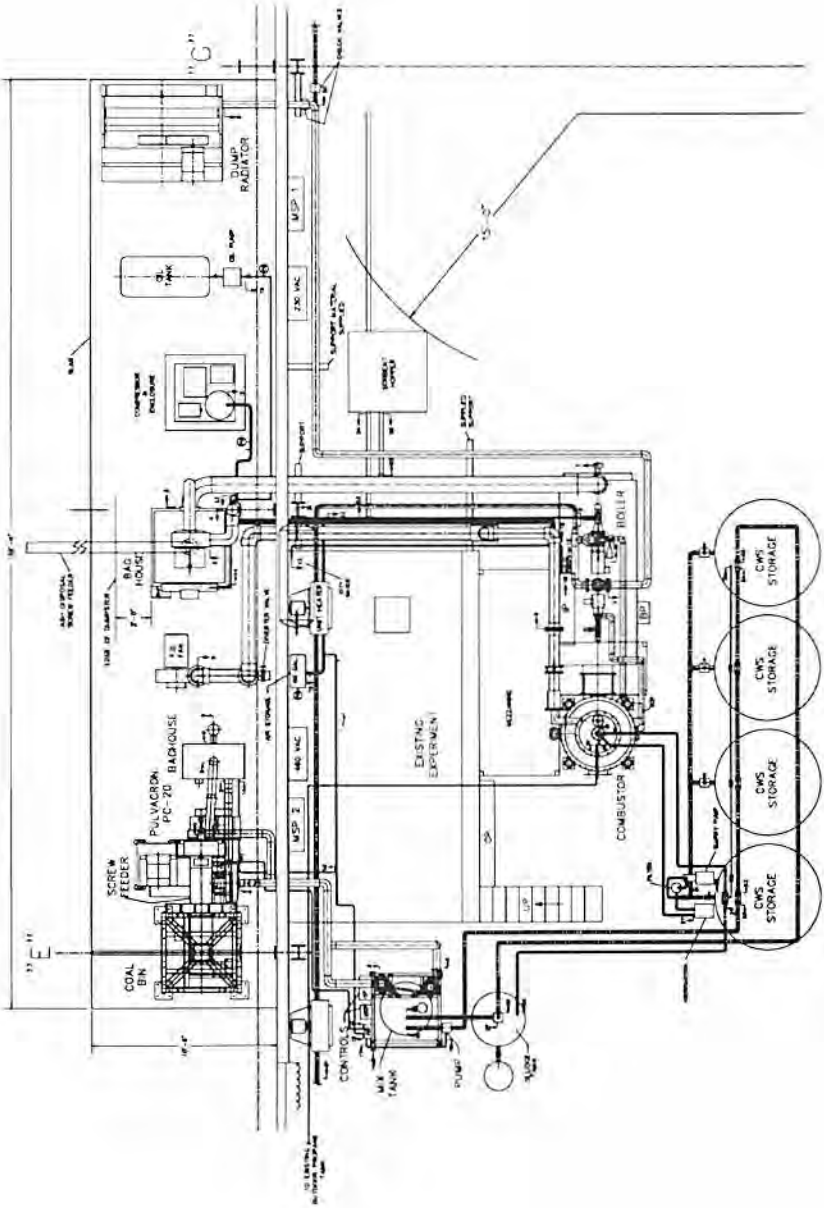


Fig. 6. Equipment configuration at demonstration site.

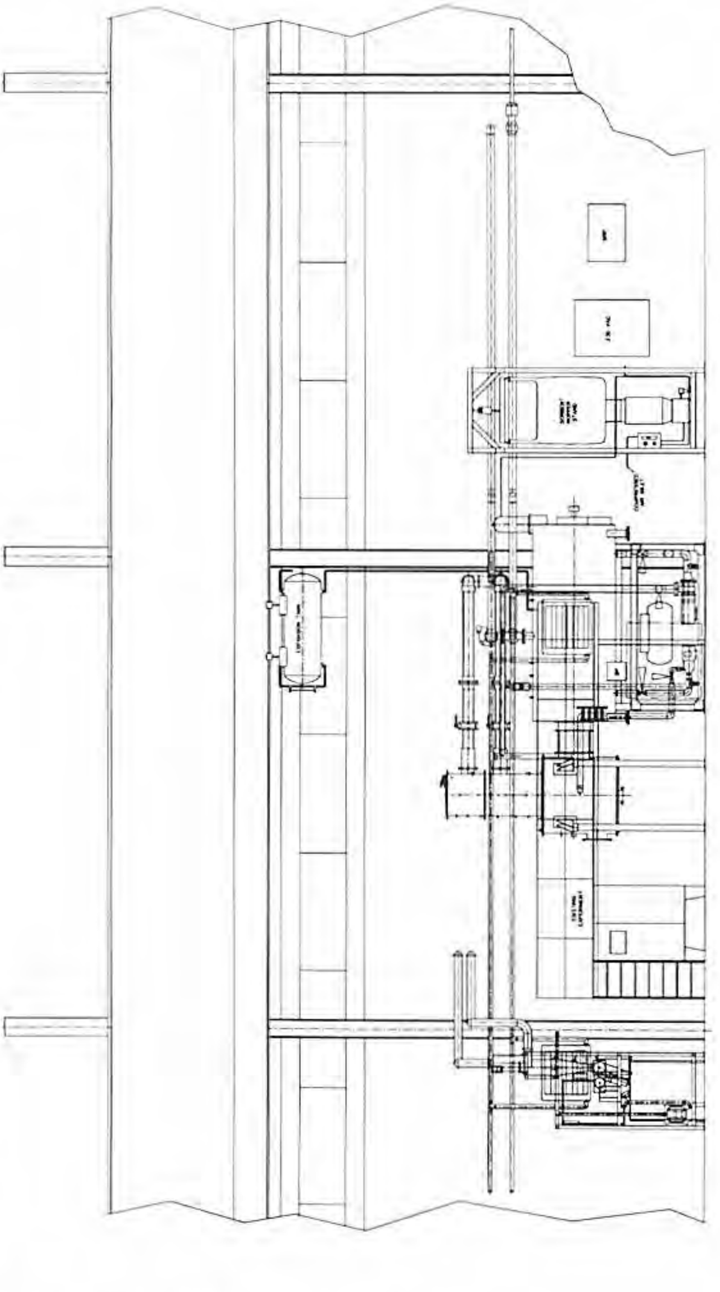


Fig 7. Equipment configuation at demonstration site.

Test Operations

Three tests series have been completed as part of the development program. The first series of tests, component and system tests, were performed to provide preliminary evaluation of the component and system performance, identify key operating variables and their ranges, and establish appropriate operating conditions for subsequent proof-of-concept testing. These tests verified that the combustor technology had been successfully scaled to the commercial market size; integration of the major system components, especially integration of the combustor with a fire tube boiler, was feasible; and the system had the potential to meet the performance goals. This testing included over 100 hours of system operation.

The second series of tests, proof-of-concept tests, were performed in the laboratory to evaluate overall performance of the space heating system and to demonstrate that the concept is technically feasible, both from a performance standpoint and from a maintenance and reliability standpoint. Combustion and thermal efficiencies, tendencies to slag, foul, erode and corrode, and gaseous and particulate emissions were evaluated. During the proof-of-concept test period, the integrated system was operated for over 500 hours with slurry firing making up close to 70 percent of these operating hours. During the course of the testing, approximately 7,000 gallons of Kentucky slurry, 6,500 gallons of Illinois (No. 5) slurry and 3,500 gallons of Illinois (No. 6) slurry were burned.

Table 3 summarizes the overall system performance on each of the three coals evaluated during proof-of-concept testing and compares achieved performance to the program goals. Best performance results were obtained with the low ash Eastern Kentucky coal, but even with the higher ash, lower heating value Illinois coals, performance goals were met. With the Illinois coals, especially Illinois (No. 6) coal with greater than 10 percent ash, system operation was more sensitive to slight changes in coal loading, slurry viscosity and operating setpoints.

Table 3. Performance goals.

	Goal	Kentucky	Illinois No. 5	Illinois No. 6
Ignition	Safe and Reliable	30 Successful Starts	10 Successful Starts	30 Successful Starts
Turndown	3:1	4:1	3:1	3:1
Thermal Efficiency (percent)	>80	85 Clean 75 Dirty	85 with Soot Blower	85 with Soot Blower
Combustion Efficiency (percent)	>99	Baghouse Ash Burnout >99	Baghouse Ash Burnout >98	Baghouse Ash Burnout >98
Emissions (lb/mil Btu) NO_x SO_x Particulates	 <0.3 <1.2 <0.02	 0.26 1.03 lb/MMBtu (Compliance) Baghouse Control	 0.30 0.68 Baghouse Control	 0.27 0.80 Baghouse Control

The third series of tests involved operation of the space heating system at the demonstration site. Initial equipment shakedown was performed using low ash Eastern Kentucky parent coal slurry. The bulk of the system operation was performed using Illinois (No. 5) parent coal slurry. This Wabash mine coal had a significantly higher ash content, approximately 10.5 percent, than that utilized during the proof-of-concept testing (7.25 percent) due to market/operating conditions at the mine.

During the demonstration period, the system was operated for upwards of 800 hours with slurry firing making up approximately 600 of these hours. An important milestone was reached in achieving unattended, automatic operation. The system was left unattended during off-shift hours of operation. To eliminate the possibility of ash accumulation in the combustor from affecting combustor operation, an automatic shut down procedure was incorporated into the automatic programming to periodically thermally shock and sweep away, with increased combustion air flow, any material build-up in the combustor. This shutdown occurred every six hours and the combustor was back on-line in less than 20 minutes.

During the demonstration, the system was operated between two and 3.5 MMBtu/hr with an average combustion efficiency of 97 percent. Approximately 25 percent of the coal ash was collected in the transition chamber and 75 percent in the baghouse. Ash accumulation in the transition chamber limited the maximum continuous operation without maintenance indicating the need for an automatic ash removal system for this area.

SUMMARY

Currently in the United States, coal accounts for only about 10 percent of the total energy utilized in the industrial market sector, and very little coal is used in the residential and commercial sectors (<10 MMBtu/hr). The development of CWS technology capable of providing a beneficial, easy to handle, low cost coal fuel and the availability of this low cost, maintenance free, environmentally compatible combustion equipment capable of utilizing these fuels, will help stimulate the utilization of domestic coal, reducing the need for foreign oil imports and conserving domestic gas supplies. Based on the results of the system demonstration, the technology is ready for additional demonstrations and commercialization.

George Woods: Our next presentation is entitled "Combustion 2000 – Low Emission Boilers Designed to Fire High Sulfur Coal." It is by David G. Sloat. He is the Senior Mechanical Project Engineer for Sargent & Lundy, Chicago, Illinois.

Dave has been with that company for thirteen years. He specializes in design of air pollution equipment and project management. He has a Bachelor's degree from the University of Illinois, Chicago and a Master's from the Illinois Institute of Technology. Dave Sloat.

David Sloat: Thank you. Today I would like to talk a little bit about a program that we have been working with; a program that we think is going to benefit the Illinois coal mining industry.

LOW EMISSION BOILER SYSTEM: DESIGNING THE NEXT GENERATION OF COAL-FIRED POWER PLANTS

JOSEPH N. DARGUZAS, DAVID G. SLOAT, AND WILLIAM R. BULLOCK[1]

Sargent and Lundy
Chicago, Illinois

ABSTRACT

This paper discusses the advanced pulverized coal power plant design being developed under the U. S. Department of Energy's (DOE) Low Emission Boiler System (LEBS) program. The primary goal of the LEBS program is to develop the next generation of pulverized coal-fired power systems to meet stringent emission requirements with high energy conversion efficiency. The LEBS concept discussed utilizes a low NO_x slag-tap firing system, an advanced supercritical steam cycle, a once-through Benson boiler, low temperature heat recovery and a regenerable flue gas desulfurization (FGD) system. This paper describes both a 400 MW commercial generating unit (LEBS) design and a proposed 50 MW proof-of-concept (POC) LEBS facility.

INTRODUCTION

The goal of the LEBS program is the expedited development of advanced pulverized coal technology. The team led by Riley Stoker has selected a concept which utilizes a low NO_x slagging combustion system to provide low emissions and good solid waste management. The emission goals established by the DOE correspond to one-third to one-half of current federal New Source Performance Standards (NSPS):

- NO_x less than 0.2lb/MMBtu
- SO_2 less than 0.2 lb/MMBtu
- Particulate less than 0.015 lb/MMBtu

However, since any new plant will most likely be required to meet even lower limits, this LEBS team has established more aggressive goals:

- NO_x less than 0.1 lb/MMBtu
- SO_2 less than 0.1 lb/MMBtu
- Particulate less than 0.010 lb/MMBtu

[1]Presented at the 102nd Annual Meeting by David G. Sloat

Additional goals of the LEBS design include improved ash disposability, reduced waste generation, high plant efficiency and a competitive cost of electricity.

LEBS CONCEPT

The LEBS concept selected by the Riley Team is built around a "wet bottom," or slagging, advanced supercritical Benson boiler. The Benson boiler is a once-through design with main steam conditions of 4,500 psi and 1,100°F and two reheats, each at 1,100°F. These advanced steam conditions are required to achieve a high overall plant efficiency of over 41 percent (HHV basis), burning a Herrin (Illinois No. 6) coal. The overall LEBS concept is shown in figure 1.

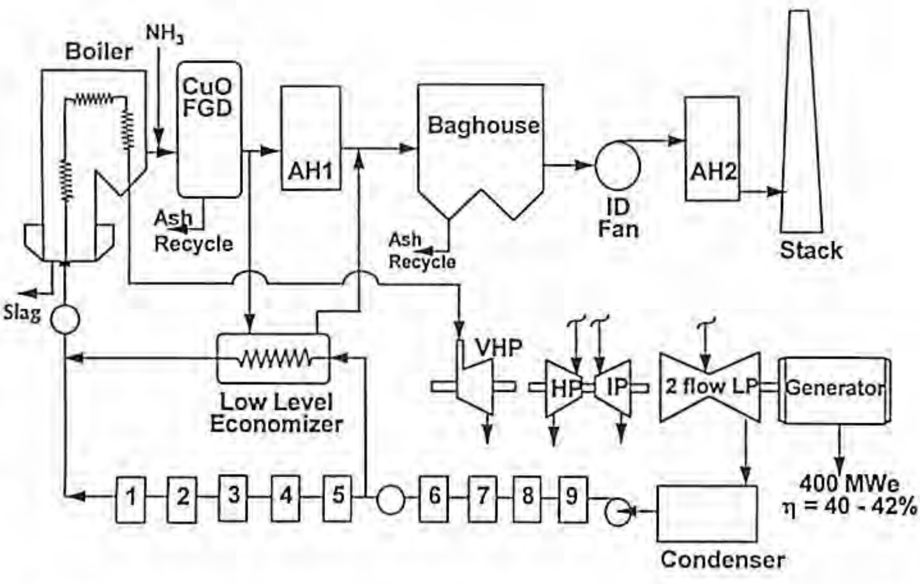


Figure 1. LEBS concept.

The development of an advanced U-fired, slag-tap furnace design for improved NO_x performance is the basis for a lower-risk system which provides the advances of ash vitrification. This is a critical element of our program, since it provides a clear path to a commercially available, utility-scale slagging boiler.

The flue gas leaving the boiler economizer is desulfurized by a copper oxide moving bed reactor. The sorbent from this reactor, alumina impregnated with copper oxide, is regenerated in a separate reactor and re-used. The hot (750°F) desulfurized flue gas is then split to provide both air preheating and low temperature feedwater heating.

The relatively cool flue gas is then thoroughly cleaned of particulate matter in a pulse jet baghouse. The flue gas then passes through the ID fan and the second air heater. The second air heater cools the flue gas to approximately 180°F. The arrangement of the two air heaters and the low level economizer allows the heat recovered even at this low flue gas temperature, to be converted to power at efficiencies approaching that of the overall cycle.

Firing System

The firing system selected for the LEBS is an advanced slagging design which will provide low NO_x emissions and good solid waste management. Stringent NO_x regulations for coal-fired boilers, an expanding byproduct market for granular slag and solid waste management considerations were factors which contributed to the slag-tap boiler selection.

As environmental restrictions become more stringent, the cost of fly ash disposal will increase. Slagging systems offer a higher potential for byproduct utilization and lower disposal costs than ash from dry bottom systems. As a result of higher combustion temperatures, conventional slag-tap (wet bottom) systems do produce higher NO_x emissions than comparable dry bottom systems. However, there has been considerable progress in controlling NO_x from existing slag-tap units and advanced slagging combustors have also demonstrated the potential to achieve the lower NO_x levels that are typical of dry bottom systems.

The primary objective of the LEBS firing system development is the commercialization of an advanced slagging system that will:

- Provide a cost-effective method of reaching the goal for NO_x emissions; and
- Provide a benign ash which can be disposed of easily or can preferably be used as a byproduct.

U-firing

The U-firing arrangement is a currently commercial slag-tap boiler technology which provides a large installed utility experience base from which to draw. The U-fired slag-tap boiler design produces the vitrified coal ash desired for the LEBS concept. However, additional efforts will be required to reduce the NO_x emissions from current levels. In the basic U-fired design, swirl burners fire downward into a refractory-lined combustion chamber. Slag is collected and tapped at the bottom of the chamber where the gases turn upward through a slag screen into the radiant furnace. In the original unstaged design, the burners were operated with ten percent excess air. Recent retrofit programs to control NO_x emissions from existing U-fired boilers have included: staged air addition, flue gas recirculation and pulverizer upgrades to improve coal fineness. To provide a new low NO_x

slag-tap design for the LEBS program, low-NO_x burners, additional air staging and reburning will be implemented. Low NO_x burners with advanced air staging and reburning technology are expected to reduce NO_x to the 0.2 lb/MMBtu LEBS program goal. A U-fired arrangement with and without fuel reburning is shown in figure 2.

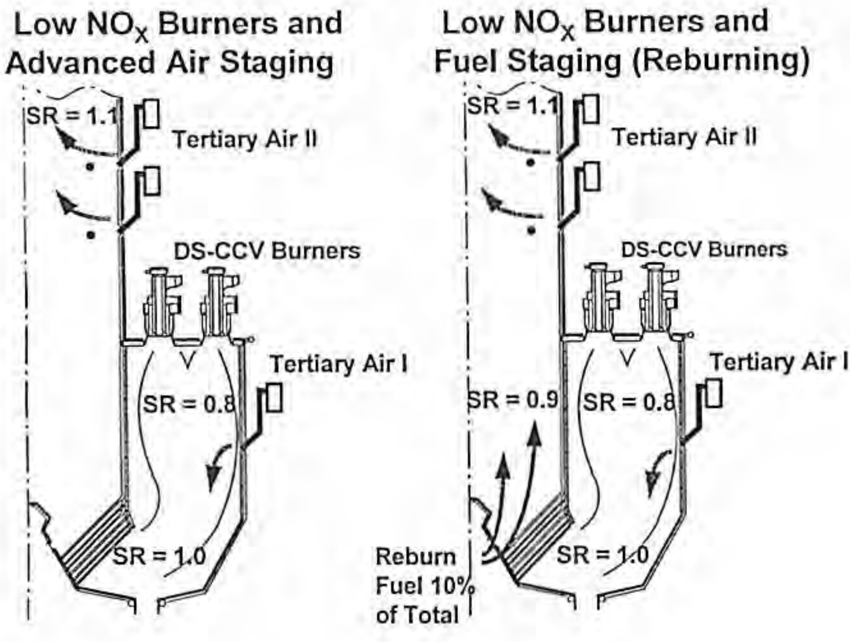


Figure 2. U-fired arrangement.

The low NO_x burner design to be utilized is a prototype burner which has demonstrated excellent performance during testing of a 70 MMBtu/hr design at the Riley Coal Burner Test Facility (CBTF). The DS-CCV burner concept combines the dual register design of the Deutsche Babcock Whirl Staged (WS) burner and the Riley Controlled Combustion Venturi (CCV) burner nozzle. Schematics showing the original WS burner and the DS-CCV burner are shown in figure 3.

Another method to further reduce NO_x emissions is to control local stoichiometry by introducing the combustion air at various locations along the combustion path. The burner (primary plus secondary air) is operated substoichiometrically, and tertiary air is added later in the furnace to provide the oxygen required to complete combustion. The air staging system for the advanced U-fired design is based on operating the burners at a stoichiometry of 0.8 and on the addition of sufficient air (Tertiary air-I) in the slag chamber to achieve the high temperatures required to maintain slag flow. The final air required to complete combustion (Tertiary air-II) will be located to optimize NO_x control and carbon burnout.

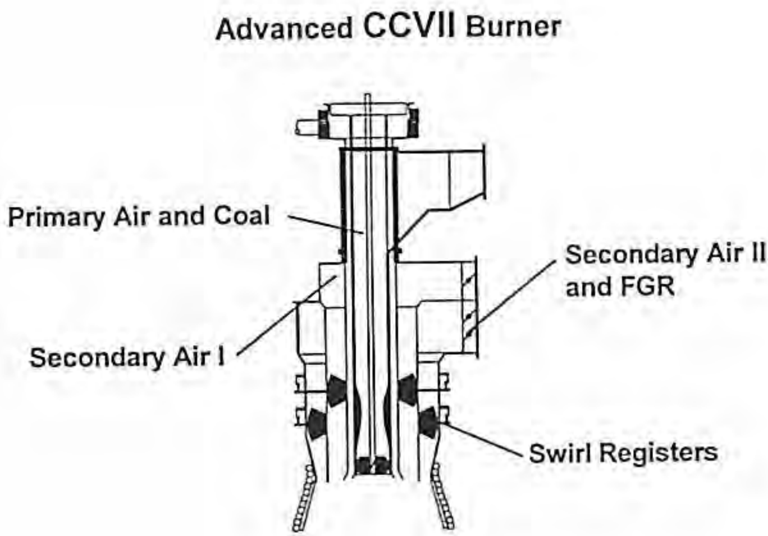


Figure 3. Advanced CCVII burner.

The high temperature conditions exiting the slag chamber and the mixing induced by the slag screen, provide an ideal location for the injection of reburning fuel. In addition, the long residence time available between the slag screen and the furnace exit can provide improved performance through optimizing the residence time in the reducing zone and the burnout time parameters. The amount of reburn fuel needed to achieve the required NO_x reduction is therefore expected to be lower than is typically required in wall-fired or cyclone-fired reburning applications.

The reburning process can increase the ash and carbon carryover to the backpass of the boiler. However, this potential problem is negated by designing for 100 percent coal ash vitrification through the use of flyash re-injection. Finer grind coals produced by dynamic classification will also improve carbon conversion. Another concern regarding the potential materials corrosion associated with deeper staging of the primary combustion zone is also less of a problem for this design. Near stoichiometric conditions in the primary combustion zone are followed by a reducing zone which is created after the slag screen. Careful design of the reburn fuel injectors minimizes the formation of strong reducing environments near the furnace walls.

Boiler System

A boiler design known as the Benson has been selected for the boiler system. The advanced design consists of a once-through, ultra-supercritical, "wet bottom" furnace with spiral wound walls.

The boiler has advanced steam conditions (4,725 psig, 1,100°F) and a double reheat arrangement. To deliver these steam conditions, the boiler uses a two-pass arrangement with radiant superheaters located in the upper furnace. The convective section of the boiler is split into two sections, and the reheat temperatures are controlled with a combination of flue gas recirculation and dampers. The furnace has been designed with a flue gas exit temperature of 2,000°F.

The water and steam circuitry is arranged to provide the most economical flow path for a continuous supply of steam. The feedwater enters the economizer, which is arranged counterflow, flows to the economizer hopper walls (vertical flow) and then enters the helical path of the furnace walls. From the furnace waterwalls, the steam enters the tangential separator which prevents liquid from entering the convection pass, which is of a combination vertical and downflow design. The steam then flows to the counterflow low temperature superheater, on to the parallel flow radiant section and finally to a parallel flow high temperature superheater. The high pressure cold reheat enters a counterflow reheater and then flows into a parallel flow high pressure reheater for final heating. The low pressure cold reheat steam is heated counterflow in the low pressure reheater. The LEBS U-Fired Boiler is shown in figure 4.

Materials

The advanced steam conditions of the LEBS plant pose significant challenges for material selection in the boiler system. The high operating temperatures and pressures will require materials which are high strength and retain their strength at the high temperatures. The boiler components expected to require advanced materials include:

- Steam separators
- Wall heating surfaces
- Final superheater surfaces
- Superheater outlet headers

The materials available to operate under these conditions include SA 213-T91 (9CR 1 Mo-V), SA 213-TP310 (25 Cr 20 Ni-Cb-N), HCM12A (12 Cr 1 Mo 1 W-V-Nb-N0 and NF616 (9 CR 1/2Mo 2 W-V-Nb-N). The most economical of these steels must be selected to provide the greatest cost benefit to the LEBS plant.

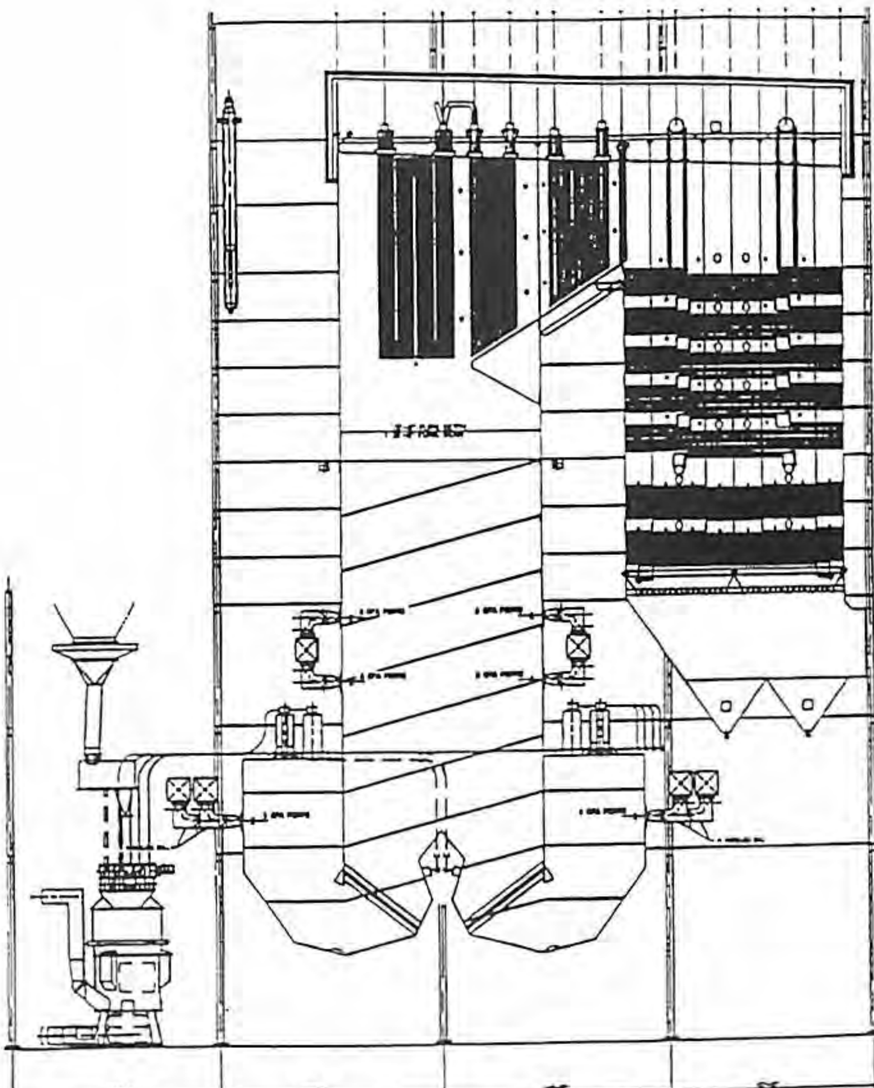


Figure 4. U-fired boiler.

The Electric Power Research Institute (EPRI) is currently supporting a study of advanced high temperature alloys in boiler applications. As part of the EPRI project, U. S., Japanese and European steel makers, boiler manufacturers and utilities are participating in a large testing program of thick section tubes in boilers. The results of this testing are expected to be available to support a commercial LEBS design within the next few years.

Refractory selection for the lower furnace is also an important consideration in the LEBS design. Most of the successful experience with slag-tap unit refractories is with European coals. Therefore, testing in future phases of the LEBS program will evaluate refractory in the lower furnace.

Steam Turbine

One of the main objectives of the LEBS development program is to achieve an overall plant efficiency of up to 42 percent. This efficiency value corresponds to a net plant heat rate of 8,125 Btu/kWh. This low heat rate will be achieved with advanced steam conditions. The LEBS steam cycle configuration is ultra-supercritical (4,500psi/1,100°F) double reheat (1,100°F/1,100°F) with nine feedwater heaters and two topping de-superheaters. This configuration was selected to maximize plant efficiency while minimizing generating costs. These steam conditions are believed economically viable for commercial operation in the year 2000.

This state-of-the-art steam cycle also employs a low level economizer which enhances the efficiency of the steam cycle by heating a portion of the feedwater in the flue gas stream. Heating the feedwater in the flue gas stream reduces the amount of higher pressure turbine extraction steam required for feedwater heating and thus contributes to a high overall cycle efficiency. This configuration, as shown in figure 5, yields a net turbine heat rate of 6,995 Btu/kWh, with an auxiliary power consumption of 7.36 percent of gross generator output and boiler efficiency of 91.86 percent; a net plant heat rate of 8,393 Btu/kWh is achieved.

The LEBS High Pressure Boiler Feed Pump (HPBFP) is located downstream of all of the high pressure feedwater heaters. Feedwater is supplied to the HPBFP by a Low Pressure Boiler Feed Pump (LPBFP) which takes suction from the de-aerator. The feedwater splits into two streams after the LPBFP. Most feedwater passes through the high pressure feedwater heaters, while approximately 16 percent of the feedwater passes through the low level economizer. These two feedwater streams combine again just upstream of the suction to the HPBFP.

Critical Piping

The LEBS high temperature critical piping consists of the main steam piping, No. 1 hot reheat piping and No. 2 hot reheat piping. The main steam piping runs from the boiler main steam line to the very high pressure (VHP)

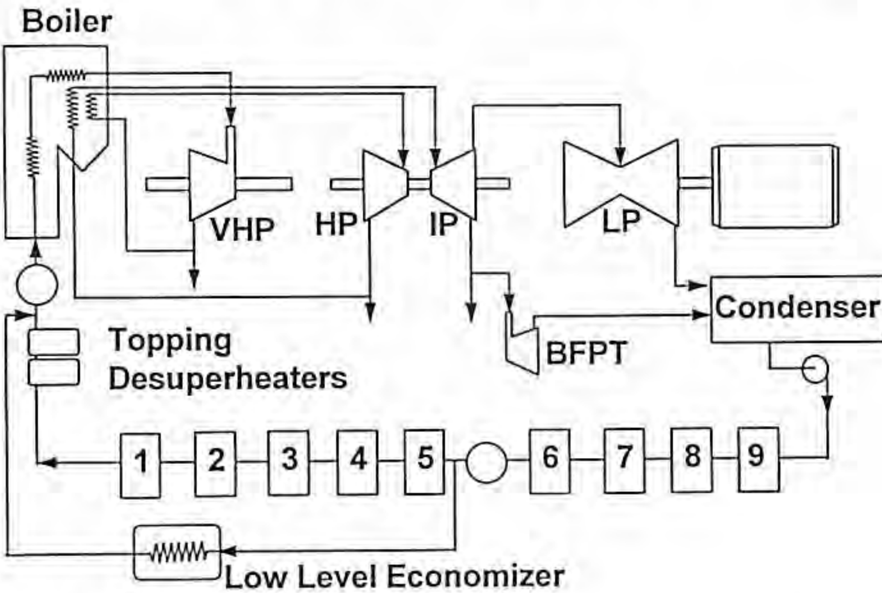


Figure 5. LEBS steam cycle.

turbine stop valve. The No. 1 hot reheat piping runs from the boiler hot reheat line to the high pressure (HP) turbine stop valve. The No. 2 hot reheat piping runs from the boiler hot reheat line to the intermediate pressure (IP) turbine stop valve. These three piping systems each transport 1,100°F steam. The normal operating capacity steam pressures at the turbines are 4,500 psig, 1,432 psig, and 387 psig, respectively.

The critical piping will be fabricated of forged ferritic steels. The piping material selected may be P91 steel as developed by Oak Ridge National Labs (ORNL), or one of the higher strength ferritic steels currently under development at ORNL, Nippon Steel and Sumitomo.

Austenitic steels have higher strengths at elevated temperatures than most ferritic steels currently certified by the ASME. However, new ferritic steels which have recently been certified, or are currently undergoing ASME certification, offer maximum allowable stresses comparable to the best austenitic steels. Austenitic steels contain both nickel (3 percent to 22 percent, typically 8 percent) and chromium (16 percent to 26 percent). Ferritic steels contain chromium (4 percent to 30 percent), but virtually no nickel. Ferritic steels are also low in carbon content.

Four of the principal disadvantages of austenitic steels in comparison to ferritic steels are:

- Higher susceptibility to stress corrosion cracking,
- Higher thermal expansion coefficient,
- Lower thermal conductivity, and
- Higher material costs.

There are some operational uncertainties regarding the use of ferritic steel critical piping at 1,100°F. To our knowledge, ferritic steel critical piping has not been used in a power plant at this steam temperature.

The primary critical piping uncertainty for ferritic steels is potential thick section (two-inch wall) welding problems and embrittlement problems at 1,100°F. If steam temperatures had to be lowered due to deficiencies in the critical piping, the turbine cycle efficiency would be reduced, resulting in a reduction in the overall plant efficiency.

AIR QUALITY CONTROL SYSTEM

The air quality control system includes both combustion and post-combustion processes implemented to control the emissions of particulate matter, sulfur oxides and nitrogen oxides. The Riley LEBS concept features a dry, regenerable SO_2 control process which has significant integration advantages for particulate and NO_x control as well as heat recovery. In combination with the selection of a slagging firing system for ash management, this approach minimizes waste and emissions from all streams leaving the power plant. Figure 6 shows the integration of the regenerable process into the low emission boiler systems.

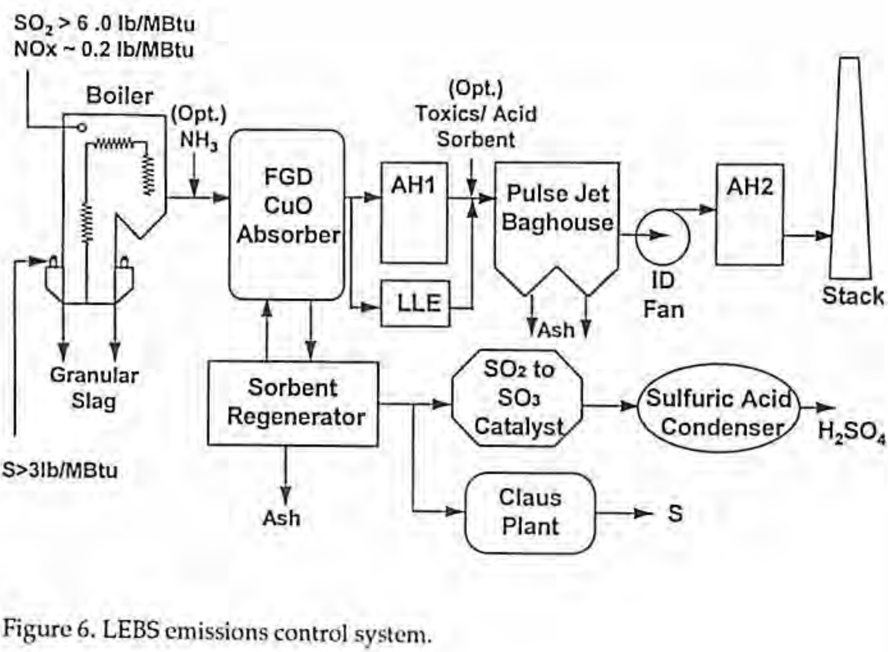


Figure 6. LEBS emissions control system.

Copper Oxide Process

The moving bed Copper Oxide Process flue gas desulfurization (FGD) system is a dry regenerable process in which sulfur oxides react with copper oxide to form copper sulfate. The flue gas is contacted with copper oxide impregnated substrate in a moving bed reactor. The design utilizes cross flow modules operating at approximately 750°F. The reactors are placed directly after the boiler economizer. Sulfur dioxide reacts with copper oxide to form copper sulfate. Sulfur dioxide reacts with copper oxide to form copper sulfate according to the following reaction:

$$CuO + SO_2 + 1/2O_2 \rightarrow CuSO_4$$

The moving bed absorber utilizes a bed of copper oxide impregnated alumina spheres which flow downward between retention screens or louvers under the influence of gravity. The flue gas flows perpendicular to the sorbent bed. The sorbent is regenerated in a separate reactor.

The sulfated sorbent is transported from the moving bed absorbers to the regenerator vessels. In the regenerator vessels, methane is used to reduce the copper sulfate to copper and sulfur dioxide according to the following reaction:

$$CuSO_4 + 1/2CH_4 \rightarrow Cu + SO_2 + 1/2CO_2 + H_2O$$

The concentrated sulfur dioxide stream resulting from regeneration may be oxidized to sulfur trioxide and condensed to sulfuric acid, or it can be converted to elemental sulfur in a Claus Plant. The production of acid byproduct provides a significant gain in thermal efficiency of the plant, whereas the sulfur byproduct may be desirable from the aspects of storage, transportation, and market value. This byproduct flexibility allows the FGD byproduct to be directed toward the better of the two markets.

The primary function of the copper oxide absorber is to remove sulfur dioxide from the flue gas. However, the absorber provides important additional benefits. First, the copper oxide/copper sulfate bed acts as a selective catalyst for NO_x reduction. Thus, NO_x may be reduced to very low levels without significant added capital cost by the addition of an ammonia injection system, either to address deficiencies in combustion NO_x control or to meet very stringent site-specific requirements. Second, the moving bed of sorbent removes a significant amount of particulate matter from the flue gas, albeit not to the very low levels required at the stack.

Finally, the absorber should remove essentially all of the SO_2 from the gas, so that acid corrosion in the downstream devices is eliminated. The hot (750°F) desulfurized (less than 0.2 lb SO_2/MMBtu) flue gas is then split to transfer heat to the feedwater in a low level economizer and an air heater. These heat exchangers benefit from the fact that the flue gas has been largely desulfurized and partially cleaned of particulate matter.

The relatively cool flue gas is then thoroughly cleaned of particulate matter in a pulse jet baghouse. The baghouse is compact as a consequence of the low particulate loading leaving the absorber, offsetting part of the higher capital cost and plan area associated with regenerable SO_2 removal.

The flue gas then passes through the induced draft fan and the second air heater. The second air heater cools the flue gas to approximately 180°F. The arrangement of the two air heaters and the condensate heater allows the heat recovered even at this low flue gas temperature to be converted to power at efficiencies approaching that of the overall cycle.

LOW TEMPERATURE HEAT RECOVERY

In combination with the advanced steam cycle, the low temperature heat recovery system contributes to the high efficiency of the LEBS plant. The low temperature heat recovery system consists of two air heaters and a low level economizer. The first air heater is of the plate-type design and operates at conventional air heater temperatures. This air heater also operates in parallel with a low level economizer which heats a portion of the feedwater from the de-aerator. The second air heater is a low temperature plate-type air heater which recovers the balance of the heat from the flue gas before it enters the stack.

The selection of this low temperature heat recovery scheme was developed to take advantage of the efficiency benefits of low flue gas exit temperatures. Reduction of the flue gas exit temperature by pre-heating combustion air increases boiler efficiency by about one percent for every 40°F reduction in exit flue gas temperature. However, the heat balance between combustion air and flue gas imposes limits on the amount of heat that can be recovered into the air. For this reason, the low temperature heat recovery system developed for this LEBS design incorporates feedwater heating in parallel with air heating. The feedwater offers a good low temperature medium to accept the low level heat from the flue gas.

Approximately 25 percent of the flue gas is sent to the low level economizer, where it is cooled to approximately 300°F. The low level economizer heats a portion of the feedwater, which bypasses the feedwater heaters, from approximately 275°F to 600°F. The remaining 75 percent of the flue gas is sent to the first air heater where it heats air leaving the second air heater from approximately 250°F to 650°F. These heat exchangers benefit from the fact that the flue gas has been largely desulfurized and partially cleaned of particulate matter by the air quality control system. The second low temperature air heater is located after the high efficiency baghouse so that the pluggage risk by flyash is even less of a concern. The lowest temperature plates of the second air heater will be coated with enamel to inhibit corrosion due to the low temperatures and the very low concentrations of SO_3 which may remain in the clean flue gas.

LEBS DEVELOPMENT PLAN

As structured by the Department of Energy's Pittsburgh Energy Technology Center (PETC), the LEBS program develops the designs through a series of steps which alternately produce a design, test the concept and then re-design, based on knowledge acquired through testing. The LEBS program is currently in the second phase of a four-phase program.

Phase I, completed in August 1994, involved the development of the LEBS concept, execution of basic testing, development of a research and test plan for future phases and the preliminary design of a 400 MW commercial generating unit utilizing the LEBS concept. Phase I testing included an evaluation of alternate slagging firing systems for the LEBS design.

Phase II involves development and optimization of the LEBS components, the preliminary design of a proof-of-concept (POC) facility and design, construction and operation of a LEBS subsystem test unit. The POC facility is planned to be approximately 50 MW and consists of a greenfield application of the slagging-fired Benson boiler, with a copper oxide flue gas clean-up system and low temperature heat recovery to include air and feedwater heating. The advanced supercritical cycle will not be included, since it would not be economical for such a small unit size. The Phase II testing will be completed at the Riley Stoker's Coal Burning Test Facility (CBTF). This facility will be configured for U-firing. Important test parameters for the CBTF will include boiler stoichiometry, residence time and coal fineness.

Phase III will involve revising the design of a 400 MW commercial generating unit and incorporating into the design the knowledge gained through the CBTF tests. Also, the POC facility design will be revised.

Phase IV of the program will involve the detailed design, construction and testing of the proof-of-concept facility.

Therefore, at the end of Phase IV, the LEBS concept will have gone through a complete cycle of design and testing. The result will be an operating 50 to 75 MW facility which demonstrates the application of the integrated LEBS concept. This demonstration will provide a basis for application of the LEBS technology to new generating capacity early into the next century. A schedule of the LEBS program phases is shown as figure 7.

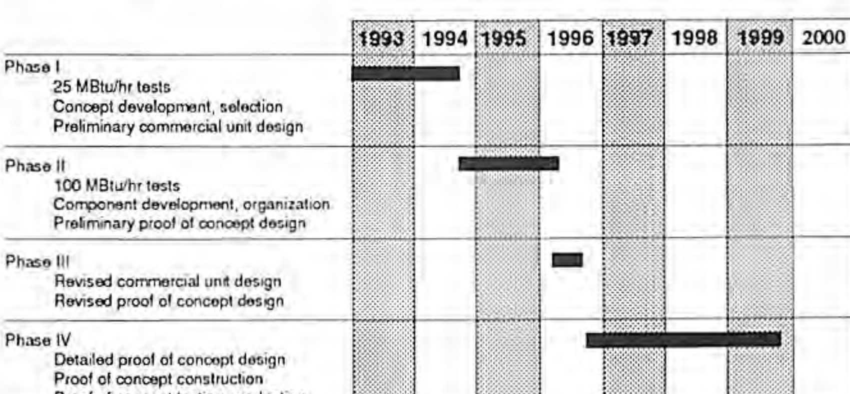


Figure 7. LEBS program schedule.

CONCLUSION

The U. S. Department of Energy's Pittsburgh Energy Technology Center has established the LEBS development program in order to help develop a new generation of clean, efficient and economical power plants. The LEBS development team led by Riley Stoker is responding to the program with a design which provides very low emissions and very high efficiency at a competitive cost. The U-Fired slagging system developed by the team not only provides low NO_x emissions, but also generates a vitrified solid waste product which is very marketable. The dry, regenerable flue gas desulfurization system generates virtually no solid waste while removing over 97 percent of the SO_2 from the flue gas. The low temperature heat recovery system uses an innovative scheme of recovering the low level heat in the flue gas into the combustion air and boiler feedwater to provide an economical option for efficiency optimization.

All of these concepts will be incorporated into the 50 MW proof-of-concept unit at the end of the LEBS program. This POC unit will demonstrate the viability of these concepts in meeting the needs of power generators in the near future.

George Woods: Are there any questions for David or for Tony Litka; I forgot to ask for questions after Tony's presentation?

If there are no questions, I want to thank each of you for attending this technical session. I definitely want to thank our presenters for coming here and talking to us this morning. With that, we are adjourned. The luncheon will be back in this room as soon as they are set up.

LUNCHEON MEETING

Thursday, September 22, 1994
La Salle Room, 12:30 P.M.

Robert Shanks: I would like to welcome everyone to the Institute's annual luncheon. We have a very busy agenda for today's luncheon session, and the first thing I would like to do is introduce those sitting at the head table. Starting at my far left, George Woods, who was the moderator at this morning's technical session; Heinz Damberger, Secretary-Treasurer of the IMI is next; Dr. Ron McMahan, our luncheon speaker today, sitting next to Heinz; Ron Morse former head of the Illinois Department of Mines and Minerals now with the Illinois EPA; and Mr. Wally Lucas, who you will meet in a moment. On my right, Fred Bowman, current Director of the Illinois Department of Mines and Minerals; Dave Webb, Freeman United and incoming IMI president; Richard Kerch, who was one of the speakers this morning at our technical session; Rolf Maurer, also one of our morning speakers; Ronnie Marcum, who will moderate tomorrow's technical session; Tony Litka from Tecogen; and on the end, we have Larry Reuss from Peabody, who you will also meet in a moment.

I was informed before lunch that we were going to be joined by a group of 17 mining engineers from China that are in our country for four months learning about the U. S. coal industry. I'm not sure whether they made it today or not. During your stay with us, we would like to extend our hospitality and hope you learn from our sessions.

As I mentioned in my opening remarks this morning, we owe special recognition to Phyllis Godwin and her crew at the registration desk and to Heinz Damberger and his staff at the Geological Survey. These people keep this meeting running smoothly and we certainly appreciate their efforts over the two days.

Our first order of business this afternoon will be the presentation of the Institute's honorary membership. And to make this presentation I would like to call upon Ron Morse, who is now Manager of the Mine Pollution Control Program of the Illinois Environmental Protection Agency. Ron.

HONORARY MEMBER AWARD

Ron Morse: I'll make this as pleasant as I can, I know you have a lot of business to do. Ladies and gentlemen, it is indeed my honored pleasure to present to you the 1994 edition of the Illinois Mining Institute's honorary life member, Mr. Walter Lucas.

Wally comes to you following a very rich tradition; Sahara Coal Company employees have served this Institute for many, many years, in fact, decades. Sahara Coal Company has presented this Institute with four presidents, five honorary life members, and with a dozen Executive Board members. We are pleased that Wally follows in that tradition.

Ron Morse

Wally is just one of the many tragedies and victims of the Illinois Clean Coal Act. He worked for Sahara Coal Company for some 37 years, and when it ceased operation in 1993, Wally became retired. He has been very busy since his retirement. He's not ever at home. I know that because I live within four miles of him. He's in a new position as a consulting engineer now, and he is working very diligently to try to promote coal products and tries to introduce people that have been displaced by the effects of the Clean Coal Act, to some new positions.

Mr. Lucas was born in West Frankfort, Illinois, on May 30, 1932. He married the former Toni Hayes. They have a daughter Stacey and a brand new nine month old grandson named Jacob. His father and his grandfather worked in the coal mines in southern Illinois. He was educated in the public schools in West Frankfort and then received his B.S. in mining engineering from the University of Illinois and worked for Old Ben Coal Company in the summers. Then he served as an officer in the U.S. Army (he calls it the brown shoe army) over in Europe, with the Corps of Engineers. He started with Sahara Coal Company in 1956 as an engineer, became preparation engineer, chief engineer, and in 1961 was elected Vice President of Sahara Coal Company. He held that title as Vice President of Operations for Sahara Coal Company until his retirement. He is a friend of the Institute. He is a friend of the mining industry, and was my former boss for almost 22 years, and I wish you would join me in welcoming your 1994 Honorary Member and my friend, Wally Lucas.

Wally Lucas

Wally Lucas: Just two quick things come to mind. I certainly didn't think that I would be here when I came to my first Institute, and I know this is going to date me. I came to the old Abe Lincoln Hotel in Springfield, from the University for my first meeting in 1949. My second thought is, when I sat down, our good director of Mines and Minerals asked me about retirement. And I said the one thing is, I sleep much better. Thank you very much.

Robert Shanks: Thank you, Ron, and congratulations to you, Wally Lucas.

Before we proceed with our program, I would like to recognize any additional lifetime honorary members who might be with us today. Would you please stand up and be recognized. *Applause.*

Next, I would like to ask any past presidents of the Illinois Mining Institute to stand and be recognized. *Applause.*

At this time, I would like to call upon Dave Webb, Chairman of the IMI Scholarship Committee, to recognize the mining engineering students from universities and junior colleges involved in this year's programs. Dave.

SCHOLARSHIP CERTIFICATE PRESENTATIONS

Dave Webb: Thank you, Bob. The Illinois Mining Institute is again proud to be able to contribute $10,000 in scholarships to students in area colleges and universities to supply our industry with bright, hardworking young career engineers and mining industrial technologists. I would like to thank my Scholarship Committee, Aaron Jackson of Kerr McGee Coal Corporation, Paul Chugh from SIU at Carbondale, and George Woods from Wabash Valley College. A special thanks to George and John Howard, who put together the actual scholarship certificates.

Dave Webb

I would like to have anybody associated with the universities to please stand. We have quite a few people here today. And maybe we could have a representative from each university come up here to present the scholarship certificates. The first school is SIU, Carbondale. Everyone please stand who is associated with that university. I believe Edwin Thomasson is going to hand out the scholarships for SIU.

Edwin Thomasson: I am sorry that Dr. Chugh could not be here today; and I think this is the first meeting he has missed in some fifteen years. He had to deliver a technical paper in Alaska and probably will be back next week.

Our scholarship winners are Mr. Bradley Bingenheimer from Chatham, Illinois; Mr. Leslie Moore from West Frankfort; Mr. Randy Rockrohr, Carbondale; Mr. Michael Spihlman from Trenton, Illinois; Mr. Eric Steidle from Downers Grove, and Mr. Michael Wilda from Belleville.

We certainly appreciate the scholarships and thank the IMI for presenting them.

Dave Webb: Our next college is the University of Missouri, Rolla. Would everyone please stand from the university. Could I have John Wilson come up please.

John Wilson: I would just like to thank the I.M.I. for all the help in providing these scholarships. They certainly help us to attract good mining students. We have three recipients this year, namely Brian Fortelka from Oswego, Illinois, Chris Huett from Mountain Home, Arkansas; and Gary Hubbard from Alton, Illinois. All three of these students are in their senior year. They have spent two to three summers working in the mining industry and, again, thanks to the mining companies in Illinois. Thank you.

Dave Webb: Our next university is Wabash Valley College. George, would you have all your people stand and come forward to the podium for the scholarship certificates.

John Howard: I would like to thank the Institute for its continued support. This morning the keynote speakers of the technical session were somewhat optimistic. They felt better about the industry in some time, and I am tickled the Institute is still giving us support for our students. We have four recipients, three of whom are working in the industry. I call their names and mention a little bit about where they are working. And one who is hopeful of becoming an employee in the mining industry.

First, Jason Williams who is working for American Federal in Rosiclare, Illinois. We have Jake Bush, who is hopeful of becoming an employee in the industry. Mr. Rockey Raney, who deserves the respect of all of us. He got off the midnight shift this morning in Eagle Valley and made the trip up here and is going to try to get a little sleep before he goes back to work tonight. So we appreciate his being here, especially. Mr. Phil Edmondson who is a public relations officer for Costain Coal Company in Kentucky. I congratulate all of you and thank you for being here. On behalf of them I thank the Institute for its generous awards.

Dave Webb: Is there anyone here from Rend Lake College. Rend Lake always comes and are always here, but their scholarship recipient this year went pro on us. He got his job offer after he was attending class, so he was gracious enough to forego his scholarship. Rend Lake reapplied the scholarship and will be giving us their report tomorrow at the business meeting.

That concludes our scholarships this year.

MEMORIAL

Robert Shanks: Thank you, Dave. On a more serious note, we would like to take a moment and honor the memories of two Illinois Mining Institute members who died during the past year. J. W. MacDonald, who as also a past IMI president, 1954-55. He became an honorary member in 1970. He was also a retiree of Old Ben Coal Company. Mr. Benjamin Wills, a retiree from Inland Coal. I would also like to take a minute and recognize many people from the coal industry who recently died in the USAir crash at Pittsburgh. Some of you may have known these people. They were all returning from a Clean Coal Technology conference in Chicago. I apologize if I mispronounce a few of the names here: Edwin Wiles from CEED; Bernie Koch from Consol; several people from Pittsburgh Energy Technical Center: William Peters, Steven Heintz, Robert Evans, Thomas Arrigoni and Tim Micilvried; several coal people from the Morgantown Energy Technology Center: William Langan and his wife Shirley, Manville Mayfied, Randy Dellefield and Sandy Webb; Todd Johnson from Babcock & Wilcox, Bemberton, Ohio; and Dan Kwasnoski and his wife Carolyn from Bethlehem Steel Corporation.

The next thing on our agenda is the presentation of the annual Reclamation Award presented by the Illinois Department of Mines and Minerals. I would like to introduce Fred Bowman, Director of the Department.

RECLAMATION AWARD

Fred Bowman: Thank you, Bob. This year's recipient of the 1994 Illinois Department of Mines and Minerals Reclamation Award is Peabody Coal Company, River King III mine. You might note before we present the award that this site has also been a recipient of two other awards. The national reclamation award in 1993 and the 1994 Office of Surface Mining reclamation award. I was at that site a few weeks ago. Peabody was gracious enough to turn the entire site over to the Illinois Department of Conservation. I hope you get a chance to see it; it is a beautiful site. It is open now to the citizens of the state of Illinois to enjoy for many years to come. Mr. Larry Reuss is the Peabody representative who will accept this award.

Larry Reuss: Thank you very much.

Fred Bowman, ILDENR Director, presents the 1994 Reclamation Award to Larry Reuss of Peabody Coal Co.

Robert Shanks: Thank you, Fred, and congratulations again to Larry and the Peabody River King III mine for their outstanding work.

As I mentioned this morning, Governor Edgar was unable to join us to be our luncheon speaker today. However, we are indeed fortunate to have persuaded Dr. Ron McMahan to fill in for the Governor.

Dr. McMahan is founder and president of RDI, a well-known consulting firm dealing with energy markets and economics. Dr. McMahan received a B.A. in physics from the University of Colorado in 1968 and subsequently served as a lieutenant in the U.S. Navy. He then returned to the University of Colorado and received his Ph.D., in 1977 specializing in economic history. Prior to founding RDI, Ron served on the faculty of the University of Colorado where he was director of the University Coal Research project for four years. During that time, he was recognized for excellence in research for his work on the economic history of the midwest coal industry. Dr. McMahan is an experienced energy economist. His understanding of our industry has made him one of the nation's most sought after experts in the areas of litigation support, purchase and acquisitions, and strategic analysis. Ron regularly advises industry leaders and public policymakers on coal and energy issues and has served as a special consultant to the President's Commission on Coal. He is also the author of the monthly market watch column published in Coal Magazine. It gives me great pleasure to introduce to you Dr. Ron McMahan.

Ronald McMahan: Thank you for having me. It is an honor to be here.

MARKETING PROSPECTS FOR ILLINOIS BASIN COALS

RONALD MCMAHAN

RDI

Boulder, Colorado

INTRODUCTION

I will attempt to give a perspective of markets for Illinois Basin coals (fig. 1), within the national context. In recent years, prospects have started to brighten slightly for a series of reasons. First, I will discuss production trends, transportation issues, marketing and the outlook, and then touch briefly on some of the factors I think are going to be important to watch in the future; for instance, the way that the acid rain bill actually shakes out in the next couple of years; other environmental restrictions that could end up having a reverse impact on some Illinois Basin coals; and generally, what may happen as a result of the major movements toward deregulation in the utility industry. These factors are going to have a significant impact on the coal industry altogether.

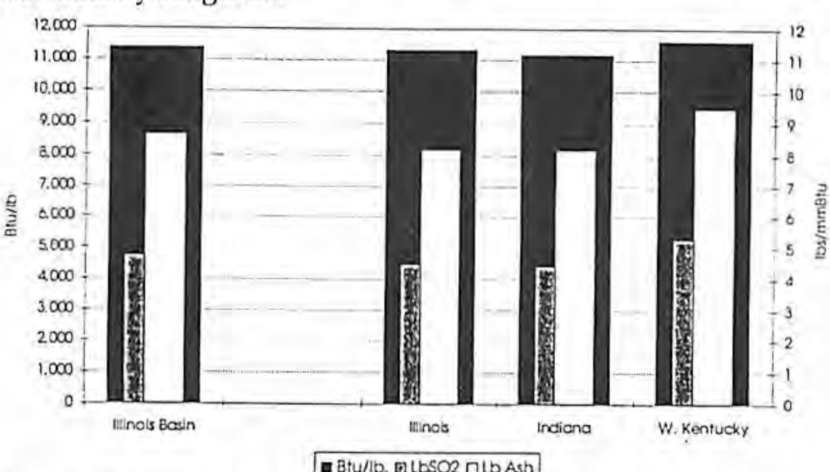


Figure 1. Comparison of average Illinois Basin coal qualities, 1993.

HISTORICAL PERSPECTIVE

Looking at the recent history of coal production throughout the Illinois Basin (fig. 2), it is obvious that 1993 was not a representative year. Typically, the Illinois Basin produces on the order of 130 million tons of coal per year, 60 million for Illinois, 40 million for Kentucky, and 30 million for Indiana (table 1). Illinois took the biggest hit during the strike last year; companies like Peabody, Zeigler, Consol, Arch and other companies took pretty good bites (fig. 3, table 2).

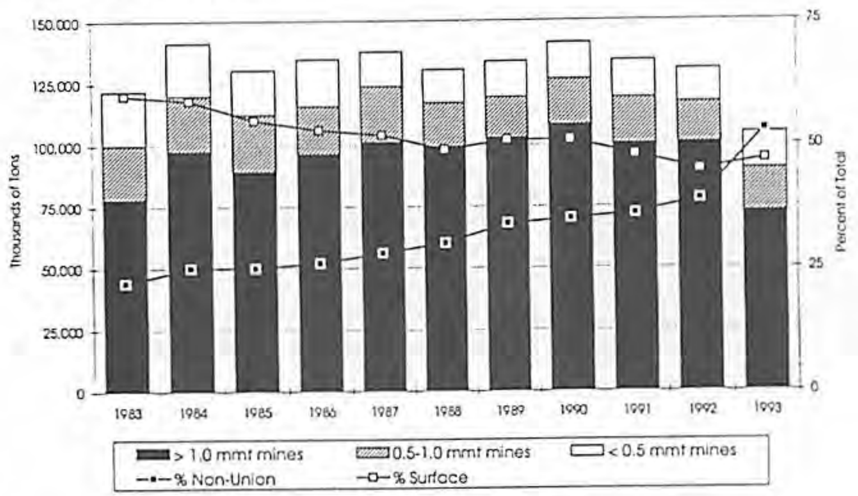


Figure 2. Illinois Basin coal mine trends, 1983-1993.

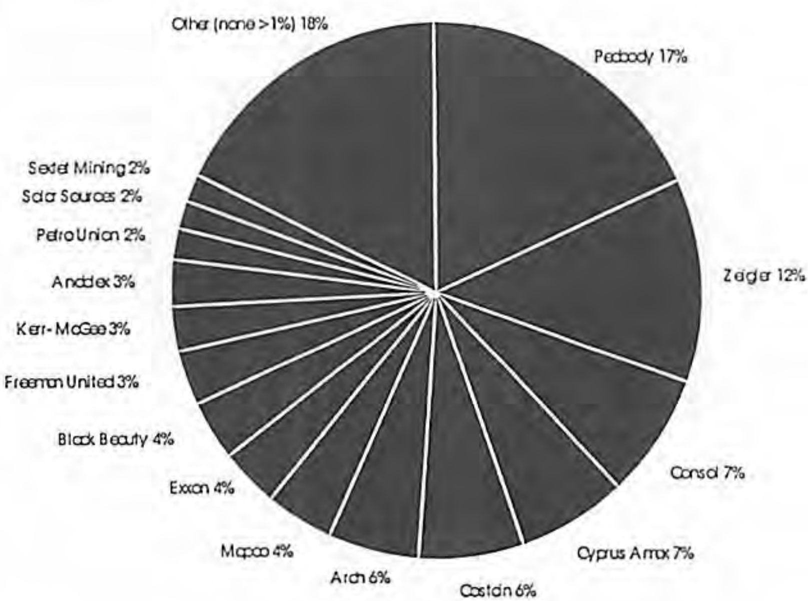


Figure 3. Illinois Basin coal production market shares, 1992.

Table 1. Production and productivity, 1982/1992 comparison.

State	Production (000) 1982	1992	% Chg	Productivity 1982	1992	% Chg	Employees 1982	1992	% Chg
Illinois	60,890	60,323	(0.93%)	17.59	31.75	80.46%	13,731	7,023	(48.85%)
Indiana	30,001	29,179	(2.74%)	22.48	38.78	72.50%	5,037	2,852	(43.38%)
W. Kentucky	38,669	40,751	5.39%	18.32	34.34	87.44%	8,319	4,437	(46.66%)
Total	**129,560**	**130,254**	**0.54%**	**18.59**	**33.59**	**80.71%**	**27,087**	**14,312**	**(47.16%)**

Table 2. Recent and expected Illinois Basin coal mine closures.

Company	Mine	1992 Tons	Remarks
ILLINOIS MINE CLOSURES			
Zeigler	Mine 25	2,607,000	GPC contract expiration/consolidation
Peabody	Baldwin	2,035,000	Consolidation with Marissa Mine
Peabody	Eagle No. 2	1,838,000	Contract switched to CAPP and/or Import
Peabody	Mine No. 10*	1,665,000	CECO contract to expire in mid-1994
Arch Coal	Horse Creek	1,319,000	GPC fuel switch to CAPP
Sahara	No. 21	897,000	Contracts expired; exited business
Peabody	River King No. 6	805,000	Reserves depleted and high costs
Sahara	No. 6	544,000	Contracts expired; exited business
Sub-Total		**11,710,000**	**10,045,000 tons excluding Mine No. 10**
INDIANA MINE CLOSURES			
Cyprus Amax	Ayrshire	2,125,000	Early termination of SIGECO contract
Zeigler	Mine No. 2	861,000	Mine/contract consolidation
Coal Inc.	Fourth Vein	445,000	Roof falls and limited reserves
Northern Coal	Flynn	306,000	
Black Beauty	Apraw*	259,000	Mine/contract consolidation
Peabody	Universal	252,000	Reserves depleted & contract expired
Sub-Total		**4,248,000**	**3,989,000 tons excluding Apraw**
WESTERN KENTUCKY MINE CLOSURES			
Consol	Hamilton No. 2	1,238,000	Contracts consolidated
Mapco	Retiki*	1,125,000	BREC contract to expire January 1996
Peabody	River Queen	631,000	Reserves depleted
Peabody	Camp No. 2	571,000	Reserves depleted/mine consolidation
Francis, S.	Jacobs Creek	556,000	
Consol	Wells Creek	403,000	Reserves depleted & contract expired
Charolais	Db92	374,000	
Thunderbird	Prestige	350,000	
P & M	Black Gold No. 1	268,000	Reserves depleted
Francis, S.	Wild Game	251,000	
Sub-Total		**5,767,000**	**4,642,000 tons excluding Retiki Mine**
Grand Total		**21,725,000**	**18,676,000 tons exc. expected mine closures**

* Anticipated closures within the next two years

Union versus Non-Union

A trend away from union toward non-union mines is well established. In Illinois, ten years ago, there were no tons produced by non-union mines. This year, we anticipate about 10 million tons of non-union production, or about 20 percent of projected production. In Indiana, over the same period, there has been about a seven million ton growth in non-union mining, and in Kentucky, where most of the non-union mines do contract mining, a growth of about 12 million tons in non-union mining occurred over that time period.

A productivity difference of about 25 percent exists between surface and underground mines (fig. 4). Obviously, surface mines put out more volume per worker-hour. Further, we see about a 25 percent difference, in both surface and underground mines, between union and non-union operators. However, this doesn't have anything to do with who works harder; it illustrates that the union mines typically tend to be the older mines. The average age of the mines in the state of Illinois is on the order of 22 years. Typically, those mines that are non-union are the newer mines, and they have a higher productivity. If one sorts this out by the age of the mine, one finds that union mines are running just about neck and neck with non-union mines.

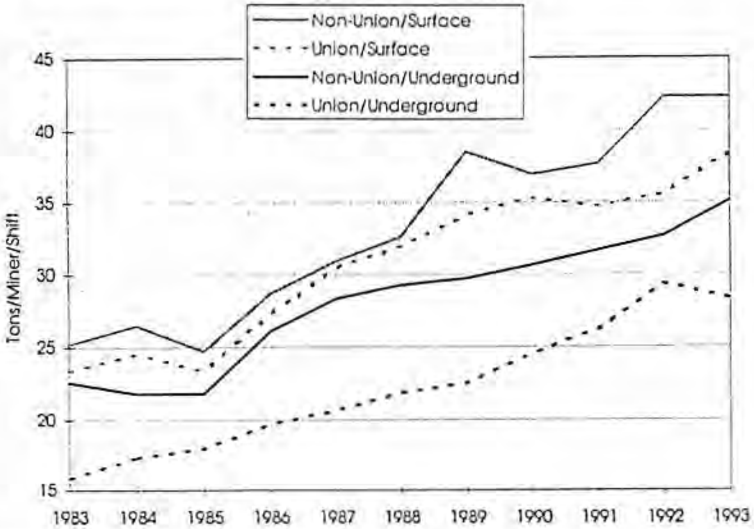


Figure 4. Illinois Basin coal mine productivity.

Spot Pricing

Illinois, Indiana, and western Kentucky move into totally different markets. However, they all tend to have similar heating and sulfur values (fig. 1). As the strike started to settle in for the latter part of 1993, prices ran up substantially; they are still running higher than they were during the non-strike period. Over the longer term, there has been a marching down of spot prices. However, Illinois broke this trend, and, in early 1993, Illinois spot prices actually were ahead of where they were in 1992. Illinois sort of began leading a recovery on the spot price front, ahead of both Indiana and west Kentucky, primarily because of the markets in which they compete and some of the competitive issues that were related to other supply regions.

One of the most important trends in Illinois has been the movement toward underground mining. This shift will happen to some extent in Indiana as they pursue lower sulfur coal reserves. Indiana has almost entirely surface mining and experienced a stronger upturn in the occurrence of non-union mining than the other states. In west Kentucky, a lot of non-union contract mining came into force starting about 1988. Also, coal began to move very heavily into the river markets. At the same time, surface mining increased and simultaneously non-union production increased.

TRANSPORTATION

Of all the Illinois Basin coal shipped, 34 percent terminates on rail, 37 percent by river and 13 percent truck (figs. 5, 6 and 7). The balance is either mine mouth or moves up into the lakes. Illinois is dominated by the rail market. Indiana moves a tremendous amount of coal by truck. In west Kentucky, much coal moves into the river market. Those Illinois coals that have typically gone into the river market moved south into the TVA and Georgia Power systems. We are probably going to see a shift away from that.

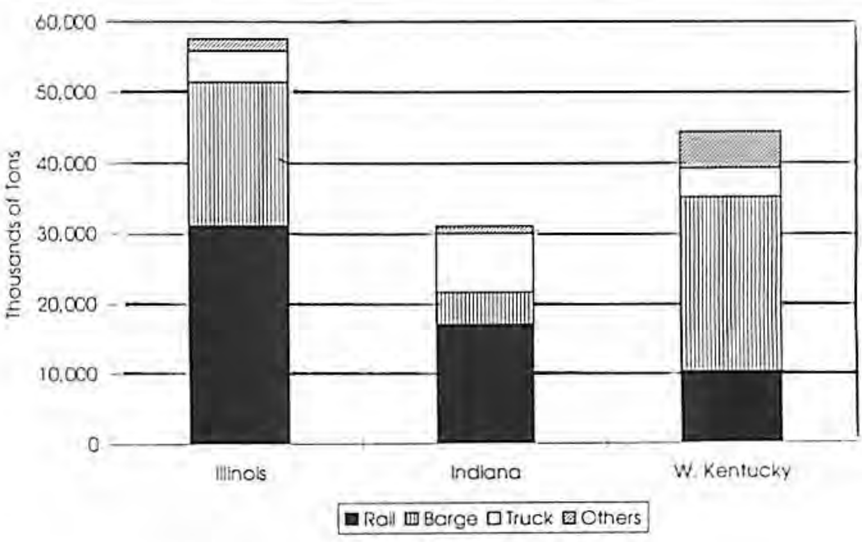


Figure 5. Illinois Basin coal terminations, 1992.

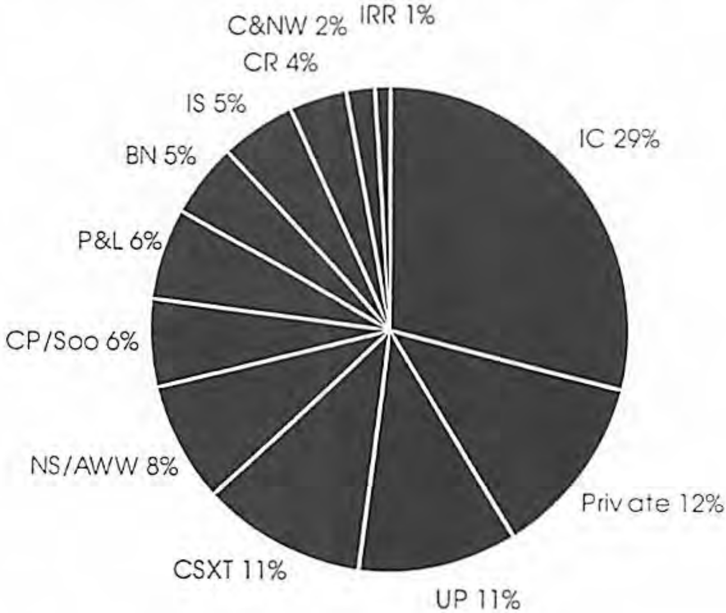


Figure 6. Illinois Basin originations – rail market shares.

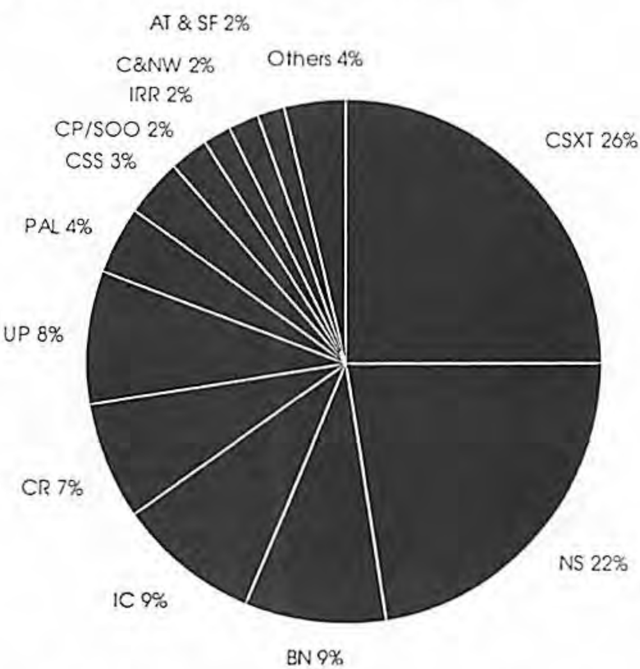


Figure 7. Illinois Basin terminations – rail market shares.

Under the Clean Air Act, the rail originations for the Illinois coal mines are going to remain very important. There are really only two railroads that originate coal in Illinois, the Illinois Central and the Union Pacific. These terminate at only eight plants that burn Illinois Basin coal. Therefore, beyond that, most of the coal that moves out of Illinois is moving on a two-line haul which historically is placed in a somewhat competitive disadvantage because anytime you get only one railroad involved, you have some trouble; by the time you get two railroads involved, the rate issue gets a little squirrely on you. What we are finding, particularly with the consolidation that is going on in the rail industry, is that much more favorable dual-line hauls are being offered in order for the railroads to keep their coal producers competitive in more distant markets. Thus, in some ways, Illinois should determine how much sense it makes to get into the river markets and compete with west Kentucky coals, versus essentially playing to the strength of the rail originations; rails can move the coal greater distances overland.

Transportation reigns. Obviously, for anything under 100 miles, trucks are the choice. Cost is reported on mileage–mills per ton per mile. This equates to about seven cents per ton per mile for a truck haul of 100 miles. The cost decreases steeply with increasing distance, but, for a long haul, movements by rail have the advantage. For a long haul movement down the river, once you get coal loaded into a barge, the cost of moving the coal by barge is very, very low. You can get coal all the way to the Gulf of Mexico and into the export market for substantially under $5 a ton.

MARKETS

Looking at the markets for Illinois Basin coal by the state of consumption, the largest single state consuming coal is Indiana (fig. 8). A lot of Illinois coal is moving into Indiana. There are a couple of major utilities there; almost 32 of the 130 million tons is being consumed in Indiana. In west Kentucky, almost all of the coal consumed originates locally, exept a little bit of Indiana coal that moves across the river. Illinois dominates its own markets; only a small amount of coal comes into the northern part of the state. The Tennessee market, primarily the TVA market, is one that will get hit hard as the TVA begins to move some of its coal supplies towards the western bituminous coals, although they are scrubbing. Missouri is one of Illinois' markets that is in jeopardy, particularly sales to Union Electric (fig. 9).

However, Illinois coal is really the coal that moves into the more distant markets. This has been good news historically, and puts it a little bit more on the bubble, not only as markets get more competitive because of the acid rain issue, but also just as markets get more competitive. All of this means that those producers who have the longer-term contracts and the lower-cost operations will be those who are able to preserve their market share.

In the central part of the basin, Illinois Basin producers own the market now and will own that market as far as any of us can see, primarily because they are able to provide coal into that market for between 80 cents and $1.00

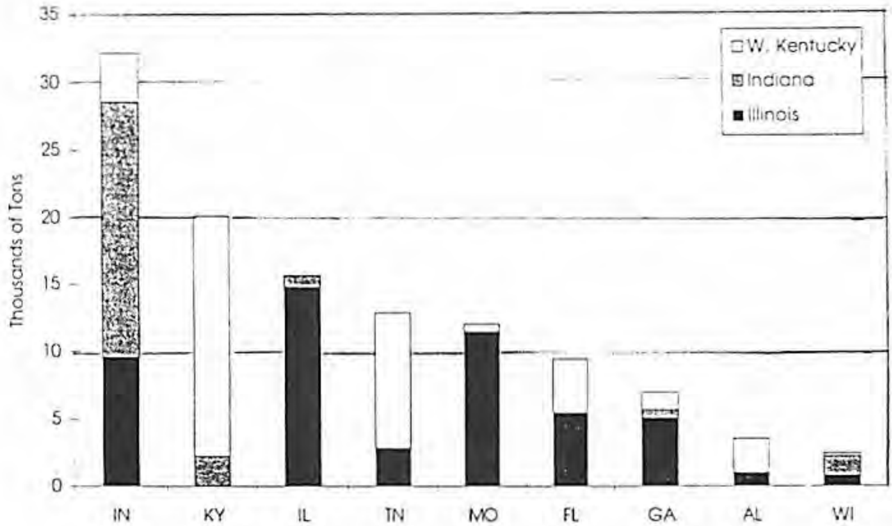


Figure 8. Distribution of Illinois Basin coal – by consuming state, 1992.

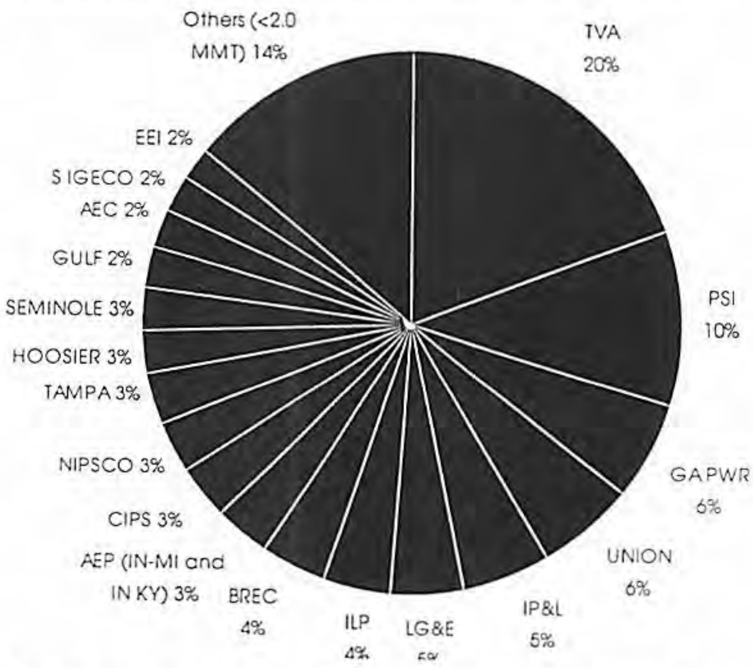


Figure 9. Market shares for Illinois Basin coal purchasers, by utility, 1992.

per million Btu delivered ($19 to $20 per ton delivered). These are spot open market prices.

Just outside this central area, this coal begins to have to move some distance by rail, and typical delivered prices are $1.15 to $1.40 per million Btu. In Indiana, the local market also runs $1.15 to $1.40. Although there are some incursion of Indiana coals into the Iowa and Michigan and Wisconsin markets, the volume is very small. The coals of the west Kentucky coal field go down into the TVA and into the river markets. A lot of the west Kentucky coal moves into the river market, almost all downstream, although there is some that moves upstream. The west Kentucky coal tends to move at about $1.05 to $1.20 delivered prices into its natural market area.

Illinois Basin Coal Competitors

The Powder River Basin is becoming increasingly competitive, including along the river at the Rockport plant and then up the Illinois River, at some Illinois Power plants. Powder River Basin coal is able to move into this region at about 80 cents per million Btu delivered. Thus, with or without an acid rain bill, it becomes a difficult decision for a utility fuel buyer to pay $1.20 to $1.40 per million Btu for indigenous coal when he can get fuel for 80 cents to $1.00.

Toward the east, the central Appalachia coals have traditionally competed with Illinois Basin coals. However, they don't share the same low cost that the western coals do, and, typically, the central Appalachia coals that move into this market are moving in for about $1.40 to $1.55 per million Btu.

What needs to be recognized is that in some ways the availability of low sulfur, low cost coal from both the West and the East tends to put the squeeze on the Illinois Basin from both sides. Because of that, those plants that have not already installed scrubbers, or that won't scrub, are going to be facing an option of switching partially or entirely to lower sulfur coals. The outlook has brightened slightly in this area for Illinois Basin producers, primarily because of the ingenuity of these electric utilities and their ability to implement some fairly creative blending technologies that are really preserving some markets for the Illinois Basin coals. Primarily, within this central market region where these coals are typically used, we really don't feel that much Illinois Basin coal will be displaced from its core market area.

Phase II

In Phase II, of all three of the high sulfur states, Illinois is in a slightly weaker position than west Kentucky and Indiana (fig. 10). Less than 25 million of the 55 million tons of coal sold to utilities moves to plants that have some scrub units, but really only about 10 million tons are moving into units that were scrubbed. This is what the state of Illinois was trying to deal with as it passed legislation that encouraged electric utilities to install scrubbers. A lot of that large rail market was not a scrub market. About 40 percent of Indiana coal is moving into units that are scrubbed, which are essentially safe markets, and almost 50 percent of west Kentucky's coal moves into scrub markets. Coal out of Illinois tends to be low cost production, especially the coal that is being produced right now. The traditional Indiana and west Kentucky coals may provide some market opportunities for low-cost Illinois coal. Beyond that, power plants must face the reality of installing scrubbers later on in this decade. Actually, plants of Illinois Power, feeling they have bought some time, may find that the decision to delay the installation of scrubbers was one of those short-sighted decisions that will come back to bite them in about a five-year period.

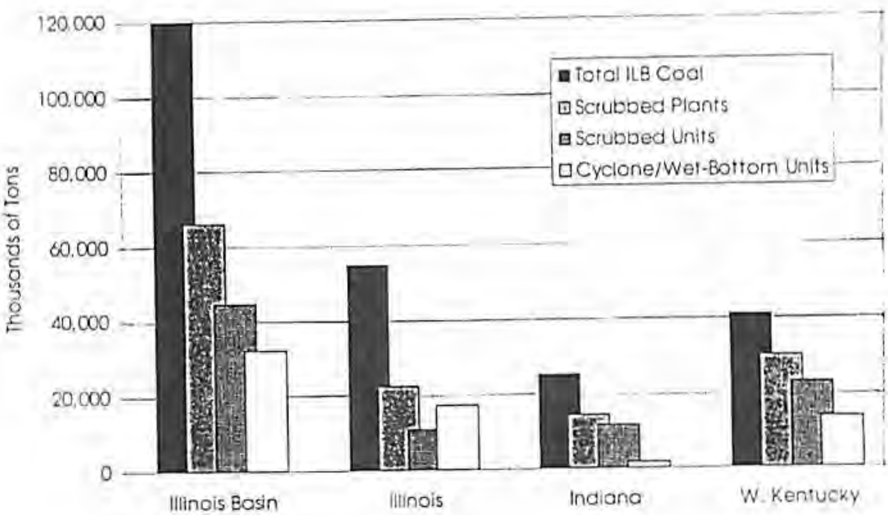


Figure 10. Illinois Basin coal purchases by plant and boiler design, 1992.

Long-Term Contracts

A lot of contracts expire first in the year 2000, then again in 2005 (fig. 11, table 3). More of the Illinois coal tends to be committed to longer-term contracts than does the west Kentucky coal; thus, more Kentucky coal is on the bubble. So when I spend time with our friends at Arch, or Zeigler, or Peabody and we talk about the future of Illinois, they see market opportunities in that there are contracts expiring at scrub plants; it is going to be a matter of how efficient can you be and whether you can get into that market at a competitive price.

Currently, about 36 million tons of Illinois coal are moving under long-term contracts. But about half of that will have expired by the year 2000. Currently, out of about 17 or 18 million tons of Indiana coal, only seven are protected past the year 2000. West Kentucky has a much higher portion of coal at risk. This is the sad news for many people. It is something that a lot of us saw coming. When we first anticipated it, the numbers were so overwhelming that we had a hard time believing that this much capacity would end up closing in the Illinois Basin over the period of time between 1992 and today. Between 10 and 12 million tons of Illinois coal has come out of the market in a very short period of time, plus about four million tons out of Indiana, and about five million tons out of west Kentucky.

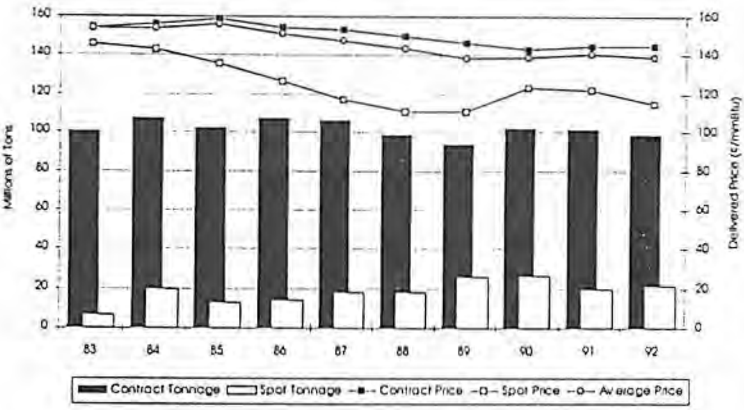


Figure 11. Utility coal shipments from the Illinois Basin.

Table 3. Tonnage under contract for major Illinois Basin producers.

	Year 2000	Year 2005
ILLINOIS PRODUCERS		
Exxon-Monterey	4,785	1,755
Cyprus Amax	4,240	2,960
Peabody Coal	2,671	533
Kerr Mcgee	2,549	1,377
Zeigler Coal	1,984	933
Freeman United	1,007	1,007
Consol	716	0
Sub-Totals	17,952	8,565
INDIANA PRODUCERS		
Peabody Coal	4,731	2,919
Black Beauty	1,491	0
Cyprus Amax	1,030	0
Solar Sources	635	635
Sub-Totals	7,887	3,554
WESTERN KENTUCKY PRODUCERS		
Costain	3174	587
Consol	1,626	1,626
Warrior Coal	1,586	0
Andalex Resources	1,020	0
Peabody Coal	968	215
Sub-Totals	8,374	2,428
Grand Total	**31,039**	**13,960**

Effects of the 1993 Mine Workers' Strike

We have seen a decline on the order of 22 million tons of production coming out of the market (table 4). From an economic perspective, that has had the effect of enabling those producers who are still out there to maintain very stable prices. Many of the mines that fell out of the supply picture now were mines that might have closed in 1995 or 1996; they ended up closing during the mine workers' strike. As anybody who has been in the business for a while understands clearly, a mine comes out of the market at one price but it takes that price, plus some incremental pricing, to bring that mine back into the market. Therefore, effectively, the incremental mines were primarily the ones that were affected first during the strike. It didn't just happen here, it also happened in Pennsylvania, Ohio, and other regions of the country. Many producers, while they said they were going to do what they can to get those mines back, sort of realized the handwriting on the wall.

Table 4. Changes in Illinois Basin utility coal purchases, 1992-1993.

	Thousands of Tons		
Source Region	1992	1993	*Change*
Illinois	54,612	40,112	*(14,500)*
Indiana	24,874	22,900	*(1,974)*
W. Kentucky	40,607	34,400	*(6,207)*
Powder River Basin	12,961	22,319	*9,358*
Eastern	39,077	45,817	*6,740*
Other Western	4,222	7,999	*3,777*
Other	139	1,268	*1,129*
Total Purchases	**176,492**	**174,815**	***(1,677)***
Total ILB Purchases	**120,093**	**97,412**	***(22,681)***

SO_2 and NO_x Effects on Markets

As we move into Phase I, it turns out that it is fairly easy to calculate exactly the kinds of premiums and penalties that are assessed against coal, based on simple mathematics of what a ton of SO_2 is trading for (fig. 12). In a market similar to the market of today where acid rain credits are trading for about \$150 per ton, a 2.5 pound SO_2 coal is the standard so-called compliance coal for Phase I. The figure indicates that a 2.5 pound coal has to sell for at least \$2.00 a ton less to be equivalent to a 1.2 pound coal in Phase I, if the credit price is \$150 per ton. As the price of a credit goes up, the spread between those numbers gets wider. Electric utility fuel buyers have charts like this sitting on their desks when they are evaluating coal bids; this is effectively how they try to appraise the value of every ton of SO_2.

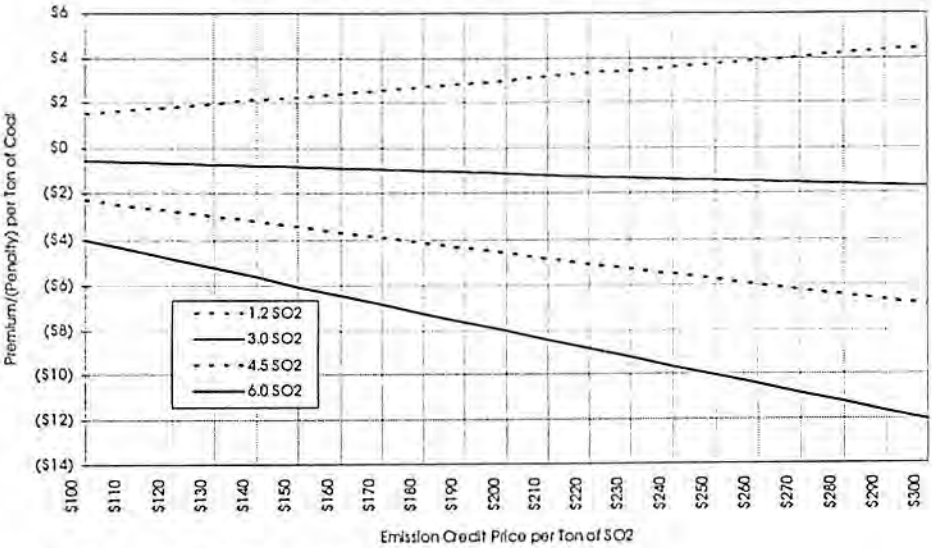


Figure 12. Phase I SO_2 penalties premiums.

Several rules of thumb can be used. At a $200 price per credit, every pound of SO_2 is worth about 10 cents per million Btu. That translates into about $2.50 per ton. The economics of an unscrubbed plant are fairly straight forward. All of this says that if a Powder River Basin coal that is on the order of 1.2 pounds is being delivered at a price of $25 a ton, you are going to have to be able to deliver your 2.5 pound coal at $23 a ton and you are going to have to be able to deliver your 4.5 pound coal at about $3 a ton less than that, about $20 a ton.

It helps for everyone to understand exactly what the value of those sulfur premiums are. We wondered when the whole acid rain bill was passed, whether this was going to work out as logically as everyone assumed it would. The average cost of reducing a ton SO_2 is really much more than the $250 per ton range. The reason the credits are trading in the $150 per ton range is because of the massive over-compliance with the bill, through switching strategies and the installation of scrubbers. Scrubbers have been installed for about 14 gigawatts of capacity, many in states that plan to burn Illinois Basin coal. This effectively protects a lot of coal more than straight economics would have done, either through legislation within the state to preserve jobs, or because some utilities realize that scrubbing now is a much wiser action than waiting and scrubbing later. The utilities were able to get their utility commissions to go along with them in building these scrubbers early.

About a million SO_2 credits a year will be generated during Phase I. That is tremendously good news for the Illinois Basin for two reasons. One is that a lot of this coal has been preserved. Only five gigawatts are actually scrubbed for straight economics; but 9 to 10 gigawatts are scrubbed preserving about 30 million tons of the Illinois Basin market. When mines close and the market shrinks by 10 or 20 million tons, it is hard to sit back and say, "Gee, it could have been worse." But, much of the market for Illinois coal has actually been preserved.

The second reason that one can take heart is because the existence of all of these credits has in fact taken the heat off those non-scrubbed plants to switch early. It created more room for these utilities to burn the higher sulfur coals in the interim, during Phase I, so that the utilities that are over-complying at one unit, now have gained flexibility at other units. If a given utility had not installed a scrubber and were buying coal at exactly 2.5 pounds at one plant, they would essentially have to buy 2.5 pound coal for all of its plants. But because it is over-complying at one plant, the balance of its plants are able to essentially commit over the limits, especially during Phase I. This is also going to carry some utilities further into Phase II than had been originally anticipated, but it has not changed the basic mathematics. The ride is over, if you will, as you get into the year 2002 or 2003. At that point, 30 gigawatts will have to be scrubbed.

There are plants right now that never even thought they were going to have an acid rain problem that are now facing serious problems. Plants that burned Powder River Basin coal during the period when acid rain caps were established are finding that during Phase II, they must reduce their emissions from .8 pounds down to .4 pounds. Why? Because their load has grown and their generation will grow over that period of time. Thus, low sulfur plants that are currently burning western Powder River Basin coal will have to install scrubbers. But once a plant installs a scrubber, it becomes much more indifferent to the coal being burned. For example, a six-pound coal scrubbed at 90 percent is going to emit .6 pounds. A two-pound coal is going to emit .2 pounds. That difference between .2 and .4 is nothing if they find that they can get better prices for the higher sulfur coals. The chart of figure 12 clearly demonstrates that a .4 pound movement in sulfur has very little impact on the value. Consequently, as these plants install scrubbers in early and late Phase II, the demand for Illinois Basin coals, not the super-high sulfur coals but coals in the 4 and 5 pound range, will enjoy a market resurgence.

As a result of the strike in 1993, Illinois lost 14 million tons in production compared to its production in 1992; Indiana only lost about 2, western Kentucky about 6 million tons (fig. 13, table 4). The strike accelerated mine closures by a year and a half; there is no way around that. At the same time, Powder River Basin coal went up by 9 million tons, and eastern coal moved in, with a growth of about 6 or 7 million tons. Other western coals rose by 3.8 million tons, and other coals by about 1.1. This is why the total utility purchases were only down about 1.6 million when nearly 22 million tons of Illinois Basin coal fell out of the market (table 4). The Illinois Basin industry took some medicine early and painfully.

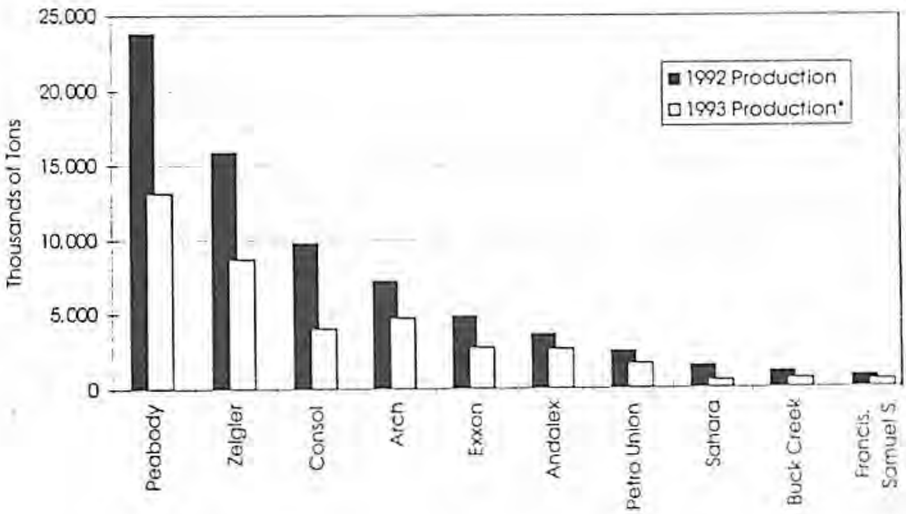


Figure 13. Changes in utility coal shipments, 1992-1993.

PRICING FORECAST AND OUTLOOK

We expect that markets for 1.2 pound SO_2 per million Btu compliance coal will tighten and prices will go up. People will find more of this coal. We base our forecast of the local 1.2 pound coals on those reserves that we feel are in place and can be brought into place during the forecast period in Illinois and Indiana, and some in west Kentucky. Essentially, the 2.5 pound coal will continue to increase its share during Phase I, and then slack off a little bit. FOB mine prices will be in the $25 a ton range; these are prices that most coal producers feel that they can live with just fine. For higher sulfur coals, a clustering of prices is noticeable between $18 and $21 dollars per ton. We feel that those prices are going to continue to step up because the market demand is pulling the price up, or rather just because of the increased cost of mining as you go deeper underground. It is sort of a cost-push increase in prices. What really happened several years ago is that the Illinois Basin found the cost more on their coal pricing. Those people who seriously predicted $11 and $12 per ton coal prices for Illinois coal just didn't know much about the cost of mining coal. Cost puts a floor under what coal can go for.

In 1991, right after the Clean Air Act came into pass, there was a cliff right at the 1995 period that went down to something on the order of 80 million tons per year for the Illinois Basin. We have revised that outlook given our experience with what's happened in scrubbing, and also the last point that I will touch on, namely, the tremendous overall growth in the 4.5

to 6 pound coal, the bread and butter coal in this region. The reason for that is very simply that the electric utility industry is undergoing some radical changes that could in fact have a significant impact on everything that is happening nationwide. Utilities find themselves having to compete with each other in the marketplace on a cents-per-kilowatt-hour basis. Utilities that are able to spread their costs over more and more kilowatt hours will find that, once they make a capital investment that allows them to be able to dispatch their plants at much higher rates, they will be able to generate that electricity on a dispatch basis against the delivered price of their spot open market coal.

What that means is that during Phase I, those utilities which were wise enough to get their scrubbers installed, effectively got those scrubbers into the rate basis prior to two events that happened at once: Phase I and the imminent deregulation of the electric utility industry. They have bitten the bullet and will be the utilities with the greatest generation growth; concomitantly, their consumption of coal will increase more than for anybody else in the country. Thus, many so-called big dirties, the plants that were targeted in Phase I as being those plants that had to be taken care of first, were the ones that installed scrubbers early. First, scrubbers will get more expensive so their capital outlay for scrubbers was somewhat lower; and, secondly, just getting them in place to the point where you will see consumption at those plants that are scrubbed going up substantially, they will be the first to get coal dispatched because of their open-market pricing on that new coal. This can be good news or bad news if you are a coal producer. The price is going to be somewhat less than their long-term contract commitment. If they are buying their contract at $25 a ton at the mine and can get open market coal at $20 or $21 a ton, that coal will be dispatched first, and you will see utilization. We already see it happening; it happened last winter.

We got another test for what will happen when all of a sudden an extremely cold winter came and supplies tightened. Demand for electricity ran up. And where did that go? In the latter part of the year, it went heavily to Illinois Basin producers who were able to get the coal delivered. And it went to the lower price coal that got into the grid at very competitive prices. That is another phenomenon that is going to happen and effectively may encourage some utilities to not wait for their commission or their states to allow them to rate base their scrubbers, but may take early action to install scrubbers.

Finally, another thing that is happening on the environmental front has to do with NO_x and air toxics. These are part of the 1990 amendments to the acid rain bill, but people did not pay a lot of attention to them. When you get down to air toxics related to trace elements in the coal, there are a great many questions being posed right now about western coals. In fact, the federal government EPA has the ability to simply make regulations on NO_x and air toxics. For acid rain, it was spelled out to the penny what the limits would be, how they were going to be calculated, and so on. With NO_x and with air toxics, the federal government, primarily the EPA, was given tremendous flexibility in establishing standards. I very strongly believe that the EPA is going to come up with standards much stricter than most people believe. They will ultimately result not just in installing more SO_2 scrubbers, but will, in many cases, accelerate the repowering of a lot of coal-based utilities.

When you look at a new baseload plant, no matter how you do the math, coal is the most viable alternative for building a baseload plant. This is particularly true for a highly efficient coal plant (i.e., 40 percent plus conversion-efficiency) which is far more efficient than a combined cycle gas plant, or anything else that anybody has on paper right now.

My presentation has been sort of good news bad news. I don't know which side we'll end up on, but I would not be surprised to see the Clean Air Act Amendments of 1997 or 1998 do some things that will ultimately, by the year 2000 or 2005, level the playing field even more in bringing these efficient low-cost midwestern coals back into the market. And, to end on the good news, we are really looking at a point where some hits are going to be taken, but not nearly at the magnitude that anybody was predicting three or four years ago. As long as those low-cost mines stay alive and viable, they are going to be poised for growth.

Robert Shanks: Thank you, Ron, for your remarks. Certainly, everyone in this room is now acutely aware of our market position, and you have given us some hope for the future.

Heinz has let me know that our guests today from China arrived just prior to Ron's taking the podium. I wonder if we could ask them to stand and be recognized so they could be welcomed to our institute. *Applause.*

At this time I would like to introduce the Illinois Mining Institute's incoming president, David Webb of Freeman United.

Presentation of the Presidential Gavel

Dave Webb: Thank you, Bob. The Executive Board of the Illinois Mining Institute felt this year's meeting to be very pivotal to the organization due to the major economic changes that we are seeing here in Illinois. And we really needed strong leadership from our president to rally the manufacturers, vendors, operators and government agencies and universities who keep the support going for this organization. I am very pleased to tell you that we received this leadership from our president this year, Bob Shanks. The vendor displays are very good; we are about two short compared to last year. The additional attendance shows we are getting strong support. Let's hope we can keep on this very honorable tradition. For your efforts, Bob, we have this engraved gavel to commemorate your presidency here. Thanks very much for your efforts.

Robert Shanks: Thank you, Dave. It has been a very good year and I would just like to thank everybody that has been involved in the Institute for their help and support. Dave will take over as president of the Institute as soon as tomorrow's session is completed, and he will begin planning for the 103rd Institute next September.

This concludes our luncheon session, and I would just like to thank everyone for attending. The crowd is certainly better than we expected, and we are very excited about it. We invite everyone to visit the exhibition areas that are open now until 7:00 P.M. this evening. And just a reminder that tomorrow we will be meeting again at 9:00 A.M. for the business meeting followed by our second technical session at 10:00 A.M. Thank you very much.

First Vice President, David L. Webb presents a souvenir gavel to President Robert W. Shanks in appreciation of his service to the Illinois Mining Institute.

FRIDAY MORNING

Business Meeting

September 23, 1994 – 9:00 A.M.
La Salle Room, Gateway Center

Robert Shanks: Good morning. My name is Bob Shanks, and I have had the pleasure of serving as President of IMI this year. To begin our business meeting, I would like the Secretary-Treasurer of the Institute, Heinz Damberger, to take the podium and present our annual report.

SECRETARY-TREASURER'S REPORT

Heinz Damberger: Good morning. Last year, at this time, we projected that we would be close to $2,000 in the red now, or reduced our end-of-year cash balance by about that much. I am happy to report that we were too pessimistic in our projection, and we came out close to even. As a matter of fact, we are a little ahead of last year's cash balance. So, we've done okay this past year. But, down the road it does look a little more gloomy. I have copies of our financial report for anyone who is interested in looking at it. We had an auditing committee of three, as always, who looked at our financial statement. Our main income items, as always, are advertising, close to $19,000 and that comes from our Proceedings; annual dues is $14,500, so that is a significant income item; exhibits, $20,000 plus—our biggest income item now and that is due to the exhibit hall that we have here now with over 70 exhibitors this year. Another significant item that we have had in the last few years is due to a donation of Zeigler Coal Company of a couple of tickets to be raffled off, to anywhere in the United States, and I would encourage you to buy some more tickets. At noon, when we close here, we will be raffling off these two tickets. Last year, that generated almost $1,800, so it has been a significant item. The total income is $65,500 and total expenses were just about the same $65,800.

The major expense items are our meeting, $22,000; publication of the Proceedings, which is a little over $10,000; and scholarships, which we have had at $10,000 for two years now, and we are planning to continue that. The general operating expenses are $23,000. All of our expenses are creeping up with inflation. So, down the road we will need to do something. Membership has fallen off a little. Phyllis tells me that we are pretty close to the number we had before the Centennial meeting. We are certainly not projecting significant increases in Exhibits. We have had some decreases there and our expenses are going up, so for this year, I project a $3,000 reduction in our end-of-year cash balance. This is a conservative but realistic estimate. Consequently, the Board had discussions on how to raise revenues and made some decisions to head off problems, which includes an increase in our membership fee next year by $5 and increases in the advertising fees by $10 for a half page and $15 for a full page ad. All of these will generate funds down the road, and we think we are going to be in good health for the next four or five years. Those are the main items of our financial situation.

As far as membership is concerned: we are at about 1150 or so, which is pretty close to what we were before the Centennial meeting. We had a significant increase in attendance for the Centennial meeting. Since everybody who registers is counted as a member, we had a significant boost in membership which has now petered off.

In attendance, we are actually ahead of last year as of this point: about 650, and we expect to reach 700 plus, which is a bit more than last year. [Actual 1994 attendance was 765]

That is about all I have to report. If you have any questions, I will certainly be glad to answer them. Thank you.

FINANCIAL STATEMENT SUMMARY

Cash Balance Beginning 9/1/93	$28,918	Cash Balance Ending 8/31/94	$28,617
INCOME		EXPENSES	
Advertising	18,894	General Operating Expense	23,197
Annual Dues	14,525	Annual Meeting Expenses	22,255
Luncheon Receipts	2,265	Publication Expenses-	
Exhibit Fees	20,338	Proceedings	10,300
Registration Fees	4,450	Scholarships	10,000
Short Course	390	Mining History Fund	66
Interest	663	Subtotal Expense	65,819
Mining History Fund	691		
Centennial Souvenirs	578		
Convention Raffle	1,785		
Miscellaneous	239		
Convention Cash	700		
Subtotal Income	65,518		
TOTALS	$94,435		$94,435

ASSETS AS OF AUGUST 31, 1994

Fixed Assets	
Office Equipment & Furniture	12,831
Liquid Assets	
Cash	28,617
Bonds	500
	29,117
TOTAL ASSETS ON 8/31/93	$41,147
TOTAL ASSETS ON 9/1/94	$41,948
1993-94 GAIN	801

NOMINATING COMMITTEE REPORT

Robert Shanks: Thank you, Heinz. The next item of business this morning is a report from our Nominating Committee. Don Arrowsmith, from Zeigler, has been the chairman of that group. Don has transferred to West Virginia within the last three months. He has completed his work and passed on the results of his group's selections to us. I will read to you the recommended slate of officers for next year.

President:	David Webb, Freeman United
First Vice President:	Bert Hall, AMAX
Second Vice President:	Aaron Jackson, Kerr-McGee
Board Members:	Doug Blackburn, Old Ben Coal Co., to serve out David Young's term on the board
	Mike Caldwell, Freeman United
	John Devon, Marston & Marston, Inc., St. Louis
	Jim Folkerts, Joy Technologies
	David Whitcomb, MSHA

Are there any nominations from the floor for officers or Board members? The Board actively reviewed this list of officers yesterday at our meeting, and we have approved them, but if there are any other nominations, we would be glad to take them. If not, would someone in the audience please make a motion to approve the slate of officers for next year. [*Motion to approve the 1994-95 slate of officers was made and seconded and was voted for unanimously by the members present.*]

HONORARY MEMBERSHIP COMMITTEE REPORT

Robert Shanks: At this time we would offer Bert Hall the opportunity to report on the work of his Honorary Membership Committee. But I don't believe Bert is with us this morning. Those of you who attended our luncheon yesterday saw the results of Bert's work. I believe everyone will agree that Mr. Lucas is going to serve very well as our new honorary member. [*Walter Lucas, Vice President of Operations (retired), Sahara Coal Company, received the 1994 Honorary Lifetime Membership award at the annual luncheon on Thursday, September 22, 1994. The award was presented to Mr. Lucas by Ron Morse, Manager of Mine Pollution Control division of the Illinois Environmental Protection Agency.*]

Next on the agenda would be the Scholarship Committee Report from David Webb.

SCHOLARSHIP COMMITTEE REPORT

David Webb: Thanks, Bob. It is a real pleasure to see all of the students here. With respect to our universities, at our luncheon here yesterday all the schools were well represented. I must say, working with the Scholarship

Committee, that all the universities are doing very well, and we are going to try real hard in the future to keep the scholarship dollars coming to continue to get bright, hardworking students in our industry. I would like representatives from each of the universities to come up and talk specifically about how things are going. SIU-Carbondale.

Edwin Thomasson: As I mentioned yesterday, Dr. Chugh is in Alaska and asked me to report to you on our Department of Mining Engineering at SIU-Carbondale. I am pleased to report that the Department is in excellent health. It is progressing toward some pretty high-powered goals that have been established both by our faculty and by our industrial advisory board. Our enrollment for the fall 1994 semester, which is underway now, is 30 undergraduate students, all of whom are juniors and seniors. This enrollment corresponds to about 60 or 70 students in a typical undergraduate program at other schools which count undergraduate enrollments at the beginning of the freshman year. Since we recruit many students from junior colleges, we don't like to count them as valid mining engineering students until their junior year. We graduated four students in May 1994, and all were placed in full time positions—three within the mining industry and one who would like to continue on in our graduate school. Additionally, we placed about 18 students in cooperative work assignments during the summer break. Currently, we have one student who is working under a co-op program with the Mine Safety and Health Administration in Harboursville, Kentucky; she will return to SIU for the spring semester. Our student quality is quite good; our average ATC scores are somewhere between 24 and 25.

In our graduate program, we have 21 students enrolled, 17 in our Master's program and four working toward Ph.D.s. We graduated six students with Master's of Science degrees in May, and all have found suitable avenues for professional growth, either in higher education, in research or in other employment.

The department continues to be quite active in mining research. In 1993, the external research funding for the department was about $1.4 million. Virtually all of our faculty are engaged in some form of research. I might point out, that although we are the smallest department in the College of Engineering at SIU, we bring in about three-quarters of the research dollars for the college. The civil, mechanical, and electrical engineering departments don't come anywhere near matching our research funding.

Our research covers four basic areas: coal processing, environmental problems related to coal mining, ground control and subsidence, and materials handling. These are the areas in which we try to concentrate our research. Our program and projects are based largely on industry needs, and we believe that we are pretty much addressing the needs of the industry as they are brought before us.

Over the past years, I think we have significantly strengthened our ties and cooperation with the U.S. Bureau of Mines and with the Mine Safety and Health Administration. For the last two years we have taken some of our undergraduate students to the MSHA Beckley academy during spring break. The academy gave them good lecture courses on various aspects of mine health and safety. They also had an opportunity to get some training with the mine rescue backpack in a simulated mine under very heavy smoke conditions. Of course, it was artificial smoke, but nevertheless, it was pretty much like the real thing. I don't know of any university where that kind of training is available. So, this is something we are concentrating on and continuing to work with at the academy. I did have a number of years with MSHA, and I have had a very good relationship with Tom Kesler at the academy long before I came back to Carbondale and the faculty at SIU. So I kind of traded a little bit on that relationship.

We also sponsored the workshop presented by the Bureau of Mines Twin City Research Center on their mine fire program. The workshop was held in June and was attended by a number of individuals, a couple from as far away as Canada. We are active in other information transfer programs. We sponsored two conferences this year, the Coal Combustion Residue Management Conference held in Springfield in April and the Fifth Annual Ground Control Conference held in Collinsville in June. Both were well attended, and some excellent papers came out of those conferences.

We are planning a second Mine Health and Safety Conference emphasizing ergonomics and health and safety related to longwall mining, probably early next summer, that is, late in June or early July. Plans for that are not yet fully formulated; we have not put out any call for papers, but we will probably be doing that very shortly.

In short, we are constantly striving to develop other information transfer activities to keep the mining industry up to date on developing technologies and other developments of interest.

Finally, on behalf of SIU at Carbondale, especially the Department of Mining Engineering, I want to thank the Illinois Mining Institute for providing the scholarships to support our mining education. We hope the IMI will be able to continue this support to the highly qualified undergraduates in our department as we strive to become a center for excellence in mining technology. Thank you.

David Webb: Thank you. Could we hear from the University of Missouri-Rolla? John Wilson.

John Wilson: Thank you. Until I read the Proceedings of last year's meeting, I didn't realize how much I rambled on, so I am going to try to be a lot more concise today.

Overall, the University of Missouri is doing quite well. We are steady at about 5,200 students. What I think is quite unique about UMR is that 30 percent of all the new students coming to the University of Missouri-Rolla have ACTs of 30 or greater. That is commendable, and it is also affecting our mining department. Last year we had 25 students who completed freshman engineering and commenced their mining courses. Three of these students have grade point averages of 4.0, and 16 of the 25 freshmen have GPA's of better than 3.5. Freshman engineering is often considered to be a

SIU scholarship winners and Dr. Edwin Thomasson, left to right: Eric Steidle, Michael Wilda, Dr. Thomasson, Michael Spihlman, and Randy Rockrohr. (Not shown, Brad Bingenheimer and Leslie Moore.)

Scholarship winners and Dr. John Wilson from University of Missouri–Rolla, left to right: Brian Fortelka, Gary Hubbard, Dr. Wilson, and Chris Huett.

difficult period for new students. So, I am very encouraged to see these results. A concern at UMR is the proposed Hancock II Amendment. Potentially, there could be a 25 percent reduction in state funding for higher education, which would create a traumatic affect on our programs. There is a strong belief that this amendment will not pass, but it certainly is of considerable concern. It is noteworthy that it is not just the coal industry in Illinois that is under economic pressure, even academia is affected!

As far as activities in the mining department are concerned, we are doing well. We have approximately 90 undergraduate and 11 graduate students. I consider us to be at about the right level for the current state of the mining industry. I personally continuously monitor what is happening in the quarrying industry and coal and metal mining industries, because we do not want to over- or under-supply graduating mining engineers. Our students come to the University for a degree with the expectation that they will get placed on graduation. Having said that, we graduated 14 students last year and all 14 did get placed. Because of the coal strike, it was a struggle to place some students who graduated in the summer. Some of the companies who usually hire engineers almost yearly, did not hire this year; however, we did well with the stone and quarry industry. A large quarrying company hired three of our graduating senior students, and two entered the tunneling business at Boston Harbor with a major contractor. Some of the graduating students were placed in the coal business in Illinois, Wyoming, and with MSHA. We currently have two students co-oping with coal companies out west. As far as summer jobs was concerned, any student that wanted a job was successful. I think we had 75 students working across the country in various aspects of mining.

Our program and student body is what we consider to be at good critical mass. This year we have not emphasized growth in enrollment. However, I have noted that the best recruiters for the Department are the students, and with a good student body and high morale, it is interesting to note the influence that this has in getting other students to want to talk about mining. I have recently been advised that we are probably one of the largest undergraduate mining departments in the United States. I hope this benefits the mining industry, now that we have a steady source of mining engineers and ensured a good strong program.

There have been a number of changes in the department in the last 12 months. Dr. Norman Smith retired. Before he retired he was the first Professor to be awarded the Old Timers Award for a faculty member. This award was introduced to recognize a faculty member who has contributed to the education of young mining engineers. Norman was the first to get this recognition, and I think it was an appropriate tribute for the contribution he has made to academia and the mining industry. We have recently hired Dr. Ahmet Unal in his place, who was a visiting professor at SIU this last year. We are pleased to have Ahmet as a member of our faculty.

We have also been setting up some reciprocal exchange programs with foreign mining universities. We have collaborative agreements with Western Australia at Kalgoolie, and Xian, China. I'll be in South Africa next week on a business trip, and while I am there, I will be working on a collaborative arrangement with my old school in Johannesburg. These arrangements are aimed at benefiting students and faculty and broadening their experience. Since mining is a truly international business, I can think of no better way to get a varied mining experience than to work a summer job in say, Australia or South Africa–true mining countries.

Hosting the Chinese delegation has been an interesting experience for all. By the time they leave, they will have spent four months in the USA obtaining an insight into modern U. S. coal mining technology. Their mining problems and challenges are unique, and I hope our training programs assist them in addressing these issues.

We at UMR still provide short courses for industry. Paul Worsey puts on his explosives course, and Jerry Tien offers his annual practical ventilation course. These courses enable us to keep in close contact with industry activities.

Our student activities include a mine rescue team that participates in two competitions each year. Mine rescue team work is a tradition in the UMR Mining Department, and I think we will continue this in the foreseeable future. The students went to Elko, Nevada, to compete in the Annual Intercollegiate Mining Competition. This involves speed tasks in old-fashioned mining techniques. UMR came back with ten trophies, having won the overall competition and five out of the seven events. We entered a girls team for the first time, and they returned with the second place trophy out of ten teams. Next year UMR will be the host, and since we are the farthest east of the schools that typically compete in this tournament, I hope we are able to induce SIU and VPI to participate. There will be three teams from Australia, and teams from most of the western mining schools such as Montana, Nevada, Idaho, Utah, Colorado.

In the field of research, we are active in water jet technology, explosives, rock mechanics, fine coal cleaning and ultra fine coal drying and pelletizing. Recently, we were awarded a contract from the Illinois Clean Coal Institute, and SIU is supporting us in this work. The project is associated with fine coal drying and pelletizing. We are still actively involved in various aspects of a coal-log pipeline transportation project. This project is nearing commercialization and involves pumping coal in the form of compacted cylinders through a water-filled pipeline.

In summary, morale is high in the UMR Mining Department, and all is well. The quality of our students continues to improve, and they are commended by companies employing them. We still have one major uncertainty: the ability to guarantee students that there will be a job when they graduate.

Scholarship support is always important, and we are very grateful for the support from the Illinois Mining Institute. We hope this can continue in the future. Thank you for all your support and assistance.

David Webb: Thank you, John. Wabash Valley College. George Woods.

George Woods: On behalf of Wabash Valley College I would like to thank the Institute for its support for our program. This year we had $1,500 in scholarships which we divided among four students. The four students were in attendance yesterday at the luncheon. I'll mention their names again: Rockey Raney, Phil Edmonson, Jason Williams and Jacob Bush. Each will be receiving $375, and they are very appreciative of the scholarships. Those four students are from the Wabash Valley Southeastern Illinois College cooperative program at Harrisburg. At that location, we have around 50 students that are pursuing an associate degree and / or a certificate. Fortunately, almost all of them are employed in the mining industry. So we don't have to worry too much about placement at this time. In addition, we have been able to maintain 15 full-time mining instructors, scattered throughout the state at different locations. They mainly provide a service to the mining industry through health and safety training, skills training and whatever kind of training the mines would like for us to provide. So we are still pretty healthy; we have students; we are still located throughout the state at Harrisburg, Marissa, Springfield, Mt. Carmel; Carterville; and we hope to continue this kind of support. Again, we thank the Institute for the scholarship funds.

Scholarship winners and instructors from IL Eastern Community Colleges, left to right: Jason Williams, Phil Edmondson, Associate Professor John Howard, Rockey Raney, Jake Bush, and Instructor Tom Kucharik.

David Webb: Thank you, George. Are there any representatives here from Rend Lake College? Harold Finn.

Harold Finn: First of all, let me, too, express our appreciation to the IMI for the scholarship support which you provide to our program. And right along that same line, let me issue an apology for the fact that we were not here yesterday for one of our students to receive that scholarship. We did have a scholarship recipient. Wednesday morning, Ricky Keel came to my office and more or less apologized for the fact that he could not be at school on Wednesday, and, at the same time, could not accept the scholarship. That is the bad news. But the good news is, the reason was, he got a job. We are happy for Ricky, but we are disappointed he will not be in our program next semester to utilize that scholarship. We have a $500 scholarship each year from the IMI, and we choose to give that to a second year student in our program, and that is the way the scholarship would have been spent this year. I told David that we would not be here, and I told him the circumstances; we will re-award that scholarship, and we will communicate who that person is to you.

The status of our program. A few years ago, we started diversification in the program at Rend Lake and what was strictly a mining technology program, diversified into other technical areas. It all started with a decline of enrollments and a need for training of new people to go to work in the coal industry. So what we are doing now and what we have been doing for the past several years, is providing the mandated federal training programs. We work with Old Ben, Consol, and Freeman mines in our district; we don't travel beyond that with the exception of statewide metal, non-metal training. So our program is a little smaller than Wabash Valley's, but we have been able to meet the needs of the mining companies in our district. We are also involved in very specialized and customized technical training that those companies are in need of; with our staff, we are able to meet those needs, and we continue to have a good relationship with them. Overall, we view ourselves as a very valuable resource to the industry, even though we are not turning out graduates with Associate and Applied Science degrees in mining technology anymore. Again, I thank the Institute for the scholarship support, and we hope that it will continue.

David Webb: Thank you very much. That concludes our university reports. I would like to thank members of the committee, Aaron Jackson, Kerr-McGee Coal Corp., Paul Chugh from SIU; and George Woods, Wabash Valley. Thanks also to John Howard, who got the individual scholarship certificates printed and framed.

We proposed to the Board yesterday that we are going to try to hold at that $10,000 level even though we see things may be changing in the economics in Illinois. We did talk about a 20 percent reduction, and we opted to hold off on our voting on this until our winter meeting to see how the finances are coming in at that time. And, if we see our way clear, we will try to go again for that $10,000 scholarship award.

I appreciate all of you representatives coming. Thank you.

Robert Shanks: Thank you, Dave. I think the scholarship support from the Institute is one of the most important functions of this group, and I think we are all optimistic we can keep that $10,000 level.

We don't normally ask for a report from the Program Committee, but I would like to thank and recognize Ronnie Marcum and George Woods for the work that they have done. I think we all agree that the papers you heard yesterday and from a review of the titles of today's papers, we have one of the best programs in recent memory. That concludes our committee reports for this morning. Is there any other business to be brought before the Institute? If not, I would just like to remind everybody that the continental breakfast is available for about another 20 minutes or so until 10:00 A.M. Take time to say hello and visit with the exhibitors who took their time to be here and help support the Institute. And if you speak with them, encourage them to return to our meeting next year.

I would also like to request once again that if you are aware of any deceased members of the IMI that you contact either Heinz or Phyllis so we can keep our Proceedings up to date. And, also, as Heinz mentioned, please remember to purchase your raffle tickets this morning for the two airline tickets that have been provided by Zeigler coal subsidiary Americoal. That raffle will be held at noon in the lobby. At that time, we will also be drawing for the golf clubs donated as a door prize by Jim Justice of Du Quoin Iron & Supply.

Our second technical session will begin at 10:00 A.M. in this same room, so we will adjourn and see you all here then. Thank you.

TECHNICAL SESSION II–NEW DEVELOPMENTS IN MINING TECHNOLOGY IN ILLINOIS

Ronnie Marcum: Good morning and welcome to the Friday morning technical session of the 102nd annual meeting of the IMI. Before we get started, I have one announcement to make. I don't know if there are any other Virginia Tech grad students in the audience besides Tom Denton. Some of you don't know it, but Tech soundly defeated West Virginia 34 to 6. We don't get to brag very often. We are bragging this morning.

This morning we have an outstanding selection of papers all of them dealing with what is going on in the Illinois Basin, especially the Crown Mine, new developments and new techniques being introduced, and longwalling at Monterey. I think all these things show the changes that are happening in the industry almost on a daily basis. We find that there are always new ways and better ways to do things. In our industry, if we don't change, we get left behind at the marketplace. I think all of these papers demonstrate some of the exciting changes going on in our industry, things that are necessary for us to continue to compete. Most of you already know what we face out there.

Ronnie Marcum

Our first speaker this morning has a paper entitled "Monterey Coal Company's Longwall Project–Change, Challenge, and Success." It is going to be presented by Mark Beerkircher. Mark is the project engineer at the Monterey's East Hornsby longwall project. Mark attended the University of Wisconsin at Platteville and transferred to Michigan Tech where he got his B.S. in mine engineering in 1989. Then he went to work for Monterey Coal Company. He recently earned a Master's in engineering management degree from Washington University. Mark has held various engineering positions with Monterey, and, as I said, he is currently project engineer for the East Hornsby longwall project. Mark.

Mark Beerkircher: Thank you, Ronnie.

MONTEREY COAL COMPANY'S LONGWALL PROJECT

MARK D. BEERKIRCHER

Monterey Coal Company
Carlinville, Illinois

INTRODUCTION

In 1989, as President Bush unveiled plans to amend the Clean Air Act, Monterey Coal Company was well underway with plans to transform No. 1 Mine from a high-sulfur, room and pillar operation to a mid-sulfur, longwall mine by 1995. After four years of engineering, planning, development, and construction, while maintaining high-sulfur coal production, the first ton of Monterey longwall coal was mined on April 11, 1994. This morning, I will provide a brief overview of the project, followed by a discussion of the key project challenges, changes, and accomplishments.

Overview of No. 1 Mine Operations

Monterey's No. 1 Mine is located approximately 40 miles south of Springfield, Illinois, between Carlinville and Gillespie. Mine facilities were constructed in 1969 to mine, process and ship over 2.0 million tons per year. Throughout No. 1 Mine's history, coal production has been limited to the high-sulfur, limestone roof of the Herrin (No. 6) seam 330 feet underground, where excellent mining conditions prevailed. These conditions permitted 24-foot wide mining, 40-foot deep cuts, using 30-inch mechanical roof bolts, which permitted safe and productive mining. Unfortunately, Monterey expected that demand for its high-sulfur coal would significantly diminish as No. 1 Mine's main customer, Central Illinois Public Service's Coffeen Station, switched to lower sulfur coal in 1994.

OVERVIEW OF THE LONGWALL PROJECT

In 1988, Monterey established a Longwall Mining Task Force to study the feasibility of applying longwall mining methods at it's No. 1 Mine to reduce operating costs. In recognition of potential Clean Air Act legislation, the adjacent lower-sulfur East Hornsby reserve became the focal point of the feasibility study in mid-1989.

By late 1990, preliminary engineering, planning, and economic modeling were completed. Negotiations with CIPS for securing a long-term coal sales agreement had been ongoing most of 1990; this was a key requirement for corporate project appropriation. Project approval was received in December 1990, after finalizing negotiations for a 20-year contract with CIPS.

One provision of the new contract called for a 200,000 ton test burn of the East Hornsby coal to assess the burn characteristics of this new coal at the Coffeen Station. Leading up to the test burn, high-sulfur coal production had to be maintained to manage near-term profitability. These factors added significant logistical challenges to mine operations and project development. Given these requirements and the necessary upgrades to mine support systems for longwall mining, the project scope resembled new mine construction within an operating mine.

Re-Opening the Main East

The project began in late 1990 by breaking the seals and renovating the Main East submain which was originally mined in the early 1970s, abandoned, and reopened in 1983 for exploration mining into the East Hornsby reserve. After two and a half years of testing and exploration mining, the Main East was again abandoned and sealed in 1986. The unique challenge of reopening the Main East was arching the belt entry through 800 feet of 40 foot high roof falls left from the early 1970s when the Main East was first mined. These falls were so massive and costly to arch that new ventilation and travelway entries were mined around the fall area. A highlight of this project was working 1,700 man-days without a single lost time accident. Details of this specific project were presented at the 1992 IMI meeting.

Construction Projects and Mine Development

As Main East renovation started, construction of an 8,000 ton raw coal silo was also underway. This second silo was required for segregating test burn coal and for increasing raw coal storage capacity for longwall mining. The 60-foot diameter, 140 foot tall, slip-formed silo was constructed in eight months. Raw coal is fed to the silo by a 48-inch belt and reclaimed by seven vibratory feeders and a 42-inch belt to the existing plant feed belt.

Concurrent with the silo work, underground crews were constructing a 1,000-ton moving car bunker which was also required for segregating test burn coal, but would also be used for regulating the surges of coal from longwall mining. This bunker was the first ever built to segregate and meter coal and was also the first fully automatic bunker with remote computer control in the United States. Monterey employees excavated over 25,000 tons of floor and roof to create the 900 foot long by 20 foot wide by 28 to 48 foot high chamber, where the bunker would later be installed. After six months of excavation and roof and rib support, contractors placed 1,300 yards of concrete and installed the bunker in two months, finishing in April 1992.

In June, with both the bunker and raw coal silo complete, these facilities were placed into service to begin segregating test-burn coal. Coal collected in the bunker during shifts of East Hornsby development was conveyed out of the mine at each shift change. By February 1993, over 220,000 tons of test-burn coal had been segregated, processed, and shipped to Coffeen Station.

CIPS conducted two separate test burns to confirm burn characteristics. On balance, the tests concluded that East Hornsby coal could be burned with modest emission-related plant modifications.

Development of the Main East submain into East Hornsby began in late 1991, while the silo, bunker, and arch projects continued. The Main East was completed by year-end 1992. The five-entry bleeder and back-bleeder were completed in February 1994, to begin longwall installation. Gateroad development for the first panel started in May 1993, and was completed in March 1994.

Since longwall operations would take place three to five miles from the existing intake and exhaust airshafts at the main portal with only four to five primary ventilation entries, a 20-foot diameter, concrete lined, intake air shaft, equipped with escape facilities, was constructed near the first longwall panel at the intersection of the First North Submain. The airshaft was completed after eleven months of construction in May 1993 and placed into service after a major ventilation change during the miners' vacation in June 1993.

New Support Systems

The demands of longwall mining necessitated new and larger support systems, such as conveyors, water, power, communication, materials handling, dewatering and compressed air, and emulsion. Engineering and procurement of these systems continued throughout the project as required.

In lieu of re-installing over 7,000 feet of track and trolley in the Main East and recognizing the benefits of rubber-tired diesel equipment, a full compliment of diesel equipment was introduced into East Hornsby throughout the project. Some of the equipment included small diesel trucks, four, six, and eight person trips, supply tugs and trams and diesel scoops. Other equipment included a road grader, shield haulers, shearer car, small fork lifts and diesel roof bolters.

Longwall Equipment Procurement

Longwall equipment procurement began as early as 1989, when a Request for Proposal was developed by the Longwall Task Force for soliciting budget quotations. This early work was revised in 1992 to reflect significant changes in technology, better geotechnical information gathered during the first year of development mining and finalized mine plans. Orders for equipment were placed in early 1993, for delivery by year-end.

Monterey selected two-leg, 620-ton face supports and 750-ton face-end supports from American Longwall Roof Supports – actually a hybrid Meco/American Longwall/Gullick Dobson support. American Longwall also provided Monterey's armored face conveyor, headgate and tailgate drives, stage loader and crusher and crawler-mounted tail. The monorail and cable handling system was supplied by Westfalia Mining Progress.

The shearer selected was a Joy 4LS5 equipped with five-foot diameter drums for a 30-inch web. Hydraulics were supplied by Hauhinco. Electrics, communication, and lighting were provided by Service Machine.

Monthly compatibility meetings were conducted from April 1993 through October 1993, to ensure that all components would be dimensionally and operationally correct. Physical compatibility was confirmed in late-November and early-December 1993, with a face mock-up at American Longwall's Abingdon, Virginia, facility. Delivery of the nearly 4,000 tons of equipment began in late-December and was substantially complete by March of 1994.

Throughout the project, Monterey Engineers were also busy filing applications for mining permits, ventilation and roof control plan revisions and two Petitions for Modification; one for 2,300 volts at the face, and the second for a 1,100 foot trailing cable between the longwall controller and longwall power center. Mining plans, set-up plans, maintenance plans and operating plans were also being developed. Early in the project, Monterey secured surface rights and negotiated subsidence agreements in preparation for planned subsidence from longwall mining.

The gantt chart in figure 1 shows the progression of the major project tasks and the critical path. Overall, project engineering lasted 18 months, followed by four exciting and challenging years of construction and development.

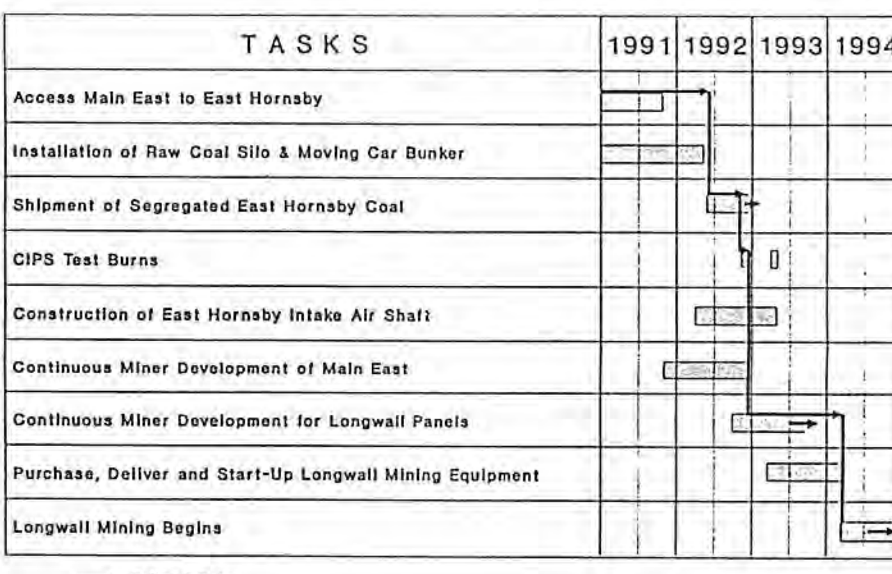


Figure 1. East Hornsby project schedule.

KEY CHALLENGES AND CHANGES

This brief project summary overlooks the numerous changes and challenges that Monterey faced throughout the four years. With the benefit of hindsight, I will review some of the key project challenges and changes, which include roof control, East-West panel orientation, mine development, project acceptance and staffing.

Roof Control Challenges

By far, roof control issues dominated the East Hornsby venture. The net change in roof conditions from the competent limestone in the Main Block to the weak, laminated, gray shale roof in East Hornsby is best visualized with the help of the USBM Roof Rating System (fig. 1) which shows the coal mine roof ranking of 97 mines in the United States, most of which are longwall mines. On average, the Main Block has a CMRR of 93, some of the best conditions. With a CMRR of only 22, East Hornsby conditions are considered some of the worst. East Hornsby's poor conditions are due to three primary factors: weak roof, horizontal stress and weathering.

East Hornsby roof consists of 35 to 50 feet of gray Energy Shale with the bottom six feet being strongly laminated. The unconfined compressive strength of the laminated shale is approximately 2,500 psi, as compared to the Brereton Limestone in the Main Block at 15,000 psi. During development of the Main East, roof problems were prevalent in a north-south orientation, typical of most Illinois mines. Overcoring measurements in East Hornsby found the principal horizontal stress to be approximately 1,200 psi oriented N57E, with a minimum stress of approximately 550 psi. This confirmed that more stable conditions would be in an east-west orientation. Cutters and kink zones were problematic throughout development. Several coping strategies were tested to reduce the effects of horizontal stresses. The most successful strategy included angled roof bolts near the rib-line where cutters were more common.

Weathering proved to be the most significant roof control challenge. In June 1993, Monterey commissioned the new intake air shaft during one of the most humid and wet summers of this century. When exposed to the moisture, the laminated shale quickly deteriorated and fell between roof bolts. Cutters and kink zones exaggerated the weathering effects by exposing more surface area to moisture. At the height of the weathering season, over 25,000 gallons of water per day was absorbed by the mine workings. Thousands of feet of entries and crosscuts were filled with falling laminated shale roof as the roof unraveled between roof bolts, in many places six feet high to the slightly more competent and resilient gray shale. Monterey's long-term solution for weathering, cutters and kinks is the installation of welded steel and alloy mesh in all future development. Monterey also relies on truss bolts in the headgate entry, both as a structural support for possible forward abutment loading and as a belly-band for supporting bagging mesh of weathered and rubblized laminated shale.

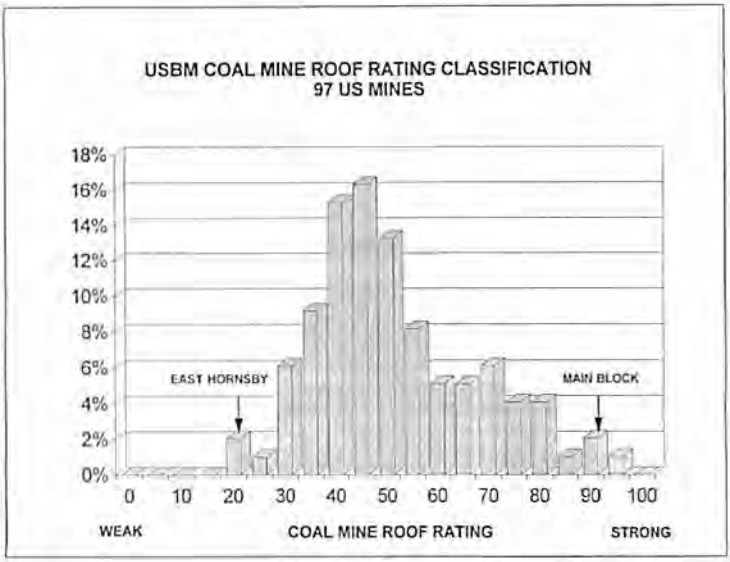


Figure 2. USBM coal mine roof rating classification, 97 U.S. mines.

East-West Panel Orientation Change

In 1991 and 1992, as development continued and the effects of horizontal stresses became clearer, Monterey was faced with the decision of reorienting the longwall panels to East-West from the planned North-South layout. After considerable evaluation of data from other Illinois mines and various consultants, Monterey chose to revise mine plans for East-West longwall panels.

One hurdle with this change was the Chicago and Northwestern's railroad which cuts north-south through the middle of the reserve. Monterey cleared this hurdle by negotiating a subsidence agreement to secure the right to subside this mainline track approximately once per year for the next 20 years. The extra costs of the railroad crossing were diluted by improving recovery and eliminating approximately 30 percent of future mine development as a result of 10,000 foot longwall panels, nearly twice the length of the north-south layout. In addition, future submain development, as well as long-term roof maintenance, was reduced by 50 percent.

Preparations for the first railroad crossing next month are nearly complete. The work includes widening the embankment to permit grading and leveling of the track as subsidence progresses, and extensive reinforcing of a 32-foot diameter concrete arch bridge constructed in 1909. Subsidence is expected to last two weeks, with approximately 5.5 feet of maximum subsidence.

Mine Development Challenges

While the East-West mine plan significantly reduced development needs, mine development rates remained a key challenge as a result of more aggressive in-cycle roof control systems, narrower mining widths, staggered and angled crosscuts, 20-foot deep cuts, 150-foot crosscut spacing and congestion in fewer entries. These changes collectively dropped unit productivity in East Hornsby to one-third the rate attained in the good mining conditions of the Main Block. Changes to pillar geometry to reduce crosscut footage has improved the cutting cycle to meet current development needs, although additional future improvements are needed to keep pace with the ever increasing longwall retreat rates.

In light of the aggressive and costly roof control required, lower productivity and the need to rapidly develop, No. 1 Mine adopted the mine planning philosophy, "If you don't need it, don't mine it," to eliminate all unnecessary crosscuts and entries. An age old practice of mining extra entries as sacrificial entries was dropped in 1993, after the roof weathering challenge. For example, a split 12-entry submain was reduced to a single eight-entry submain with reduced entry centers. In the future, five entry bleeders will be replaced with small diameter airshafts and three entry bleeders. Collectively, this will eliminate an additional 15 percent of development footage, costs and long-term roof-maintenance liability.

Incorporating Project into No. 1 Mine Operations

Incorporating the project into the day-to-day operations was somewhat of a shock to the mine's mature work force, who had no previous longwall experience and little exposure to poor roof conditions. The vast array of new equipment, technology, systems, terminology, regulations and safety hazards were also a significant challenge for mine management and employees.

Logistics of the project schedule and plan required better communication and planning than necessary in the past. The heavy load of construction work and rising load of roof renovation resulted in numerous concurrent projects which competed for attention, people, resources and equipment.

The lack of in-house experience had both good points and some shortcomings. Monterey conducted "Longwall 101" classes for all employees early in the project and again before wage employees bid on the longwall jobs. The training plan for the new longwall crews consisted of over seven days of classroom training and over two months of on-the-job training. Follow-up refresher training was utilized to re-inforce concepts.

Staffing Challenges

Along the four-year venture, Monterey faced numerous staffing challenges ranging from project team organization and changes, to the No. 2 Mine closing and company reorganization, the 1993 labor contract negotiations and the longwall staffing strategy.

In early 1990, Monterey established a minesite project team of five engineers, one cost accountant, and a project manager. This team remained intact until February 1993, when the closing of No. 2 Mine and corresponding company reorganization dissolved many of the team members into the permanent new company organization located at No. 1 Mine. Six months later, No. 2 Mine reopened, leading to a second reorganization and round of personnel changes. This level of change at the height of the project resulted in some re-work and lost information. Fortunately, nothing significant was lost through the cracks.

The impacts of the reorganizations were more apparent underground as new faces and names entered the mature No. 1 Mine organization. Adding to this challenge were the negotiations for the 1993 labor contract. Monterey continued to operate for over a year under the 1988 agreement, including through the BCOA strike. At times, productivity, morale and absenteeism levels pressured the project schedule.

No. 1 Mine was also faced with staffing and training longwall crews. After considering numerous staffing strategies, Monterey opted for classified longwall operators, longwall repairmen, and longwall utility men. With this configuration, longwall operators were trained to operate and perform routine maintenance on all longwall face equipment by rotating weekly from shearer, to shields, to headgate, to floater before returning to shearer. Longwall utility men are trained relief operators for filling possible vacancies who normally work outby the face building cribs, handling belt structure and stoppings, and assisting with longwall service train moves. Longwall repairmen were primarily trained to maintain the longwall, but were also skilled operators.

The longwall operates three shifts per day with a maintenance window from 8:00 A.M. until 12:00 Noon. The rotating staff and rotating shifts allow personnel to develop and maintain all the necessary production and maintenance skills. Of course, the complex equipment, new procedures and terminology challenged these workers. Employees responded very well to this steep learning curve and new staffing arrangement.

CONCLUSION

Combined, the numerous challenges and changes were overwhelming at times, but solid management, leadership and teamwork avoided many of the potential pit-falls, resulting in a proud list of accomplishments.

First, Monterey transformed its No. 1 Mine to a productive longwall operation without in-house experience. To make up for this deficiency, Monterey utilized outside consultants for critical technical work, equipment procurement, roof control and risk assessments under the attention of Monterey staff–an effective combination. Monterey personnel were very fortunate to tour and inspect many of the operating longwall mines around the country, especially here in Illinois.

Second, Monterey maintained high-sulfur coal production to its customers while constructing the various facilities and separately supplying over 200,000 tons of test burn coal. The successful test burn affirmed the coal sales agreement and continued operation of No. 1 Mine.

Although the immediate roof strata posed many problems to development mining and outby areas, these same conditions were found to be favorable for the longwall. The first cave-in occurred after only 40 feet of advance and full subsidence was measured after only 350 feet of advance. Furthermore, approximately 97 percent of subsidence occurs within 10 days. With such quick relief, abutment loading forward and on gate entries is minimal.

Another key success was Monterey's rigorous equipment procurement process. The series of compatibility meetings and physical tests resulted in a smooth start-up that was free of equipment compatibility problems. The days and weeks spent traveling to verify dimensions, to test fitness for purpose, to audit quality assurance during manufacturing and to perform physical compatibility tests, proved to be a worthwhile investment.

Similar benefits were realized in selecting a customized face dust control system, which proved successful enough that Monterey started cutting bi-directionally on April 11, 1994. The system consists of strategically located custom sprays on the shearer, cross-frame drive, stage loader and crusher. Sprays were also incorporated into each shield canopy and caving shield. To date, the dust levels have remained below 1.5 mg/cc without using the shearer boom spray-bar or the shield sprays. On-going internal and independent measurements of dust levels are being closely monitored as productivity increases and conditions change.

One of the most important accomplishments was Monterey's safety record throughout project construction and development. The arch project and initial longwall face setup were each completed without a lost time accident (LTA). The bunker project had one LTA. Recently, with the adoption of roof mesh, the mine went 12 months without a roof-related lost time accident in East Hornsby. The safety record, while not perfect, is certainly admirable, considering the scope of work.

These are only a few of the accomplishments achieved since project inception in 1989. Many other improvements and optimizations were made as a result of employee involvement and feedback from operations around the United States, and here in Illinois. Despite the disruptive organizational changes and the numerous challenges, Monterey management successfully guided the project from inception to start-up, three months ahead of schedule and under budget–the beginning of another 20 years of safe and productive operation at No. 1 Mine.

Finally, I would like to thank Monterey Coal Company for the opportunity to share this information with you this morning. I would also like to thank co-authors Doug Brockhaus, Tom Daniel, Lee Dodd, Paul Mihalek, J. V. (Butch) Mocsary and Jeff Padgett for their assistance in preparing this presentation.

Ronnie Marcum: Thanks, Mark. That was a well-prepared presentation. Our next speaker is going to give a presentation on the operational experiences with a miner bolter in the Illinois Basin. Jim Hess is the Superintendent of the Orient No. 6 mine for Freeman United Coal Company. Jim is a longtime coal miner; he has over 25 years experience in the mining industry, all in the Illinois Basin. He has worked for a couple of different companies and has held every operational position and title from hourly worker right on up the ranks to superintendent. Jim.

OPERATIONAL EXPERIENCES WITH A MINER/BOLTER IN THE ILLINOIS BASIN

JAMES R. HESS

Freeman United Coal Mining Co.
Waltonville, Illinois

INTRODUCTION

At the Freeman United Coal Mining Company's Orient No. 6 Mine, located in Jefferson County near Waltonville, Illinois, a different concept in continuous mining development for longwall panels is being used. Faced with a common problem in longwall operations, development of territory for the longwall mining system, Freeman instituted a miner/bolter development machine to enhance the mining rates in the longwall panels.

At Orient No. 6, mining occurs in the Herrin (Illinois No. 6) Coal seam. The seam has a thickness of about five to six feet; the overburden is 700 to 800 feet. The immediate roof is formed by the dark gray shale and the medium gray shale facies of the Energy Shale Member. While the shale normally forms a stable roof, the historical mining experience indicates that bed separation along the laminations can cause problems at the mining face. In continuous mining sections, the separating layers will fall, or they must be cut down. The floor is formed by clay stone; it is normally stable, except when wet. Because of the roof instability, the enhanced roof control features of the miner/bolter operation became a powerful driving force for this acquisition. Rather than developing the normal 18 to 20 feet before roof control is installed, it is now possible to control the roof immediately. Resin impregnated conventional bolts are used as roof support; lengths of seven to eight feet are used, in concert with a fourteen foot plank or steel plate.

EQUIPMENT

Section equipment is composed of the following: miner/bolter, shuttle cars, roof bolter, exhaust fan, battery-powered scoop, and ratio feeder.

Miner/bolter: Joy Model 14CM10-15	
Cutting width	15 ft 6 in.
Max. cutting height	10 ft 5 in.
Min. cutting height	4 ft
Grd. pressure	27 psi
Voltage	995 vac
Power	710 hp

Roof drills: Two (mounted on the Joy Miner/Bolter)	
Tram height	4 ft 2 in.
Feed	6 ft 8 in.
TRS reach	9 ft 5 in.
Timber cyl.	8 ft 6 in.

Shuttle cars: Two Joy Model 10SC22-56AE 4
Capacity 255 cu ft
Voltage 250 vdc
Roof bolter: Lee Norse TD2 43 5 4E
Scoop: Ingersoll Rand Model 488
Exhaust fan: Joy Axivane MN 29 21 3500
Horsepower 100 hp
Style Self tramming
Volume 30,000 cubic feet per minute

VENTILATION SYSTEM

Primary face ventilation is with exhaust tubing because of the long crosscut center dimensions and because of onboard roof bolter modules that inhibit machine-mounted scrubbers. It was decided that exhaust ventilation was the only practical method to maintain requirements for respirable dust levels and face ventilation. The exhaust ventilation system is powered with a Joy 100 hp exhaust fan and 20-inch diameter tubing. With this system, we have had over 600 feet of exhaust tubing in service and have maintained acceptable ventilation and dust control levels. Over 600 feet of tubing have been connected to the fan while maintaining required face ventilation.

ROOF SUPPORT

As the miner advances, roof bolts are installed within approximately 42 inches of each rib and within 48 inches of the previous row, using a wooden plank or an approved steel channel. The wooden plank has a minimum thickness of two inches; it is eight inches wide and 14 feet long. A distance of 42 inches is maintained between the rib and the outside row of bolts on the plank or steel channel.

A variance of four inches on the straights and six inches on corners is permitted. Following completion of the mining cycle, which includes cleanup and rock dusting, a center bolt is installed before any more coal is mined in the working face. At least one center bolt is installed in each board. The mining cycle is complete after a sufficient distance is developed inby the crosscut to turn the crosscut. During operating weekdays, the center bolt is installed within 24 hours after the place has been mined. During holidays, weekends and unplanned work stoppages, the center bolts are installed within 72 hours after the place has been mined. No mining is permitted in areas that have not been center-bolted following the 24-hour period; only examinations are permitted.

When mining a crosscut, roof bolts, in conjunction with wood or metal plates, may be used in place of the center bolts in the plank when plank placement renders it impractical to install the center bolt through the plank.

Crosscuts may be mined from areas supported with planks that are not center-bolted.

When mining into a three- or four-way intersection, the intersection must have the center bolts installed in the boards prior to mining into the intersection.

Roof bolts that are a minimum of 84 inches in length utilize an expansion shell, and 24 inches of resin are used with a five-inch by five-inch steel plate and wood plank.

When mining a crosscut, supplemental props or jacks are installed inby the crosscut location prior to the crosscut being mined.

If the ATRS system cannot be pressurized against the roof, the bolt spacing is reduced by an amount to allow the operator to work under supported roof while installing roof bolts, or temporary supports must be installed.

BASIC OPERATING CYCLE

The miner advances approximately four feet. At this time, mining stops, and the ATRS system is placed firmly against the mine roof and the bolting cycle begins.

In order to expedite the installation of the wood plank/steel plate and the bolting process, the use of a two-piece roof bolt is used rather than a one-piece bolt. The outside roof bolts are seven feet in length and the center bolt is eight feet long.

Following the installation process of the roof support system, the next plank/steel plate to be installed is placed on the plank jacks prior to the lowering of the ATRS system.

As a feature for machine and personnel safety, the ATRS system must be fully lowered before the machine may tram and mine.

Roof support materials, boards, plates, bolts and resin are stored on the miner/bolter. Onboard storage can accommodate approximately fourteen boards or fifty steel planks and an adequate supply of bolts and resin. Assuming normal roof conditions and board spacing of four feet, the supply of fourteen boards will allow 56 feet of advance before supplies must be replenished.

In practice, the wooden plank is preferred over the steel plate as the roof support method. In very irregular roof conditions, the wooden plank is more resistant to bending and breaking than the steel plates. When wood planks are unavailable, it is not uncommon for operators to double up the steel plates to stabilize irregular roof strata.

OPERATIONAL REVIEW

Performance of the miner/bolter unit is based on several operating issues: the loading/cutting cycle, the haulage cycle, board spacing and operating procedures, such as wedge cutting and undercutting. Operation analysis has indicated that, with no delays, the miner/bolter unit has a potential of 171 linear feet per shift. Procedures such as board spacing can affect the unit shift potential up to 20 feet; waiting on haulage vehicles, up to 36 feet; and wedge cutting and undercutting procedures, up to five feet per shift.

The typical performance of the miner/bolter unit is 3.8 minutes per linear feet of advance. The maximum linear feet mined in one shift has been 160 feet. It has been our experience that the miner/bolter in longwall panel development has advanced at similar rates as our regular place miner sections. These rates can be improved with the proper haulage system. Using available equipment, we have experienced the most favorable mining rates with cable reel shuttle cars used in a piggyback scenario at the miner/bolter. We have presently installed a loading machine behind the miner/bolter and are evaluating its performance.

Crew Size

Miner operator	1	Scoop utility person	1
Bolter operator	2	Mechanic	1
Shuttle car operator	2	Foreman	1

Total crew size: 8

Safety

Injuries to roof bolter operators accounted for 23 percent of the total accidents during the year before we started the miner/bolter operation. This type of accident has dropped to 12 percent of the total accidents after the miner/bolter system was put into operation.

We had a 63 percent reduction in injuries to roof bolter operators alone. In addition, timberman injuries have been reduced because cribs are shorter as a result of the lower mining height. Further, the planks and steel plates have allowed us to discontinue the use of the wire mesh on the headgate entry used to protect the stage loader area from falling rock.

Question: What kind of productivity do you have?

Jim Hess: We measure productivity on our development sections as footage advanced. We will advance approximately 82 feet per shift.

Question: Did you experience any increase in accidents with this type of mining system?

Jim Hess: With the place mining system versus the miner/bolter mining system, we have reduced our roof control accidents by 63 percent, and that is a result in a change in the mining system. Roof bolters in our mine mainly get hurt from the shoulder down to the tip of the fingers as a result of falling shale material and we have eliminated those type of accidents with the miner/bolter system. One thing that we used to have to do with place mining systems was that at our longwall headgate, we would have to put wire mesh alongside the stage loader to reduce the amount of material that would fall in that walkway area and hit operators on the longwall face. We had seven lost-time injuries as a result of all the falling material along the stage loader before putting wire mesh up. As a result of going to the miner/bolter system, and plank mining, we have completely eliminated putting the wire mesh alongside that stage loader, so this reduced that altogether.

Ronnie Marcum: Thanks again, Jim. Very interesting and very educational.

Our next paper is about the operation of the Joy Flexible Conveyor Train or the FCT, at the Marissa Mine of Peabody Coal Company. It is going to be presented by John Hill. John is the General Manager at the Marissa Business Unit at Peabody. John is a graduate of West Virginia University and I know he is feeling very sorry for himself this morning, but there will be other years I'm sure. John got his mining engineering degree from WVU in 1976 and has held various positions in the industry for some of the bigger companies, Armco Steel, A. T. Massey and Shell Mining. John has been with Peabody for the last couple of years and has been in his current position at General Manager of the Marissa Business Unit since May of this year. John.

John Hill: I was hoping nothing would be said about the football game last night. Every time I get up to speak, I am reminded of the story about the young preacher. He had just gotten out of the seminary. He got sent out on his first week, his first Sunday to preach on this little circuit out on the plains. He understood that they were going to be relatively small churches, but when he went to the first church, he was really dismayed to find that there was just one old farmer sitting in the front pew. He didn't have any idea what he should say. He thought about it for a minute and thought, "Well, I'll just ask him." So he walked down to the front of the church and asked the old farmer, "Brother, it is just me and you here, do you think I ought to preach."

He said, "Well, I'll tell ya. If I had got up this morning, loaded up my wagon and went out to the field to feed the cattle and there wasn't but one cow showed up, I'd a fed it."

The preacher said, "Brother, you're right." And he launched into the preachin', and he preached and he preached. About two hours later he closed with the prayer and stepped down from the pulpit and said, "Well brother, what do you think?"

The farmer said, "Well, I'll tell ya son. If I'd a got up this morning, loaded my wagon up and went to the field to feed my cattle, and there wasn't but one cow showed up, I'd a not fed it my whole wagon load."

So I'll try not to feed you all a wagon load here today.

OPERATION OF THE JOY FLEXIBLE CONVEYOR TRAIN AT THE MARISSA MINE

JOHN C. HILL
Peabody Coal Company
Marissa, Illinois

INTRODUCTION

The Marissa mine is a part of the Marissa Business Unit. The Business Unit also includes the overland belt to the Randolph Preparation Plant, the Randolph Plant itself, a short line railroad and the operation of the Kaskaskia Regional Port District Dock No. 1. The Marissa Business Unit is a newly formed entity created as a result of the decentralization of Peabody Coal Co. - Midwest. The Marissa Business Unit produces at an annual rate of slightly in excess of 3 million clean tons, all of this production being dedicated to the utility and industrial markets. The total complex employs in excess of 400 people and is located in St.Clair, Washington and Randolph counties of Illinois.

The Marissa mine is a six-unit continuous miner operation located about 35 miles southeast of St. Louis. The mine is located in the Herrin (No. 6) seam and exhibits a typical quality of 10,800 Btu/lb, 3 percent sulfur, 13 percent moisture and 9.5 percent ash. Five of the six continuous miner units utilize shuttle car haulage, and the sixth uses a Joy Flexible Conveyor Train (FCT), which is the subject of this paper. Each of the six Joy 12CM12 continuous miners operating in the mine is equipped with a flooded bed scrubber and radio remote control and is ventilated by a single split of intake air directed up the right side of the section, sweeping the faces and returning down the left side of the section. Most of the units are equipped with two roof bolting machines and employ either three-way dump feeders or multiple feeders. There is no pillar extraction done in the mine. However, second mining is done on the perimeter of our panels, intake and return rooms.

The Joy FCT came to the Marissa mine in early 1993, but did not go into operation until March of 1994, because of the intervening contract strike. The remainder of the discussion about the FCT is divided into four portions. First, I will discuss the technical aspects of the unit; second, the mine design and operational changes associated with the unit; third, the performance of the machine; and finally I will discuss the successes and difficulties we have encountered with the machine.

GENERAL ARRANGEMENT

The general arrangement of the FCT at Marissa is as follows. The unit is 300 feet long. The unit is comprised of about 140 cars, each approximately two foot in length, that supply the framework on which the tram chains are driven and operate; they carry the belt structure and the conveyor belt. In addition to the cars that form the majority of the FCT, there is an inby unit that receives the coal being dumped from the continuous miner conveyor chain and an outby unit that delivers the coal onto the section belt. Both the inby and outby units are integral parts of the FCT (fig. 1). The belt is 37 inches wide, continuous over the length of the FCT and runs at about 700 feet per minute. This belt speed allows for a carrying capacity of about 16 tons per minute, a capacity factor that has led to some of the difficulties at Marissa. The belt is driven from each end by two 30 hp motors, yielding a total belt drive horsepower of 120. Finally, there is a 40 hp pump motor that supplies hydraulic power to the unit.

Although the belt on the FCT is continuous, the FCT is made up of six segments. The four segments in the center are about 60 feet in length and the inby and outby segments are about 30 feet in length (fig. 2). Each of the center segments is made up of about 30 cars. There is a drive car on each end of the center segments and on the inside end of the inby and outby segments. In other words, each of the inner segments is driven from both ends and the inby and outby segments are driven from only one end. Each of the segments has its own tram chain, but shares a tram motor on either end with its connecting segment. The tram motors are connected to a reducer that drives a cross shaft; this cross shaft in turn drives a dual speed reducer that drives the tram sprocket on either end of two segments. In reference to figure 2, the G tram motor would drive the short outby segment and the outby end of segment 1. The H tram motor would drive the inby end of segment 1 and the outby end of segment 2, and so on. The tram motors are all interconnected through the control system and work in unison.

Programmable controllers are used to operate the system and sense various FCT parameters. The unit is remotely controlled. It is equipped with a diagnostic display panel that informs the operator of current operating status, displays various messages in case of an operational problem and will display pertinent operational information such as motor amperages, etc. upon request.

MINE DESIGN AND OPERATIONAL CHANGES

The FCT presented the need for a number of mine design and operational changes for the Marissa mine. The FCT is capable of turning 90° angles; however, it certainly does not operate at its optimum in that configuration. We therefore chose to set up the unit on a 60° orientation radiating out from the belt entry (fig. 3). In this orientation the unit operates very efficiently; however, it will not efficiently develop new panels for itself. Therefore, in addition to the unit where the FCT is located, we have another unit dedicated to developing new panels for the FCT (fig. 4).

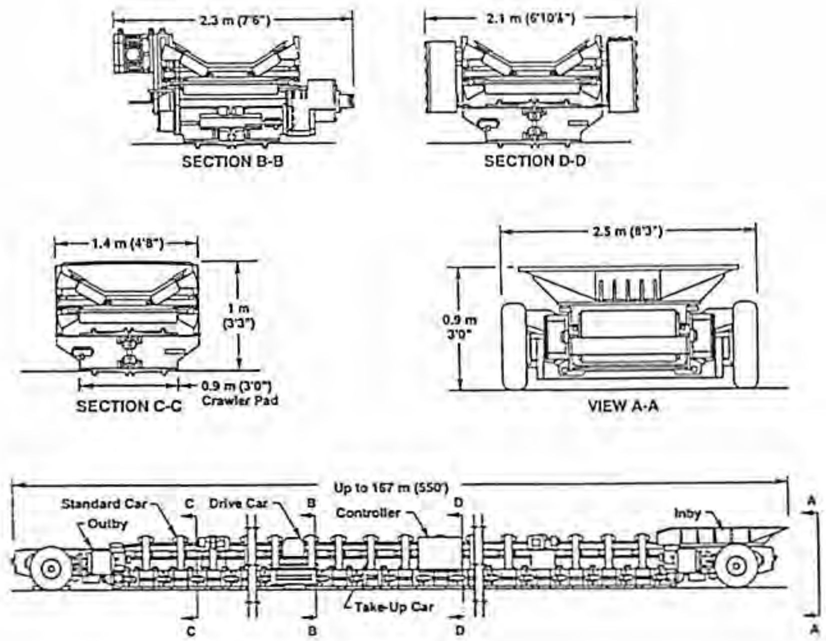


Figure 1. General arrangement of Joy Flexible Conveyor Train.

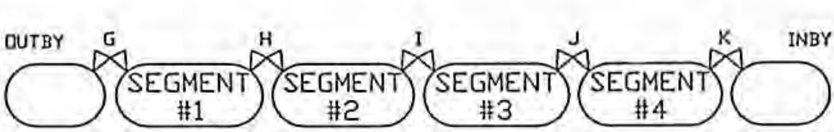


Figure 2. Segments of the FCT.

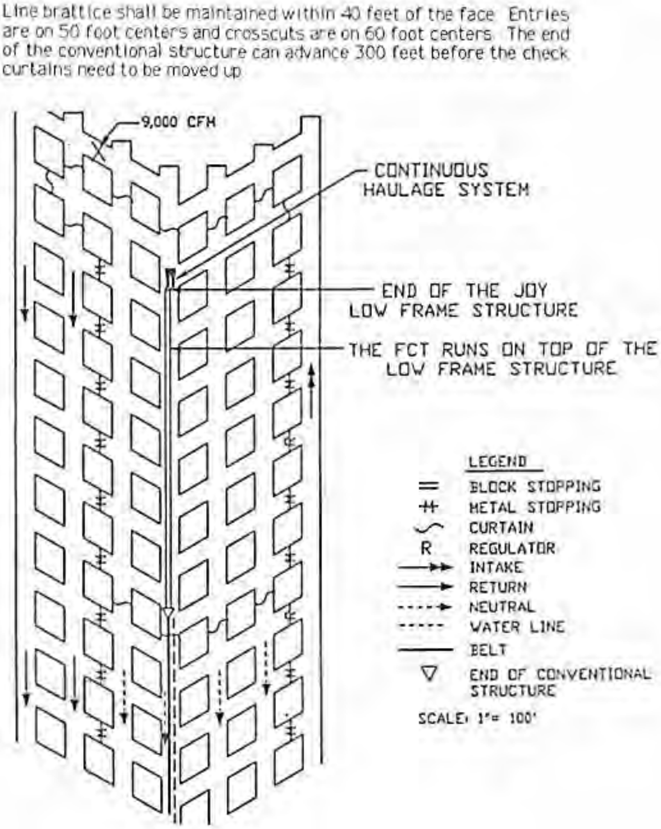


Figure 3. Continuous haulage 7 entry system.

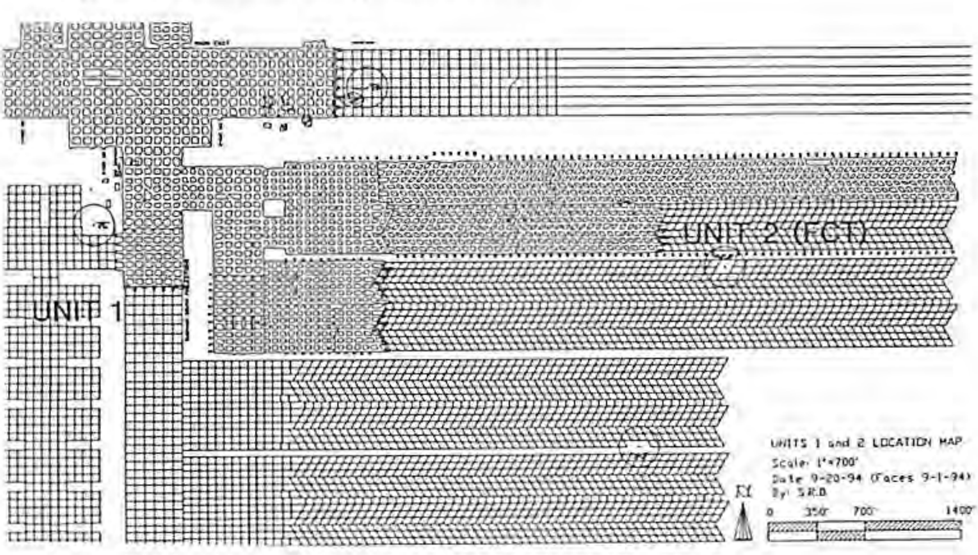


Figure 4. Location of units 1 and 2 in Marissa Mine.

We have elected to limit the length of the panels to about 4,000 feet to avoid the necessity of setting an intermediate belt drive or drives. This creates the need to move the unit to a new panel about every three to four months. Each panel belt requires a belt storage unit in addition to the drive so that the low structure can be moved more quickly and efficiently. Ventilation on the unit is not significantly different, nor is roof control.

PERFORMANCE

The performance of the FCT has generally been positive, with some caveats. If you look at safety, there has been no change in the number of injuries observed on Unit 2 compared to our other continuous miner units (fig. 5). Based on this very preliminary data, you could not draw any conclusion about the safety gained by eliminating shuttle car haulage, nor could you draw the conclusion that the system had any additional hazards associated with it.

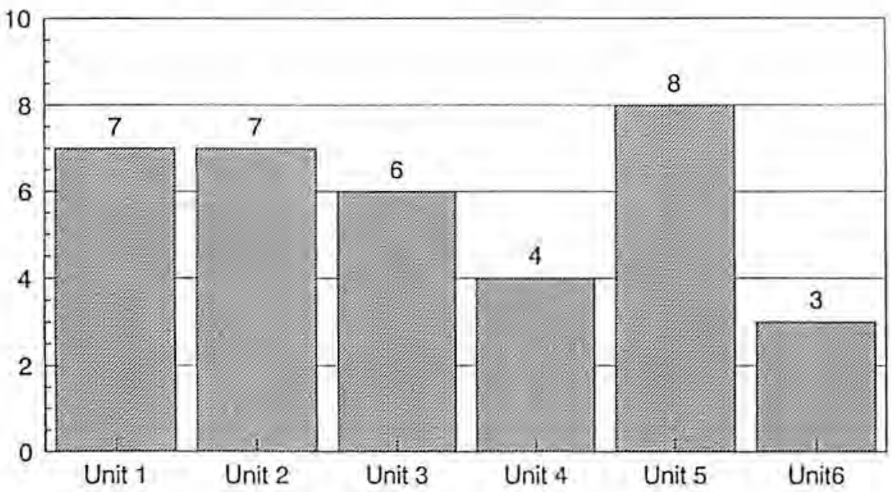


Figure 5. Comparison of number of all injuries of units at Marissa Mine; Unit 2 is FCT unit.

If you look at production on a unit-shift basis, the FCT is outperforming the average unit by about 200 tons per unit shift (fig. 6). The natural conclusion that would follow from this data is that the system is also more productive on a tons-per-man-shift basis as there are two fewer persons on each producing shift. However, we have not yet verified that conclusion, and that is one of the caveats mentioned above. We operate Unit 2 where the FCT is located two production shifts each day, with the third shift idle for maintenance. Although we do operate the unit with two less production employees per day, we on average have about four more persons than would be normal on the unit each idle shift. In addition, there is an inordinate amount of weekend work associated with the unit. Also, the presence of the belt storage unit requires a significant investment in time when a new panel is set up. Finally, the productivity of Unit 1 dedicated to developing for the FCT, is nearly the lowest in the mine because they are continually moving back and forth from the mains to the panels (fig. 6). The combination of all of the above may or may not be enough to dilute the higher unit-shift productivity of the FCT, but our payroll system does not currently track hours on a unit basis, and we are therefore unable to substantiate either case. In the very near future, we hope to be able to track all of the hours charged to the particular operating unit and, at that time, will be able to more fully evaluate the productivity of the FCT on a per-person basis.

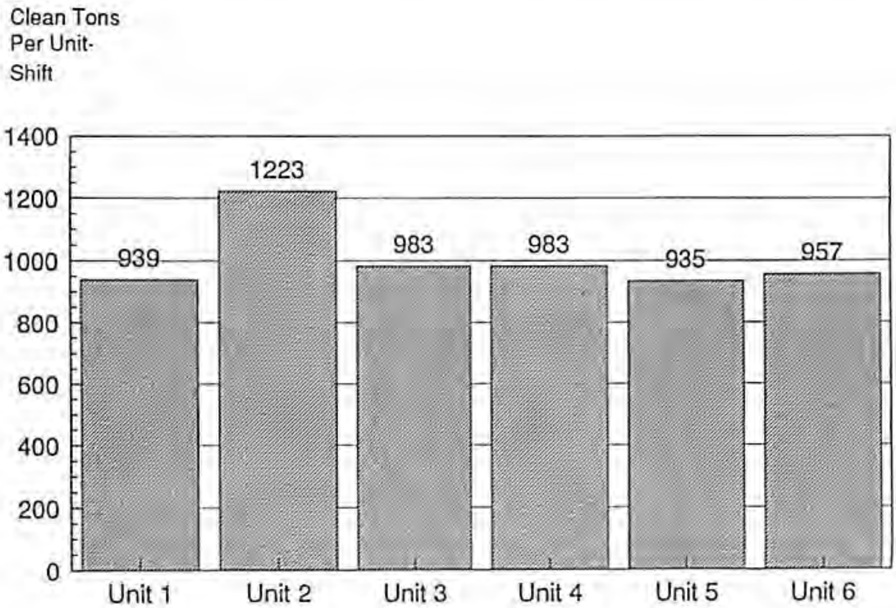


Figure 6. Comparison of clean tons per unit-shift of units at Marissa Mine.

Finally, in terms of availability, the FCT has not performed as well as we had hoped. As can be seen in figures 7 and 8, the major delays have been on belts and the crawler drive system. The delays seem to be somewhat cyclic in that belt problems are replaced by crawler problems, and so on (fig. 8). Figure 9 manifests the delays in availabilities; they are generally trending somewhat upward but are still on average well below 95 percent, a number we think should be easily achievable on a new piece of machinery.

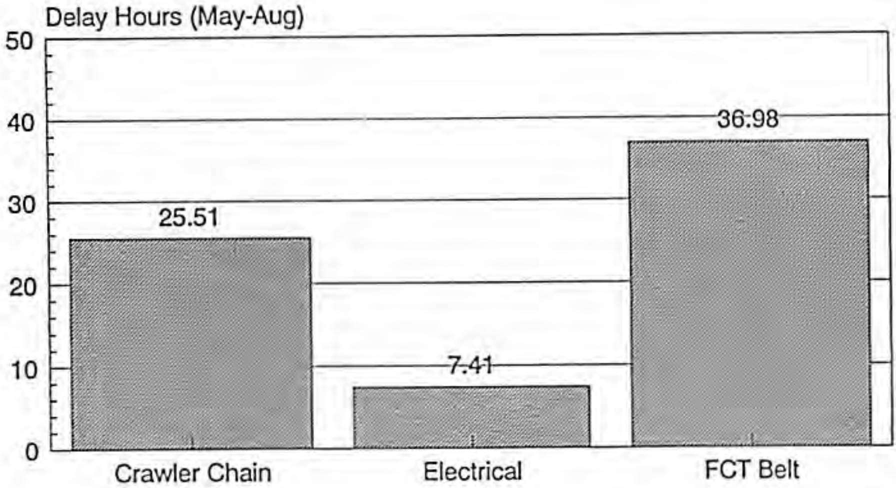


Figure 7. Major delays at FCT unit by type.

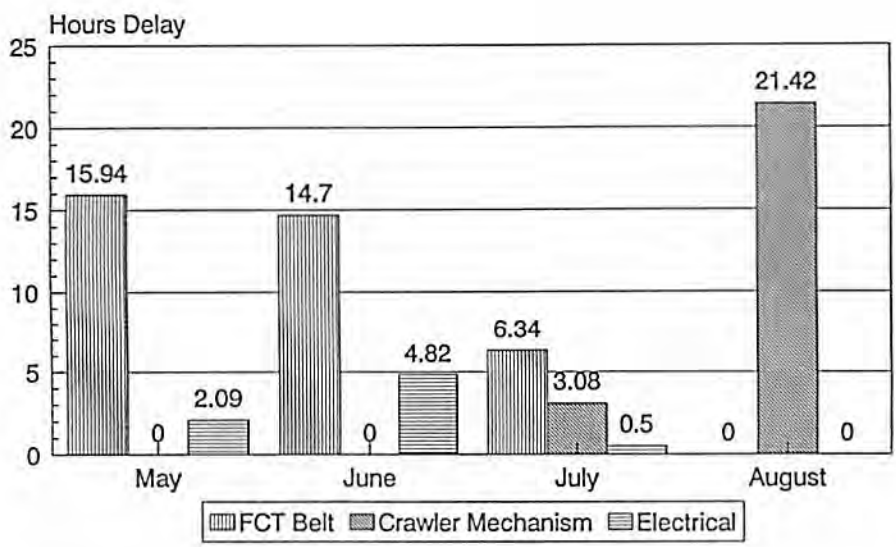


Figure 8. Major delays at FCT unit, May to August, 1994.

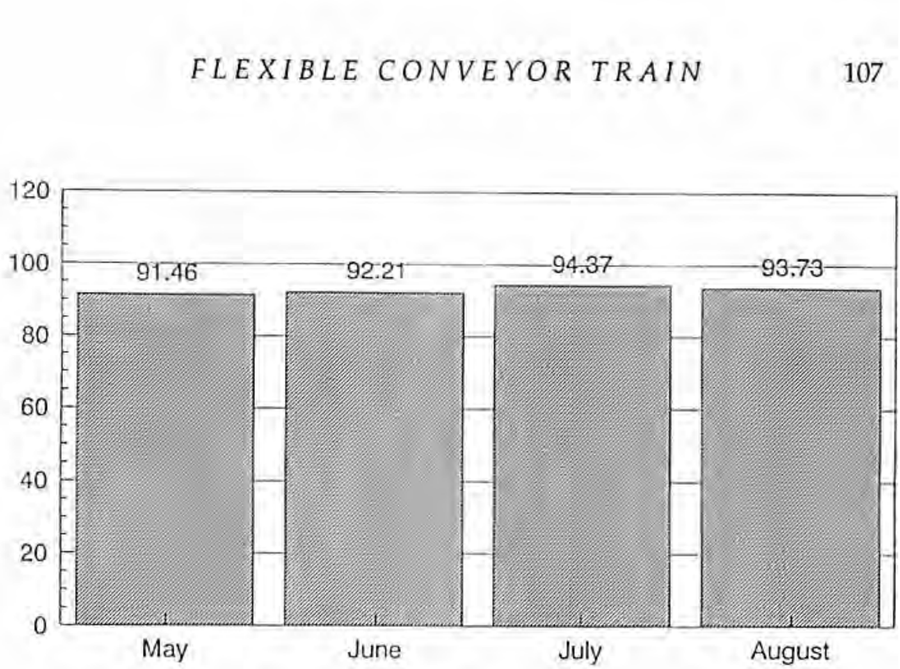


Figure 9. Percent availability of FCT unit May to August, 1994.

SUCCESSES AND DIFFICULTIES

Obviously the success that we enjoy with the machine is the increased productivity on a unit-shift basis. As was mentioned earlier, the FCT unit runs on average over 200 clean tons per unit-shift more than our other miner units. As was mentioned earlier, the FCT unit operates with two fewer persons per shift than our normal continuous miner unit (one FCT operator versus three shuttle car operators).

There are, however, a number of difficulties that we have encountered during our first six months of operation. The three areas are belt, crawler mechanism and operational.

FCT Belt

One of our biggest challenges so far has been the FCT belt. We have consistently had problems with the belt slipping on the drive rollers and coming out of the guides and occasionally turning completely over. The belt is a rubber belt with a Kevlar core. The core is about 3.5 inches wide and about one-fourth inch thick. This Kevlar core acts as a stretch limiter and gives the belt strength. Joy recommends that the belt be tensioned such that the percent of stretch is less than eight percent. They also emphasize the need to keep the drive side of the belt very clean. It is their contention that this combination of clean belt and six to eight percent stretch will minimize slipping of the belt and will also minimize the problem of the belt coming out of the guides and/or turning completely over. We still have not found the correct combination of belt cleanliness and tension that will allow the belt to run consistently. We are currently running the belt at about ten percent stretch and have reduced the slipping problem considerably. But, as Joy represents will happen in this "over-stretched" condition, we continue to have difficulty keeping the belt in the guides in a curve. The belt problems are exacerbated by the fact that we have significant difficulty keeping the inner side of the belt clean. The cleanliness problem results primarily from the belt being overloaded and the spillage falling down on the lower belt and carried back into the inby drive roller. The overloading occurs because of a "mis-match" between the FCT and 12CM12 miner. The miner is capable of loading rates of 30 tons per minute, while the FCT conveying rate is about 16 tons per minute. This condition could be cured by slowing the miner operators down. This is difficult to do because using a smaller miner defeats the purpose behind the FCT; putting enough water and scrapers on the belt to keep it clean and relatively dry, floods out the section and section belt. As you can see, there are no readily available solutions to the belt cleanliness problem. However, a new hopper that Joy has added to the Freeman FCT is said to have helped spillage considerably, and we are scheduled for that retrofit soon.

We have also encountered a number of problems with the edge of the belt ripping. As was mentioned earlier, the strength of the belt, in a traditional sense, comes from the Kevlar core, and the edges of the belt are left to stretch by design. This same design and construction can also leave the belt vulnerable to ripping when it comes out of the guides or when a roller malfunctions or comes out. There have been a number of situations in which the edges of the belt were ripped sufficiently that it had to be cut and spliced. There are currently four splices in the belt on the FCT with less than 300,000 tons having been conveyed over it.

Finally, again as a result of the design and construction of the belt, the majority of the tractive effort and resultant wear is concentrated in the region where the Kevlar core exists. This results in inordinate wear to the center of the lagging on the drive pulleys. As a result, the lagging needs to be replaced frequently, and, upon replacement, normally only exhibits wear in the center six inches of the roller.

Crawler Mechanism

The crawler mechanism has also been an area where we have had considerable difficulty. As was described in the section on general arrangement, the crawler assembly is not continuous but is in fact made up of six flights, four of which drive from both ends. During operation, the machine is often in motion–changing places, positioning itself under the miner, and so on. In addition, the crawler chain and pads are exposed to mud and water, and, by virtue of their design and application, it is not practical to build them as heavy or wear resistant as many other crawler configurations in the mining environment. It is also difficult to examine many of the components, especially the sprockets, for wear or damage. Finally, the drive mechanism is somewhat unwieldy to work on. The combination of all of the above has lead to several significant delays when the crawler mechanism failed. It is not atypical for the FCT to be down for approximately 24 hours when a drive sprocket fails. In defense of the FCT, we are currently gathering data on wear lives for the components and will begin a program of scheduled change out, which should relieve some of the unscheduled down time. However, there will continue to be a need to devote significant manpower to this maintenance on weekends.

Operational Problems

There have been a number of operational problems associated with the FCT that have either caused mining delays or necessitated the assignment of additional resources to have the unit ready to operate on a predictable basis. First among these operational difficulties has been a significant amount of time devoted to moving the belt on the unit. Peabody's experience with FCTs at the Camp mines has indicated that at a 300-foot length, the unit was relatively simple to advance. The pressure was released from the belt, the ramp and rails were pulled up and the FCT and low structure was pulled up, reconnected to the ramp, and the unit was ready to run as soon as belt structure was installed. Our experience here at Marissa has been significantly different. The continuous miner is capable of pulling the ramp and rails up with little difficulty most times, but it is not able to then pull the FCT and low structure up. We believe that the difficulty occurs as a result of our relatively soft floor. We have found that we need to rig sheave blocks on the FCT and low structure to advance them. The dilemma is that the ramp and FCT cannot be reconnected as the sheave and rope assembly cause the two to be about two feet apart when the pulling stops. The miner is then required to push the ramp and rails back far enough to be reconnected to the FCT, a process that can require over an hour to complete. This time, coupled with normal move time and the need to dedicate several people to the cables and sheaves, creates some of the question about productivity that was mentioned earlier. Joy does have a self-advancing unit available and in operation at Freeman, which we hope to visit soon. If the unit operates as advertised, it should reduce or eliminate a number of the problems we currently have with advancing the FCT.

An additional operational problem occurs with the changing of panels. As has been mentioned previously, the efficient advancing of the FCT requires the addition of a belt storage unit in the panel conveyor system. The storage unit is relatively large and complex and increases move time from one panel to the other by about four days. The obvious, but costly, solution to this problem is the acquisition of another storage unit to be set up on the next panel prior to moving. This should reduce the movement from one panel to another to a weekend job.

CONCLUSION

We have had both successes and difficulties with the Joy FCT at Marissa mine. The successes are obvious, as are the difficulties, and both will require considerable effort to maintain and cure, respectively. We are committed to seeing the FCT successful at Marissa as we believe that continuous haulage is the new paradigm in underground section haulage, and we intend to be on the leading edge of the change. Also, as a wise man once said, Joy can fix anything, if you have enough money.

Question: What kind of centers do you run on it and what's your recovery percentage?

John Hill: We don't do any second mining, so we run it a typical 50 by 60 center, and we run our centers on 60 by 60 on other sections. And typical mine recovery would be in the 50 to 55 percent range. The reject on the raw product would be about 35 percent, or 65 percent recovery.

Question: Do you have any super-sections on the other units?

John Hill: No, we don't have any super-sections. Again, I have been teasing Bill and Charlie, telling them that we are going to set up a super-section with cableless haulage to see if that FCT will really run. But we don't have any super-sections set up on the other units; it is something we are currently looking at.

Question: (inaudible)

John Hill: We are looking at those inby and outby cars by virtue of the fact that they have the single drive; they get more wear than the others. We are looking at about 400 hours on those, just to change them out. It is analogous to a conveyor chain on a miner; we are looking at them every two or three, maybe four months. On the inner segments, we are looking at 800 hours intervals, especially relative to changing out the crawler sprockets.

Question: What about belt life?

John Hill: We have about 600 total linear feet of belt, in 300 foot sections. The cost I can't comment on. Joy might be able to. We have a maintenance agreement with Joy, and I am not privy to all the costs of the particular components. We are in our second panel now, a 4,000 foot panel, and we are on our second belt.

Ronnie Marcum: John, thank you again very much. It is a very interesting topic and well presented.

Our next topic is going to be on the full pillar extraction at the Kathleen Mine at Arch, using mobile roof supports. Eric Grimm is going to present that. Eric is the General Mine Foreman at the Kathleen Mine. Eric has a B.S. in mining engineering from the University of Missouri at Rolla. He got that in 1983. He spent about five years with Old Ben Coal Co., before coming to Arch in 1989. He has held various engineering and supervisory positions at Arch. He is currently the General Manager at the Kathleen Mine. Eric.

Eric Grimm: Thank you Mr. Chairman. On behalf of Arch of Illinois' Kathleen Mine, it is a pleasure to address the Illinois Mining Institute today. This morning, I am going to talk about productivity improvements we have made at the Kathleen Mine. The addition of the mobile roof supports for full pillar extraction is just the latest in a series of improvements.

FULL PILLAR EXTRACTION AT THE KATHLEEN MINE WITH MOBILE ROOF SUPPORTS

ERIC S. GRIMM
Arch of Illinois, Inc.
Percy, Illinois

ABSTRACT

The Voest Alpine Breaker Line Supports (ABLS) resemble self-propelled longwall shields. Each individual unit consists of four hydraulic legs extending from the base of the unit, pressing a solid flat canopy against the mine roof. Each support unit is capable of exerting 606 tons of force against the roof. A chain curtain on the sides and rear protects the interior of the support from falling rock. The internal scissoring lemniscate design allows for parallel movement of the canopy as it is raised or lowered. Each ABLS has 750 feet of 4 AWG trailing cable to supply 480 volts AC to a permissible controller and a 40 hp explosion-proof electrical motor. The hydraulic pump and reservoir are self-contained and protected with an automatic fire suppression system.

INTRODUCTION

The Kathleen Mine was opened in August 1984, by Carter Coal Corporation as a contract mining operation for Arch of Illinois. The mine operated three continuous miner sections for a total of six machine-shifts per day, five days per week. Productivity averaged 815 raw tons per man-shift (RT/MS) for an annual output of 774,000 clean tons. All run-of-mine product was shipped by truck to the Captain Preparation Plant for cleaning and shipment to various long-term customers of Arch of Illinois. The Kathleen Mine was idled in June 1986, due to lower cost production being obtained from the newly acquired Denmark Mine (formerly the AMAX Leahy Mine). In August 1989, Arch of Illinois assumed management of the Kathleen Mine. Rehabilitation work was begun at this time, and production resumed in October 1989. Currently, the Kathleen Mine runs six machine-shifts per day, averaging 1,750 RT/MS for an annual output of 1.6 million clean tons.

OPERATIONS

The Kathleen Mine is located just southwest of Cutler, Illinois, in Perry County. The mine portals are an old highwall left during surface mining operations conducted by the Arch of Illinois Captain Mine. The Kathleen

Mine is staffed by 104 U.M.W.A.-represented employees and 28 salaried employees. Production is provided by three continuous miner sections dumping on 42-inch panel and mainline belts. Two sections develop and then retreat full extraction room and pillar panels; the third section develops mainline entries. The daily schedule for each section is two production shifts and one idle shift. A different unit is scheduled idle for equipment maintenance and section deadwork each shift. Two sections produce each shift for a total of six machine-shifts per day.

GEOLOGY

Mining operations are conducted in the Illinois (Herrin No. 6) Coal seam. The coal ranges in thickness from 4.4 feet to 7.3 feet, with an average thickness of six feet. The overburden at the portal is 95 feet and ranges from 85 feet to 155 feet throughout the reserve. The immediate mine roof in ascending sequence is composed of:

- Energy Shale - a soft, gray shale.
- Anna Shale - a hard, black shale.
- Brereton Limestone - a hard, dense limestone.

The Energy Shale unit is generally weak, poorly-bedded and contains numerous slip planes, with no particular orientation. The Energy Shale occurs in small lenses or pods above the coal seam ranging from zero to seven feet. Above the Energy Shale is the Anna Shale, a hard, black, well-laminated, well-jointed shale that is zero feet to six feet in thickness. This is the most wide-spread unit forming the immediate roof. Next in the sequence is the Brereton Limestone, a hard, dense, well-jointed limestone that is three feet to eight feet thick. The hard shale and limestone combination roof provides good top conditions and excellent anchorage for roof bolts.

The immediate floor is composed of a weak fireclay ranging from two feet to seven feet in thickness. The fireclay is typical of the Herrin Coal seam; when it is exposed to water for a short period of time, it loses all bearing capacity and makes mining conditions difficult. This has not been a major problem because the Kathleen Mine is a relatively dry mine.

EQUIPMENT

The graph in figure 1 illustrates that in the ten years the Kathleen Mine has been operating, productivity has more than doubled from 815 RT/MS to 1,750 RT/MS, while maintaining a constant plant yield of 65 percent. This doubling of productivity has been made possible by the dedication of the work force at the Kathleen Mine and by the commitment Arch Mineral Corporation has made to provide capital for the latest and most up-to-date mining machinery.

Originally, each section at the Kathleen Mine was equipped with one Joy 12CM-11 continuous miner, three Joy 10SC22B D.C. shuttle cars, one Lee Norris TD-243 dual boom roof bolter, one Stamler 480 volt feeder and one S & S 86 scoop. All equipment was purchased used.

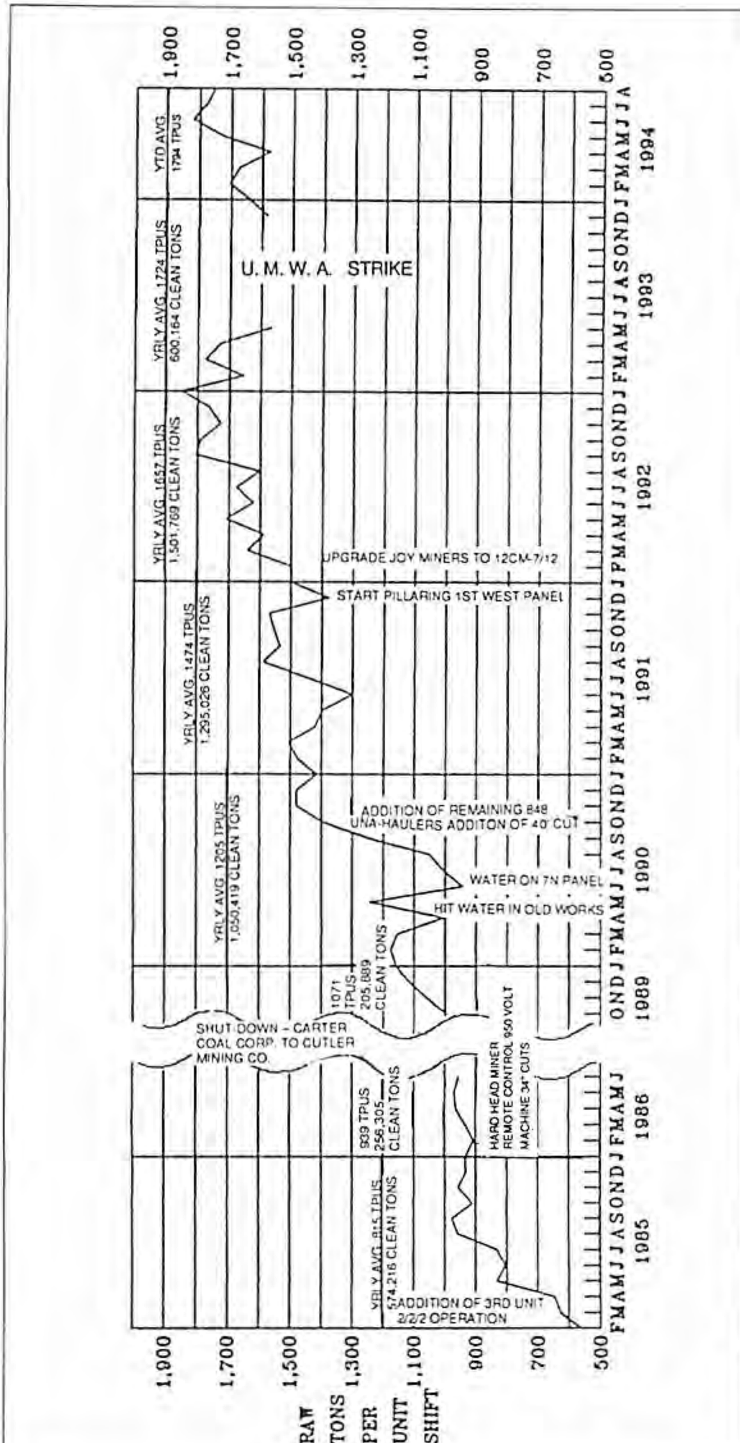


Figure 7. Kathleen Mine productivity rate since reception.

When the mine was opened by Arch of Illinois in August 1989, the 1980 vintage continuous miners were rebuilt and upgraded to 12CM-7s. The upgrade consisted of:

- Eliminating the ripper-veyor chain design for gear-driven cutters and with hard head design.
- Upgrading the electrics from 480 volts to 995 volts.
- Replacing the two 135 hp cutting motors with two 210 hp cutting motors.
- Installation of radio remote control to allow increased cut depth from 20 feet to 34 feet.

In February 1990, Kathleen Mine began replacing the Joy 10SC22B D.C. shuttle cars with Simmons-Rand 848 Un-A-Haulers. The 848 Un-A-Haulers with articulated bodies and 1,350 AMP/hr batteries offered several advantages:

- Decreased car change out time at the miner.
- Increased cut depth from 34 feet to 40 feet because of the operator end-driven configuration.
- Increased payload from seven tons to nine tons.
- Elimination of trailing cable permissibility problems.
- Off section capabilities, supply and support functions.
- Flexibility in mining planning. The current mining plan, with full pillar extraction, would not be possible using shuttle cars because of cable restrictions.

Currently, the 848 Un-A-Haulers are undergoing rebuild with the replacement of the center section and trailer. The new trailers are 18 inches longer and have a deeper profile, which has increased the capacity from nine tons to ten tons.

In October 1991, the continuous miners started undergoing their second rebuild and upgrade. The machines were converted from 12 CM-7s to 12CM-7/12s. This upgrade consisted of:

- Splitting the machine frame to widen the conveyor from 30 inches to 38 inches.
- Replacing the 70 hp single-motor gathering pan with a dual-motor gathering pan with 140 horsepower.
- The tram speed was increased from 65 to 85 FPM.
- Maintenance requirements were reduced with the addition of solid-state drive and vacuum contactors.

Currently the 12CM-7/12 continuous miners are being replaced with new Joy 12CM-12 total remote/cableless machines. The major improvements on these machines are:

- An overall machine height of 54 inches, a reduction of four inches by moving the left side controller to the operator deck and lowering the scrubber fan and duct work.

- An overall ground clearance of 12 inches, an increase of three inches.
- A crawler pad width of 22 inches, an increase of four inches to better accommodate soft bottoms.

At the same time as the second generation of continuous miner rebuilds were ongoing, the Lee Norris TD-243, 1970 vintage roof bolters were being replaced with Simmons-Rand TD-2A/43 roof bolters. These machines feature an articulated four-wheel drive design with a single 80 hp drive motor and inch tram from the right side operator bolting station.

From observation, it could be seen that the full productivity potential of the higher horsepower continuous miner, in conjunction with the cableless haulage, was being hindered at the section tail piece. The 480 volt Stamler feeder breaker with a six-ton surge hopper and a single 75 hp conveyor/chunk breaker motor was not allowing us to take full advantage of the rapid payload discharge rate of the 848 Un-A-Haulers, thus increasing cycle time. Starting in April 1993, the Kathleen Mine began replacing the 1975 vintage Stamlers with Long-Airdox feeder breakers. These machines are 995 volt electro-mechanical feeder breakers with dual 125 hp conveyor and chunk breaker motors and a 1,100 t/hr feed rate to match the 848 UN-A-Hauler discharge rate.

The addition of four Voest Alpine Breakers Line Supports in the summer of 1994 is just a further step in the commitment of Kathleen Mine to further increase productivity.

PANEL GEOMETRY

The first seven years of production at the Kathleen Mine was from limited extraction room and pillar panels. These panels were located in the eastern half of the mine reserve where subsidence rights did not exist. Planning was started in 1989 for full extraction room and pillar panels for the western portion of the reserve where valid subsidence rights were held. The First West panel started developing by super-section in April 1991. A total of 15 entries were developed on 50-foot centers, with 100-foot crosscut centers. The 18 feet wide entries produced a block size of 82 feet by 32 feet. Pillar extraction commenced in December 1991, with one continuous miner.

Two entries around the perimeter of the panel were left intact to serve as bleeder entries. This allowed for mining 10 of the 14 blocks on a pillar line. Pillaring the 4,000-foot panel was successfully completed in four months. The experience acquired during the development and retreat of the First West panel, led mine management to change successive panel development for the following reasons:

- The development of 15 entries required the use of a super-section for no appreciable increase in productivity.
- Face ventilation was difficult to maintain during development and retreat.
- The intake stopping line had to be removed and rebuilt as the panel retreated.

The revised panel configuration retained the 50 feet by 100 feet entry and crosscut centers. The first of three panels on the bleeder system is developed with nine entries driven to the boundary. Starting at the boundary, a six-entry room set is driven 300 feet off the intake side of the panel, as shown in figure 2.

Because the first panel on the bleeder system must develop its own bleeder as it retreats out, two blocks at the end of the rooms are oriented parallel with the chain blocks to form bleeder entries. Once a wrap-around bleeder is established, room and pillar extraction begins with the inby row of blocks. After extracting the room blocks, the chain blocks are extracted working from the rooms to the return stopping line. The last room block in each row is left to maintain the wrap-around bleeder. After a total of 30 pillars are extracted, a new six-entry room set is driven outby of the last set. The two room blocks left from the last room set will be extracted with this new set of room blocks. This cycle is repeated until the panel is retreated to the panel neck.

The second panel on the bleeder system is developed in the same manner as the first panel (fig. 3). The rooms are driven 300 feet off the intake side of the panel and hole into the bleeder of the adjacent panel. The rooms now have an additional row of blocks because a bleeder has already been established. The bleeder blocks from the adjacent panel are now extracted.

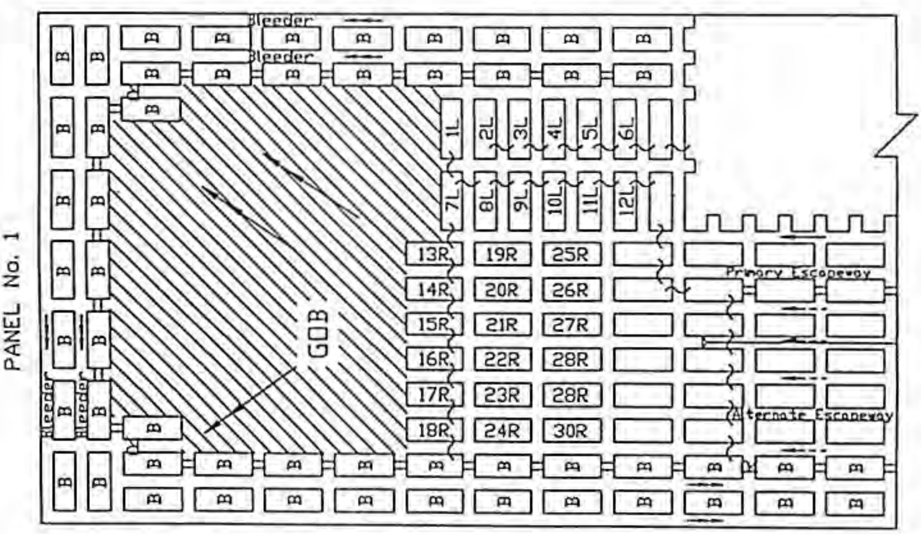


Figure 2. First panel on bleeder system.

A total of 42 pillars is extracted per room cycle in the second panel. The development and retreat of the third panel on the bleeder system is identical to the second (fig. 4). A typical three-panel system recovers 1.5 to 2 million raw tons of coal, of which approximately 36 percent is from full pillar extraction.

PILLAR EXTRACTION

Prior to the introduction of the Voest Alpine Breaker Line Supports (ABLS), the roof control plans required that two rows of four breaker posts and one row of three turn posts (11 props total) be set prior to the start of mining the first lift in the pillar, as shown in figure 5. The eight breaker posts are used to establish the break line of the roof, while the three turn posts are used to protect the continuous miner as it makes the lift and fender into the pillar. After completing the first lift and fender cut sequence, the continuous miner is backed out of the pillar and all but one of the 11 props are recovered, if possible. One prop is left standing as a means by which to gauge roof movement while making the next outby lift. Prop recovery is accomplished by using pull ropes tied around each prop at the time of installation.

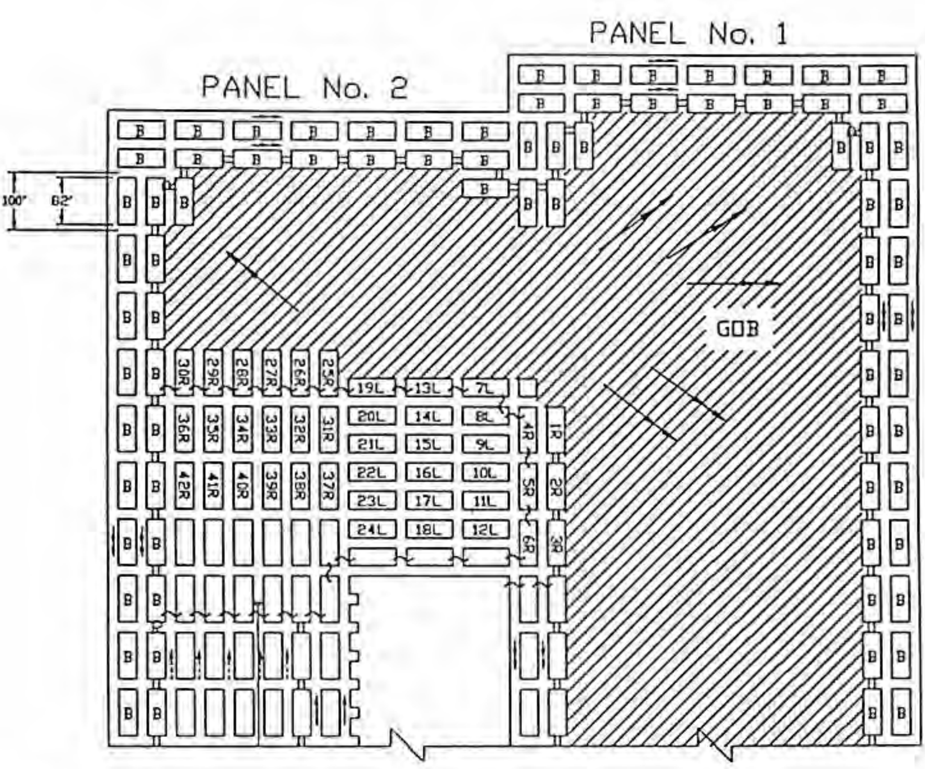


Figure 3. Second panel on bleeder system.

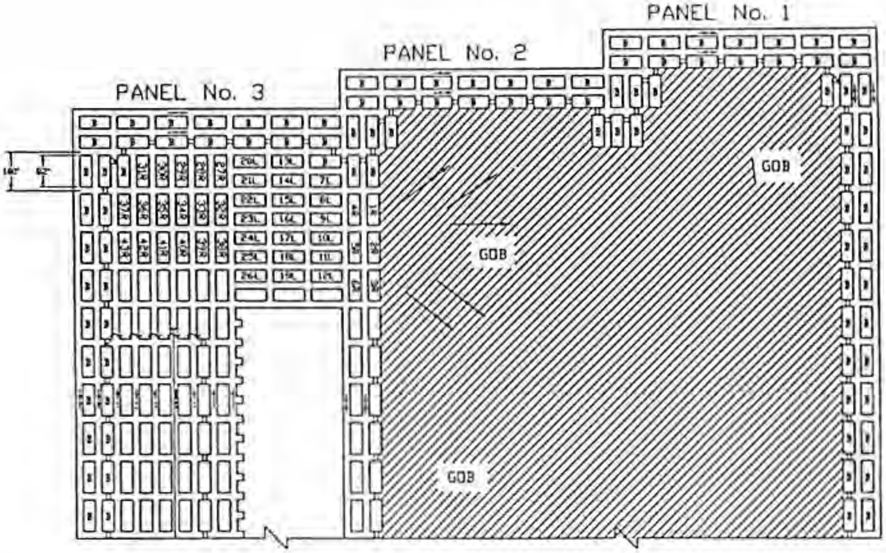


Figure 4. Third panel on bleeder system.

INSE

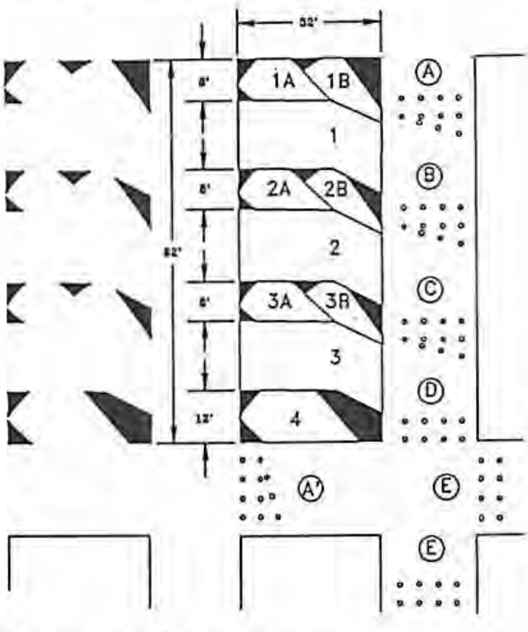


Figure 5. Full pillar extraction with wooden props.

Once these props have been recovered, a new breaker post line and turn post line is established, approximately 25 feet outby of the previous location prior to starting the second lift and fender sequence. An average of six minutes production time is lost each time the breaker prop line and turn prop line is recovered and re-established when the entry height remains constant. If the entry height changes from one lift to the next lift because of top conditions, this time will be longer. The continuous miner must be backed all the way out of the pillar block to clear the intersection to allow the section scoop access to the prop line. The short props will be exchanged for longer props, or props that are too long will be cut to fit. During the extraction of one pillar, the prop line must be recovered and re-established three times, resulting in 18 minutes to 30 minutes of lost production time per pillar.

The constant setting, recovering and resetting of the timber prop lines is extremely labor intensive. All props must be handled and set by hand; this increases the likelihood of back strain or injuries to the personnel handling the props.

To reduce production delays and the likelihood of material handling injuries, the Kathleen Mine management decided to purchase some form of mechanized mobile roof supports. Studies revealed that the production delays due to re-establishing roof support could be cut in half. The mechanization of the roof support would greatly reduce the material handling requirements at the active gob line. Mechanized roof supports with a large canopy area would provide for greater support and control of the immediate roof than passive timber props. Enhanced roof support would increase the safety for operating personnel and better protect capital equipment. In May 1994, the Kathleen Mine purchased four Voest Alpine Breaker Line Supports model 140/320-540.

MACHINE SPECIFICATIONS

The ABLS units resemble self-propelled longwall shields. Figure 6 shows the basic ABLS components. Each individual unit consists of four triple-stage hydraulic cylinders (props) extending from the base of the unit to a solid-rigid canopy. The independent operation of the front and rear props controls the forward and aft tilt of the rigid canopy. The ABLS unit is designed to accommodate a lateral canopy tilt of 6.5 degrees from center. This allows for setting the props perpendicular to the roof even with undulated floor. The internal scissoring lemniscate connects the canopy to the base of the unit via a swivel cylinder and mount. The aligning cylinder between the lemniscate and the swivel frame acts as a shock absorber in the event of rapid loading. The four hydraulic cylinders have check valves and are protected against overloads by rapid-pressure relief valves. The rated load for each support unit is 606 tons with a yield setting load of 476 tons.

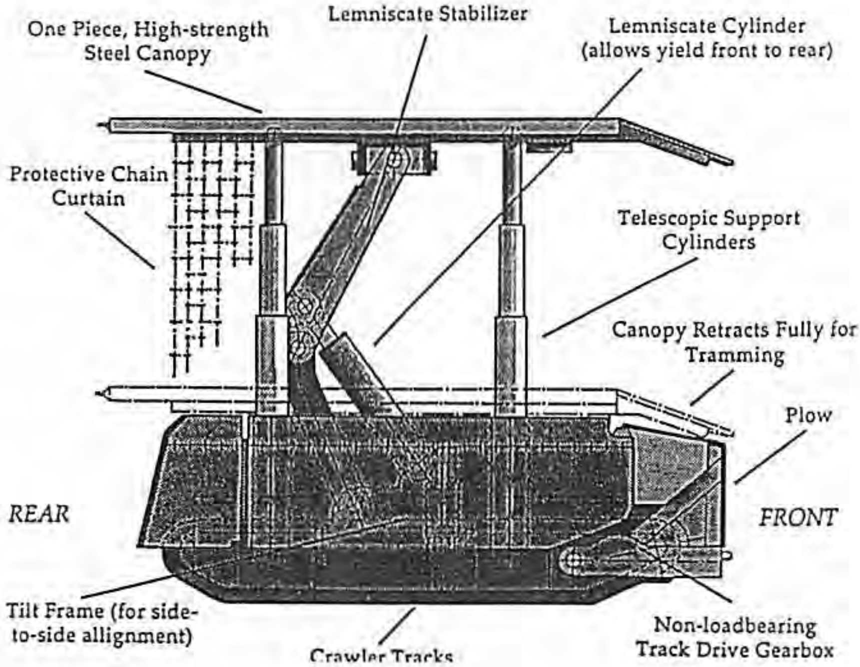


Figure 6. Alpine Breaker Line Supports (ABLS).

Each ABLS unit has 750 feet of 4 AWG trailing cable to supply 480 volts AC to a permissible controller and a 40 hp XP electrical motor. The hydraulic pump and reservoir are self-contained and protected with an automatic dry chemical fire suppression system. A chain curtain on the sides and rear protects the interior of the unit from falling rock. A clearing plough on the front of the ABLS prevents the buildup of gob beneath the crawler tracks during tramming. Each crawler track is driven by a hydraulic motor via a bevel gear, planetary drive and chain sprocket. Tram speed is 40 feet per minute in both directions.

Three separate modes of control are available on the ABLS units; radio remote control is used during full pillar extraction for pendant control for tramming the unit over larger distances, and manual operation off the valve bank levers is used for maintenance and emergency purposes. The pendant control will only exercise the tram functions; all other functions must be controlled remotely with the radio, or manually at the valve bank. Each unit operates on its own distinct radio frequency.

The operating range of the ABLS unit is 51 inches collapsed and 126 inches at full extension. The overall length with the clearing plough is 13 feet and 7-1/2 inches; the width is 6 feet and 7 inches. Each unit weights 22 tons and exerts a maximum floor pressure of 14.2 psi when tramming and 412 psi when set at yield load.

PILLAR EXTRACTION WITH ABLS

The timber prop line used on the long axis of the pillar for lift and fender sequence 1, 2 and 3, have been replaced with a pair of ABLS units, as shown in figure 7. The use of the ABLS units has not completely replaced the need for timber as all entrances to the gob must be propped off. The timber prop line along the short axis of the pillar is still used for the No. 4 lift. This set of timbers was previously set to block the entrance to the gob; three turn props are added prior to the start of lift No. 4.

For lift and fender sequence No. 1, the lift (gob) side unit is set up against the breaker prop line. The solid side unit is offset 18 to 24 inches to close the distance to the continuous miner. The breaker prop line is not recovered prior to setting the ABLS units. This would slow production and expose face personnel to an unnecessary risk. The power cables for each unit are hung down the length of the solid rip to prevent them from being damaged. When setting the units, the front props are set first. If any roof breaks, it will slide back towards the gob. While turning the continuous miner into the pillar lift, it is necessary to limit the buildup of coal in front of the ABLS units. The supports will move easier and are less likely to belly out when advanced. The canopy does not have to be lowered as far from the roof in order to move. If necessary, the unit can be quickly reset if the roof starts to break. The ABLS units must be advanced quickly after each lift is completed so the roof has little time to deteriorate. If the gob is tight behind the ABLS units, then the rear of the canopy must be lower than the front before

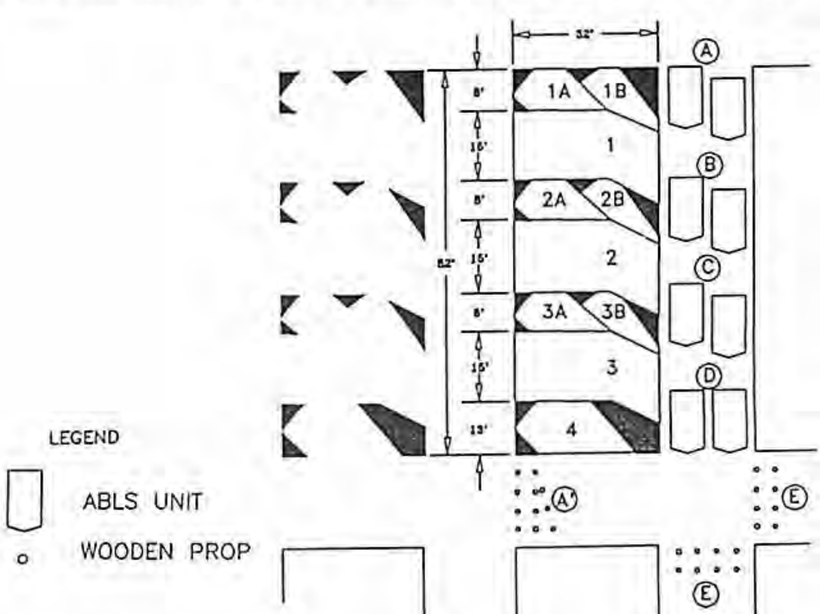
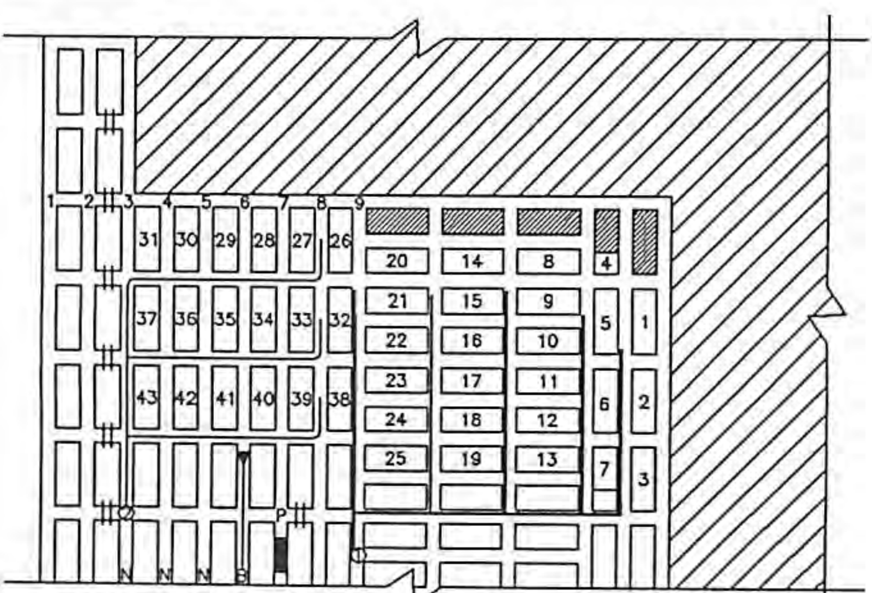


Figure 7. Full pillar extraction with Alpine Breaker Line Supports.

attempting to tram forward. The gob side support is advanced first, then the solid side support. Each support is moved six feet at a time before resetting and moving the other support. This allows one unit to support the top while protecting the other unit as it moves.

The pillar extraction sequence for a section, starting in the bleeder blocks, moving to room blocks and then chain blocks, has not changed with the use of the ABLS units.

Efficient move time between room pillars and chain pillars with the ABLS units is dependent upon proper cable routing. Two separate sets of power cables and distribution boxes are required to sequence the ABLS units from bleeder and room blocks through the chain blocks, as shown in figure 8. When extracting the bleeder and room blocks, the ABLS units are powered from the distribution box on the right side of the section, just outby the rooms. The retreat direction in these blocks is left to right. After extracting the last room block (No. 25 block), the ABLS units must be trammed 500 feet to the chain blocks. Chain blocks are extracted from right to left. This requires the ABLS units to be powered off a distribution box on the left side of the section against the return stopping line. To decrease the time required for the move from room blocks to chain blocks, the second set of power cables and distribution boxes are already in place. Once the supports are trammed into place at block No. 26, the power cables are switched. The set of cables from the right side distribution box are pulled back, rolled and stored for later use.



①Distribution box location for bleeder blocks and room blocks.
②Second distribution box location for chain blocks.

Figure 8. Distribution boxes and cable routes for Alpine Breaker Line Supports.

CONCLUSION

To date, we have only retreated the last one-third of a panel with the mobile roof supports. The area in which we operated was some of the worst top conditions we had encountered to date; this area had numerous slips, horse backs and changing entry height. During this learning period, we were able to average 1,750 RT/MS. The breaker line supports enabled the Kathleen Mine to maintain a level of productivity and safety that would not have been possible with timber props alone.

ACKNOWLEDGEMENT

I'd like to acknowledge the help that Brad Rigsby at the Kathleen Mine has given me in putting together this presentation. I appreciate his help.

Question: Can you describe your panel belt configuration?

Eric Grimm: The belt tail sits in the No. 6 entry just outby the No. 4 room. The section power center sits in the No. 7 entry 100 feet outby the belt tail off the No. 6 room. This allows the feeder and section power center to remain 150 feet from the gob line after pulling the room pillars. Sometime during the extraction of the last row of room pillars, the belt is retreated 300 feet. After the first row of chain pillars is extracted, the section power center is pulled back 300 feet. The belt and power are now set to finish the chain pillars and start development of the next set of rooms.

Ronnie Marcum: Thank you, Eric. Again, a very well presented paper. In fact, all these papers this morning were just outstanding. I think we had a great program this year.

I think we have a raffle now.

Heinz Damberger: Yes, we will be raffling off our tickets. There are two airline tickets to anywhere in the continental U. S. You can still buy raffle tickets. There is also a set of golf clubs, donated by Jim Justice of Du Quoin Iron & Supply, that we will raffle off.

Ronnie Marcum: On behalf of President Shanks and all of the officers of the Executive Board, we are officially adjourned.

ILLINOIS MINING INSTITUTE
ACTIVE MEMBERS

AARON, STEVE, Supv. of Environ. Services, Arch of Illinois, Inc., P.O. Box 308, Percy, IL 62272 618/497-2141

ACTON, WILLIAM A., Sr. Project Engr., Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

ADAMS, R. W.(DICK), Sales Rep., Birmington Bolt Co., 809 Skyline Dr., Marion, IL 62918 618/993-2611

AHRENS, WILLIS, Sales, Joy Technologies, Inc., Box 1269, Mt. Vernon, IL 62864 618/532-2396

ALDRIDGE, WILLIAM P., Reg. Mgr., Payhauler Corp., 1333 Kirk Rd., Batavia, IL 60510

ALEXANDER, RON, District Mgr., Berry Bearing Co., 1250 N. Michigan Ave., Danville, IL 61832-3560

AMICK, MICHAEL R., Bus. Develop. Mgr., Fosroc, Inc. - Celtite Mining & Tunneling Div., 150 Carley Court, Georgetown, KY 40324 502/863-6800

ANDERSON, A. DALE, Dir. Res. Acquistion & Dev., A.D. Anderson & Assoc., Box 2488, Mt. Vernon, IL 62864 618/242-7155

ANDERSON, DAVID, Reg. Mgr., MSA, 1000 Nicholas Blvd., Elk Grove Village, IL 60007 708/439-7474

ANDERSON, LYNN, General Mgr., Mining Div., Schroeder Brothers Corp., P.O. Box 72, Nichol Ave., McKees Rocks, PA 15136 412/771-4810

ANDOS, NICK, Pres., Centrifugal & Mechanical Industries, 200 President St., St. Louis, MO 63118 314/776-2848

ANTONINI, ROY, Retired, Peabody Coal Co. (Ret.), Box 91, Dowell, IL 62927 618/568-1537

ARMOUR, CPA, MICHAEL K., Consultant, 1414 S. Fifth St., Springfield, IL 62703

ARNESON, N. ARNE, Pres., Arneson Timber Co., 1600 S. Warson Rd., St. Louis, MO 63124 314/961-1999

ARNETT, GREG, Mgr., Engr., Freeman United Coal Mining Co., P.O. Box 570, Canton, IL 61520 309/647-0855

ARROWSMITH, DON, 5060 Robin Hood Dr., Ashland, KY 41101-6838

ARTHUR, ANDY, Sales Engr., Scott MTS, P.O. Box 1416, Rolla, MO 65401 314/364-4008

ASHBY, W. CLARK, Prof., Southern IL University, Dept. of Botany, Carbondale, IL 62901 618/536-2331

ATTERBERRY, JIM, Gen. Mgr., Woodruff Supply Co., Inc., P.O. Box 626, Benton, IL 62812

AUSTIN, THOMAS J., Safety Dir., Freeman United Coal Mining Co., PO Box 100, West Frankfort, IL 62896 618/932-2164

BACH, KENNETH J., Sales, Mine Safety Appliances Co., 1000 Nicholas Blvd., Elk Grove Village, IL 60010 7608/439-7474

BACKS, GLENN, Maint. Supt., Monterey Coal Co., P.O. Box 94, Albers , IL 62215 618/248-5121,x253

BADE, HAROLD, Pres., A.S.P. Enterprises, Inc., 1546 Fenpark Dr., Fenton, MO 63026 314/343-4357

* Honorary Member for Life

\+ Life Member

BAHR, E. WAYNE, Mgr. Coal Research & Dev., IL DENR, 325 W. Adams St., Springfield, IL 62704 217/782-9741

BAINE, TOM, Shop Supt., Lebco, Inc., P.O. Box 656, Benton, IL 62812 618/439-6345

BAKER, DAVE, Mktg. Mgr., Fairmont Supply Co., P.O. Box 952, Fairmont, WV 26555-0952

BALLARD, D. MARK, Pres., The National Museum of Coal Mining
Freeman Unied Coal Mining Co., 1204 Anderson Dr., Marion, IL 62959

BARBER, PAUL B., Mgr. of Preparation, Arch of Illinois, Inc., R.R. 1, Percy, IL 62272 618/497-2141

BARBOUR, DEWAYNE D., Branch Mgr., National Mine Service Co., P.O. Box 1766, Mt. Vernon, IL 62864 618/244-6066

BARKER, KENNETH E., Maint. Foreman, Wabash Mine, Cyprus AMAX Coal Co., P.O. Box 144, Keensburg, IL 62852 618/298-2394

BARKLEY, DANIEL W., Engr., IL Dept. of Mines & Minerals, P.O. Box 10197, Springfield, IL 62791-0197 217/782-4970

BAUER, FRED, Mgr. Capital Acquisition, Americoal Development Co., 50 Jerome Lane, Fairview Hts., IL 62208 618/394-2400

BAUER, MARY, Secretary, IL Dept. of Mines & Minerals, 503 E. Main, Benton, IL 62812

BAUER, ROBERT A. (BOB), Head, Earth Hazards/Engr. Geol. Section, IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/244-2394

BEAL, LARRY, Sales Supv., Century Lubricants, P. O. Box 161, Marion, IL 62959 618/997-2302

BEAVEN, BRUCE, Supt., Ohio #11 Mine, Island Creek Coal Co., 1741 Hilltop Road, Morganfield, KY 42437 502/389-1071

BEAVER, GARY, Pres., Lebco, Inc., PO Box 656, Benton, IL 62812 618/439-6345

BECK, ROBERT E., Prof. of Law, Southern IL University, Law School, Carbondale, IL 62901 618/453-8753

BEERKIRCHER, MARK, Project Engr., Monterey Coal Co., RR4, Box 235, Carlinville, IL 62626 217/854-3291

BELL, JERRY, Sales Rep., Flanders Electric of Illinois, 1000 N. Court St., Marion, IL 62959 618/993-2681

★ BELL, LANNY, (Retired), Roberts & Schaefer Co. (Retired), 5712 Brookbank, Downers Grove, IL 60516 312/968-6433

★ BENNETT, JOHN C., (Retired), Peabody Coal Co. , 301 Greenhaven Dr., Belleville, IL 62221

BENNETT, PHILLIP E., Vice Pres. Sales & Marketing, Lakeshore Mining Equip. Co., RR4, Industrial Park Rd., Benton, IL 62812 618/435-4422

BENSON, JOHN H., Pres., John Benson Electric Co., 1708 N. 8th St., St. Louis, MO 63102 314/421-1200

BERNHARDT, HORST, Sales Mgr., Westfalia Mining Progress, Inc., 255 Berry road, Washington, PA 15301-2773 412/225-4049

BERRI, JR., ROBERT, RPG, Berri Exploration Services, P.O. Box 19871, St. Louis, MO 63144-0271 314/962-5270

BERT, CAROLYN K., Exec. Sec., Women in Mining, P.O. Box 308, Percy, IL 62272 618/497-2141

BERTELSMAN, DAN, Sales Rep., Midco Equipment Co., 11475 Page Svc. Dr., St. Louis, IL 63146 314/872-8440

BETZ, FRED, Vice Pres., Baker-Bohnert/Service Group, P.O. Box 169003, Louisville, KY 40256-9003 502/634-3661

BEVERIDGE, T. SCOTT, Dir., Materials Mgmt., Arch Mineral Corp., P.O. Box 250, Carterville, IL 62918 618/985-8316

BHAGWAT, SUBHASH B., Head, Mineral Econ. Sect., IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/244-

BIEREI, GREGG, Mgr. of Engr. & Environ. Affairs, Arch of Illinois, Inc., P.O. Box 308, Percy, IL 62272 618/497-2141

BISHOFF, STEVEN M., Mgr. Environ. Engr., Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

BISHOP, DANNY, District Rep., The Crosby Group, Inc., P.O. Box 3128, Tulsa, OK 74101-3128

BISHOP, MARY, State Mine Inspect., IL Dept. of Mines & Minerals, 503 E. Main St., Benton, IL 62812

BIVER, SANDY, Purchasing Assoc., Americoal Development Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2400

BLACK, TOM, Dir. of Hardfacing, Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, OH 44117

BLACKBURN, W. DOUG, Pres., Old Ben Coal Co., 500 N. Du Quoin , Benton, IL 62812 618/435-8176

BLAIS, RUSSELL A., Vice Pres., Marketing, Naylor Pipe Co., 1230 E. 92nd St., Chicago, IL 60619 312/721-9400

BLAKLEY, DON, Land Reclama. Spec. II, IL Dept. of Mines & Minerals, Coal Development Park #2, Carterville, IL 62901 618/985-6525

BLOSS, DONALD J. (DON), Sales Mgr., Midco Sales & Service, 11475 Page Service Dr., St. Louis, MO 63146 314/872-8440

BLUMENFELD, ANDY, Dir., Research, Arch Coal Sales, City Place One, St. Louis, MO 63130 314/994-2848

BOHANNON, JERRY, Erosion Prod. Specialist, American Excelsior Co., 2329 Chaffee, St. Louis, MO 63146 314/993-5540

BORDER, WILL, Sales Engr., Joy Technologies, Inc., #4 Industrial Park, Mt. Vernon, IL 62864 618/244-7678

BOREN, STEVE, Acct. Cons., Kiefer Electrical Supply Co., RR3, Rend City Rd., Benton, IL 62812 618/724-2515

★ BOTTOMLEY, J. A.,

\+ BOWMAN, F. T., Pres., Bowdil Co., Box 20470, Canton, OH 44701-0470

BOWMAN, FRED K., Director, IL Dept. of Mines & Minerals, 300 W. Jefferson, P.O. Box 10137, Springfield, IL 62791-0137 217/782-0031

BOZELL, RONALD R., Dist.t Mgr., Illinois Bearing Co., 811 Larry Power Rd., Bourbonnais, IL 60914-1319

BRADY, JAMES, Costain Coal Co., Box 289, Sturgis, KY 42459

BRANDLEIN, THOMAS F., Sales, Roberts & Schaefer Co., 120 S. Riverside Plaza, Chicago, IL 60606 312/236-7292

BRANDT, JOHN A., Pres., Lafayette Coal Co., 200 Frontage Rd, #200, Burr Ridge, IL 60521 708/986-1456

BRANSON, RICHARD R., Sales Mgr., Reaco Battery Service Corp., Rt. 1, Box 48, Johnston City, IL 62951 618/983-5441

BRATCHER, HAROLD, Driver Sales, Joy Technologies, Inc., RR#1, Box 281, Texico, IL 62889 618/266-7866

BRAXMEIER SR., THOMAS A., Secy./Treas., Gunther-Nash Mining Construction Co., 2150 Keinlen Ave., St. Louis, MO 63121 314/261-4111

BRAXMEIER, JR., THOMAS, Project Engr., Gunther-Nash Mining Const. Co., 2150 Kienlen Ave., St. Louis, MO 63121 314-261-4111

BREEDLOVE, JOHN, Vice Pres., Heintzmann Corp., P.O. Box 301, Cedar Bluff, VA 24609 703/964-7413

BRENDEL, JAMES B., Dir. of Engr., Gunther-Nash Mining Construction Co., 2150 Kienlen Ave., St. Louis, MO 63121 314/261-4111

BRETZ, MARK, Vice Pres./Group Superv., Aaron D. Cushman & Assoc., Inc., 7777 Bonhomme Ave., , Clayton, MO 63105 314/725-6400

BRINKMANN, DEBORAH, , T. J. Gundlach Machine Co., #1 Freedom Dr., Belleville, IL 62222 618/233-7208

BRITTON, RANDY, Sales Rep., National Mine Service Co., P.O. Box 1766, Mt. Vernon, IL 62864 618/244-6066

BROCKHAUS, DOUGLAS A., Environ. Engr., Monterey Coal Co., 6 Greenridge Dr., Carlinville, IL 62626 217/854-9038

★ BROECKER, CLETUS A., Consultant, 1790 E. 54th St. #102, Indianapolis, IN 46220-3454

BROWN, GORDON, Pres., Hillsboro Coal Co., Box 280, 925 S. Main St., Hillsboro, IL 62049 217/532-3969

BROWN, JIM, Mine Engr., White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

BROWN, JOHN , Sales Engr., Scandura, Inc., 12101 Mastin, Overland Park, KS 66213 913/681-80667

BROWN, RANDY D., Customer Service Ctr., Mgr., Fairmont Supply Co., 1525 Herbert Street, Mt. Vernon, IL 62864 618/244-5344

BRUCE, BRENDA, Eagle Seal Mine Sealant, P.O. Box 283, McLeansboro, IL 62859 618/643-2588

BRUCE, GARY, Pres., Eagle Seal Mine Sealant, P.O. Box 283, McLeansboro, IL 62859 618/643-2588

BRUCE, JOHN, Sales Rep, CSE Corporation, 7722 Melody Lane, Newburgh, IN 47630

BUCK, JAMES W., Mgr. Engr. Services, Cyprus AMAX Coal Co., 20 NW First St., Evansville, IN 47708 812/421-3900

BURKE, JAMES E., Pres., Wescott Steel, Inc., 425 Andrews Rd., Trevose, PA 19047 215/364-3636

BURKE, KIM A., Vice Pres., Engr. , Anker Energy Corp., 2708 Cranberry Sq., Morgantown, WV 26505 304/296-1616

BURKETT, KEN, Outside Sales, The Mine Supply Co., 1703 Shawnee St., Mt. Vernon, IL 62864 618/242-2087

BURRIS, MARK, Sales Rep, Rudd Equipment Co., P.O. Box 3935, Evansville, IN 47737 812/867-6661

BURROWS, BILL, Vice Pres., Longwall Prods., Long-Airdox Co., 455 Racetrack Road, Washington, PA 15301 412/223-8420

BURTON, ANTHONY, Midwest Reg. Mgr., American Longwall, Inc., P.O. Box 102, Whittington, IL 62897 618/629-2402

BUSSLER, JAY M., Sr. Buyer, Freeman United Coal Mining Co., R.R. 1, Box 127, West Frankfort, IL 62896 618/932-2164

BUTTRUM, ROBERT, Sales & Service Rep., The Mine Supply Co., 1703 Shawnee St., Mt. Vernon, IL 62864 618/242-2087

BYRD, BRENT, Engr. Systems Mgr., M&S Fire & Safety, P.O. Box 4348, Evansville, IN 47724 812/424-3863

BYROM, ROY, Pres., Coal Industry Consultants, Inc., P.O. Box 4345, Wheaton, IL 60189-4345 708/858-8673

CADY, PHIL, Sales, Ford Steel Co., P.O. Box 54, Maryland Heights, MO 63043 314/567-4680

CALDWELL, CARL, Reg. Sales Mgr., McJunkin Corp., 835 Hillcrest Dr., Charleston, WV 25322

CALDWELL, MIKE, VP Engr. & Oper. Planning, Freeman United Coal Mining Co., Box 100, West Frankfort, IL 62896 618/932-2164

CAMPBELL, BILL, Mine Admin. Mgr. Wabash, Cyprus AMAX Coal Co., P.O. Box 144, Keensburg, IL 62852 618/298-2394

CAMPBELL, BILL G., Pres., Stonebridge Press Ltd., 7620 W.H. Negley Rd., Henderson, KY 42420 502/826-0341

CAMPBELL, JOHN A. L., Consultant, Consultant, 11816 Bevenshire Rd, Oklahoma City, OK 63162 405/270-3733

CAMPBELL, PAT, State Mine Inspector, IL Dept. of Mines & Minerals, RR 2, Box 412, Pinckneyville, IL 62274

CAPPER, H. PAUL, Vice Pres., General Steel Contractors, P.O. Box 1078, Hopkinsville, KY 42241 502/886-8857

CARE, DAVID L., Supv. of EE Dept., Freeman United Coal Mining Co., P.O. Box 100, Route 37N, West Frankfort, IL 62896 618/932-2164

CAREY, JOHN, Vice Pres., Alminco, Inc., 1411 Delaware Ave., Lexington, KY 40505 606-231-7022

CARPENTER, TODD, Dist. Sales Mgr., WIKA Instrument Corp., 522 W. Belden Ave., Chicago, IL 60614 312/327-5208

CARR, BILL, Acct. Consultant, Kiefer Electrical Supply Co., R.R. 3, Benton, IL 62812 618/724-2415

CARR, ROBERT J., Sales Engr., Industrial Process Equipment Co., 2800 Locust St., St. Louis, MO 63103 314/534-3100

CARRIL, LARRY, Gen. Sales Mgr., Cummins Gateway, Inc., 7210 Hall St., St. Louis, MO 63147 314/389-5400

CARSON, GUY, V.P. Operations/Sales, CSE Corporation, 600 Seco Rd., Monroeville, PA 15146

CARTER, LEE, Prof. Engr., Professional Engr., 622 Belson Ct., Kirkwood, MO 63122 314/831-4091

CARTER, PAULA, Accts. Payable Clerk, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2462

CARVER, ROBERT, Sales Eng., Carpco, Inc., 4120 Haines Str., Jacksonville, FL 32206 904/353-3681

CASON, MICHAEL J., Reg. Sales Mgr., Kanaflex Corp. of IL, 800 Woodlands Parkway, Vernon Hills, IL 60061

CASTLE, BRIAN R., Gen.l Mgr., Scott M. T. S., Inc., 16720 STATE RT. O, Rolla, MO 65401

CAUTHEN, WILEY M., V. Pres.,Government Aff., Florida Gas Transm. Co., P.O. Box 945100, Maitland, FL 32794-5100 407/875-5800

CAVINDER, MARK, Mgr. of Mines, Old Ben Coal Co., 500 N. Du Quoin, Benton, IL 62812 618/435-8176

CHADY, DARYL, 201 W. Park St., Benton, IL 62812

CHADY, JAMES D., (Retired), Old Ben Coal Co. (Retired), 201 W. Park St., Benton, IL 62812-1932 618/435-5971

CHALLANS, DAN, Asst. Dir., IL Dept. of Mines & Minerals, 300 Jefferson St. Suite 300, Springfield, IL 62704 217/524-4622

CHAMBERS, MARK, Mgr. Corp. Purchasing, Peabody Coal Holding Co., 301 N. Memorial Dr., St. Louis, MO 63141

CHARD, STEVEN (STEVE), Bureau Chief, IL Dept. of Agric., Div. of Nat. Res., State Fairgrnds P.O. Box 19281, Springfield, IL 62794-9281 217/782-6297

CHASE, DAVID H., Vice Pres., Chase Pump Equipment Co., Inc., P.O. Box 812, 603 S. Main St., Henderson, KY 42420 502/826-8713

CHERNUTA, F. DAVID, Sr. Mining Engr., Marston & Marston, Inc., 13515 Barrett Pkwy, St. Louis, MO 63021 314-984-8800

CHILDERS, CURT, Benetech, Inc., 1750 Eastwood Dr., Aurora, IL 60506 708/844-1300

CHISM, KAY, Payroll Clerk, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208-2015

CHISMAR, BEVERLY, Buyer, Freeman United Coal Mining Co., P.O. Box 615, West Frankfort, IL 62896

CHOU, CHEN-LIN, Geologist, IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/244

CHRISTOPHERSEN, JOHN, Pres., Jacon Equipment Co., P.O. Box 9650, Fort Wayne, IN 46809 219/625-3311

CIMA, GREG, Pres., Cima Electrical & Mine Services, Rt. 2, Box 320, Benton, IL 62812-9588 618/439/7211

CLAPACS, J., Sales Rep., Shelby Spray System, 416 W. 3rd Ave., Central City, KY 42330 502/754-3454

CLARK, BRUCE, Vice Pres., Lake Shore Mining Equip. Corp., 500 S. Stephenson AVe. Suite 301, Iron Mounton, MI 49801 906/779-5822

CLARK, CARSON, Sales Rep., McJunkin Corp., 4505 Gilbertsville Hwy., Calvert City, KY 42029 502/395-7171

CLARK, RODNEY, Sales, McJunkin Corp., 4050 Gilbertsville Hwy., Calvert City, KY 42029

CLARK, TERRY, Chairman, Mining & (Retired)Indust., Rend Lake College, R.R. 1, Ina, IL 62846

CLARKE, ROBERT P., Off. Mgr., Rust Environment & Infrastructure, 555 N. New Ballas Rd., St. Louis, MO 63141 314/447-4984

CLAYTON, DANNY, Reclamation Mgr., Sahara Enterprises, Inc., P.O. Box 330, Harrisburg, IL 62946 618/252-8321

CLEGG, KENNETH E., Coal Geologist (Retired), IL State Geological Survey, P.O. Box 112, Urbana, IL 61801 217/367-3653

CLIFFORD, JAMES, Vice Pres., Roberts & Schaefer Co., 120 South Riverside Plaza, Chicago, IL 60606 312/236-7292

CLINARD, MIKE, Dist. Sales Rep., Broderick & Bascom Rope Co., Rt. 3 Oak Grove Indus. Park, Sedalia, MO 65301

CLINE, LYLE, Mining Engr., SIU Dept. Mining Engr., 1605 Estate Lane, Marion, IL 62959-1578

CLINTON, JEFF , Sales Mgr., Diesel Mining Equip., Div. of Wallace Auto, 5605 Hwy 34 N, Raleigh, IL 62977 618/244-6066

COLLINS, DON, (Retired), 9020 Stonebridge Dr., St. Louis, MO 63117 314/994-7044

CONAUGHTY, MARTIN, Sales Rep., National Mine Service Co., P.O. Box 1766, Mt. Vernon, IL 62864 618/244-6066

★ CONERTY, BETTY, Admin. Asst. (Retired), IMI, RR, 3, Box 128B, Urbana, IL 61801 217/328-1702

CONNER, ERIC, Engr. Asst., Old Ben Coal Co., 500 N. Du Quoin, Benton, IL 62812 618/435-8176

CONNER, RICK, Surveyor's Helper, Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

COOK, LEON, Mgr., Sesser Concrete Products Co., P.O. Box 100, Sesser, IL 62884 618/625-6323

CORNELIUS, TODD, Sales Rep., Sollami Company, P.O. Box 627, Herrin, IL 62848 618/988-1521

COSTELLO, ALLEN J., Geologist, IL Mine Subsidence Insurance Fund, 4 Executive Dr., Fairview Heights, IL 62208 618/624-3350

COURSON, RICHARD, Pres., Courson Coring & Drilling, R.R. 1, Box 38A, St. Peter, IL 62880

COURTNEY, JIM, Mgr., Mining Tool Sales, Kennametal, Inc., P.O. Box 231, Latrobe, PA 15650 412/539-5342

COUSINS, MATTHEW, Warehouse Mgr., Long-Airdox Co., 3206 W. DeYoung, Marion, IL 62959 618/997-4335

COX, ED D., Pres., E&C Loading, Inc., RR1, Box 230, Elizabethtown, IL 62931-9728 618/285-3320

★ CRAGGS, JOE, (Retired), Peabody Coal Co., R.R. 3, Box 47A, Taylorville, IL 62568

CRELLING, JOHN C., Prof., Southern IL University, Dept. of Geology, Carbondale, IL 62901

CREWS, DANIEL, Sales Rep., Mainline Power Div., J. H. Service Co., Inc., P.O. Box 4315, Evansville, IN 47724 812/425-2555

CROSS, CHARLES K., Vice Pres., Simpson Materials Co., P.O. Box 68, Valley Park, MO 63088 314/225-4944

CRUZ, PAUL, Sales Rep., Grindex Pumps, P.O. Box 920, HOMEWOOD, IL 60430-0920 812/983-4427

CUMMING, ALEC, Sales, Hummer of Naperville, 3300 Ogden Ave., Lisle, IL 60532 708/505-8282

CURETON, SONJA, Accounts Payable Clerk, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208-2015

CURRY, JAMES E., Sales Mgr., American Mine Tool Co., P.O. Box AG, Chilhowie, V A 24319 703/646-8990

CURTIS, MONICA, Accounts Receivable Clerk, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208-2015

CURTIS, SAM, Supt. of Maint., Freeman United Coal Mining Co., Box 100, West Frankfort, IL 62896 618/932-2164

CURTIS, TREVOR, Gen. Mgr., Meco Belts/American Longwall, Grandview Boulevard, Zelienople, PA 16063

CUSHMAN, TOM, Vice Pres., Phillips Machine Service, Inc., P.O. Box 1245, Beckley, WV 25802-1245 304/255-0537

CWIKLOWSKI, TOM, Sales, Sligo, Inc., 140 E. Prairie Ave., St. Louis, MO 63147 314/231-3050

DAMBERGER, HEINZ H., Head, Coal Section, IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/333-5115

DAME, JR., CHARLES D., Chief Safety Inspector Orient 6, Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

DANIELS, DAVE, V. Pres., Partner, Hanson Engineers, Inc., 1525 S. 6th St., Springfield, IL 62703 217/788-2450

DANKO, J. ROBERT, Supt., Marissa Mine, Peabody Coal Co., RR1, Box 135D, Marissa, IL 62257 618/295-2374

DANKO, JOHN, (Retired), Peabody Coal Co., P.O. Box 272, Sparta, IL 62286

DANNER, STEPHEN K., Geologist, IL Mine Subsidence Insurance Fund, 4 Executive Dr., Suite 4, Fairview Hghts., IL 62208 618/624-3350

DARGUZAS, JOSEPH N., Proj. Mgr., Sargent & Lundy, 55 E. Monroe, Chicago, IL 60603 312/269-6902

DAUSMAN, BRUCE R., Mgr. of Engr., Black Beauty Coal Co., P.O. Box 312, Evansville, IN 47702

DAUTEL, ROBERT, Supt.Mine Rescue Station, IL Dept. Mines & Minerals, 300 W. Jeferson St., Suite 300, Springfield, IL 62791

DAVENPORT, JACK W., Acct. Consultant, Kiefer Electrical Supply Co., R.R. #3, Rend City Rd., Benton, IL 62812 618/724-2415

★ DAWE, RUSSELL T., (Retired), Inland Steel Coal Co.,

DE MARIS, PHILIP, Asst. Geologist, IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/244-0082

DEMIR, ILHAM, Geologist, IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820

DENEAL, GERALD, Sr. Environmental Engr., Kerr-McGee Coal Corp., P.O. Box 272, Harrisburg, IL 62946 618/268-6584

DENNISON, ROGER, Supt., Turris Coal Co., P.O. Box 22, Elkhart, IL 62634 217/947-2951

DENNY, DONNA, Vice Pres., J&D Repower, Inc., 818-A South Land Str., Harrisburg, IL 62946 618-253-4512

DENNY, JOHN, Pres., J&D Repower, Inc., 818-A South Land Str., Harrisburg, IL 62946 618-253-4512

DENTON, THOMAS G., Staff Mine Engr., Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62812 618/268-6562

DEVON, JOHN, Vice Pres., Marston & Marston, 13515 Barrett Parkwy Dr., St. Louis, MO 63021 314/984-8800

DeWITT, THOMAS J., V.P. & Gen. Mgr., Morgantown Machine & Hydraulics, RR5, Box 250, Morgantown, WV 26505-9805 304/296-8371

DI LORENZO, SYLVER, Supt., Coal, Inc., RR4, Box 262, Linton, IN 47441 812/648-3027

DIETZEL, CHARLES M., Mgr., Plant Ops. & Maint., Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

DIMITROFF, JIM, Sales, Du Quoin Iron & Supply Co., P.O. Box 181, Du Quoin, IL 62832 800/535-5157

DOBBINS, DOUGLAS, Mine Planning Engr., Old Ben Coal Co., 500 N. Du Quoin, Benton, IL 62812 618/435-8176

DODD, JOHN L., Sales/Service Engr., Joy Technologies, Inc., 4217 Lilac, Mt. Vernon, IL 62864 618/242-3650

DODD, LEE W., Longwall Maint. Coord., Monterey Coal Co., RR 4, Box 235, Arlinville, IL 62626

DODRILL, BRENT, Tech. Asst. to VP, Consolidation Coal Co., P.O. Box 566, Sesser, IL 62884 618/625-2041

DONALDSON, DENNIS J., Indus. Serv. Engr., Central IL Public Service Co., 1800 W. Main , Marion, IL 62959 618/997-3311

DONEY, ED, Mgr. Underground Planning & Econ., Kerr-McGee Coal Corp., P.O. Box 25861, Oklahoma City, OK 73125 405/270-2969

DOOM, WM. J., Corp. Office Mgr., J. H. Service Co., Inc., P.O. Box 4315, Evansville, IN 47724 812/425-2555

DORGAN, DOUGLAS G., Asst. Vice Pres.-Marketing, IL Central Railroad, 455 N. City Front #19, Chicago, IL 60611-5504 312/755-7888

DOTSON, JOHN D., Electrical Engr., Freeman United Coal Mining Co., P.O. Box 184, Chatham, IL 62629-0184

DOWNEN, ROBERT P., Pres., Jader Fuel Co., P.O. Box 520, Shawneetown, IL 62984

DOWNING, DOUG, Dir. Environ. Affairs, Arch of Illinois, Inc., P.O. Box 308, Percy, IL 62272 618/497-2141

DREYER, RICK, Central South Major Accts. Mgr., T. J. Gundlach Machine Co., P.O. Box 385, Belleville, IL 62222 618/233-7208

DRONE, RON, Agent, J&D Repower, Inc., 818-A S. Land Str., Harrisburg, IL 62946

DROPPLEMAN, J. P., Pres., Ocenco, Inc., 10225 82nd Ave., Kenosha, WI 53142-7737

DUANE, LEN, Sales, Marion Mining Bolts, 1700 Grand, apt. A, Johnson City, IL 62451 618/997-2167

DUGAN, L. B. (DIXIE), Pres., Dixie Dugan, Inc., 7766 Meadow Ln., Newburgh, IN 47630

DUGGER, LARRY, Pres., Woodruff Supply Co., Inc., P.O. Box 426, Madisonville, KY 42431 502/821-3247

DUMONTELLE, PAUL, Group Head, Groundwater &^ Environ. GeologyGeol. & Geochem., IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/333-5114

DUNCAN, ROD, Asst. Sales Mgr., J. H. Fletcher Co., P.O. Box 2187, Huntington, WV 25722 304-525-7811

DUNCAN, S. W., Pres., Duncan Foundry & Machine Works, Inc., Box 433, Alton, IL 62002 618/465-7724

DUNFORD, JEFFREY L., Sales Rep., Construction Machinery Corp., P.O. Box 97, Marion, IL 62959 618/993-2299

DURBIN, TAMI, Optical Sales, M & S Fire & Safety, P.O. Box 4348, Evansville, IN 47724 812/421-3707

DUTCHER, RUSSELL R., Dept. of Geology, Southern IL University, Mail code 4324, Carbondale, IL 62901 618/543-7062

DYE, JOHN, Sales Mgr., Halbach & Braun Ind., 90 West Chestnut Str., Washington, PA 15301 412/225-7840

EASTWOOD, ROGER, General Mgr., K&E Technical, Inc., P.O. Box 165, West Frankfort, IL 62896

EDMONDSON, CARROLL, Safety Coordinator, White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

EDWARDS, BRENT, Vice Pres., Ashby Electric Co., Inc., P.O. Box 55, Madison St., Sebree, KY 42455 502/835-7534

EGAN, LINDA, Sales, Allen-Bradley, 3787 Rider Trail S., Earth City, MO 63045 314/291-0083

EGBERS, BOB, Sales Rep., Victaulic Co. of America, 519 S. Lincoln Park Dr., Evansville, IN 47714-1535

EGLI, ERICH, Project Engr., Gunther-Nash Mining Construction Co., 2150 Kienlen Ave., St. Louis, MO 63121 314/261-4111

EISON, WALTER E. (MONK), Pres., Western Kentucky Energy Equip., Inc., P.O. Box 81, Madisonville, KY 42431

ELDERS, STEVE, Service Rep., Lake Shore Mining Equip. Corp., RR4, Industrial Park Rd., Benton, IL 62812 618/435-4422

ELGIN, BILL, Tech. Mgr., Goodyear Tire & Rubber Co., 605 State St., Newburgh, IN 47630 812/853-5844

ELLIOTT, ALCWYN, Sales Mgr., Hauhinco Trading, 510 Keystone Dr., Warrendale, PA 15086 412/741-1433

ELLIS, GORDON B., Branch Mgr., Bearing Headquarters Co, 329 S. 9th St., Mt. Vernon, IL 62864

ELLIS, GREG, Sales Engr., Eastern Electric Apparatus Repair Co., Inc., 1565 S. Vandeventer Avenue, St. Louis, MO 63110 314/776-2344

ELLIS, JOHN C., Mgr., Materials Handling, Henry A. Petter Supply Co., P.O. Box 2350, Paducah, KY 42001 502/443-2441

ELLIS, RON, Tech. Sales, Emmick Oil/Chevron, P. O. Box 1914, Owensboro, KY 42302

EMANUEL, LEO J., Vice Pres. Sales/Mkt., Leeco Steel Products, 1600 S. Kostner AVe., Chicago, IL 60623 312/762-4800

EMERY, JANA, Accts. Payable Supv., Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2486

ENNIS, BILL, Reg. Sales Mgr., Astralloy Wear Technology, P.O. Box 170974, Birmingham, AL 35217-0974 205/853-0300

ESTEL, STEVE, Engr. Tech., Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

EVANS, BRAD, Warehouse Mgr., Freeman United Coal Mining Co., RR 4, Virden, IL 62690 618/965-5527

EVANS, Jr., DONALD G., Sales Rep., Long-Airdox Co., 3206 W. DeYoung, Marion, IL 62959 618/997-4335

FARLAINO, G. REGGIE, Sales Rep., Phillips Machine Service, Inc., Rt. 2, Box 97, Greenville, KY 42345 502-338-4341

FARTHING, MAX, Purchasing Agent, MAPCO, Dotiki Mine, P.O. Box 128, Clay, KY 42404

FAVERO, DAVID, Patrick Engineering, Inc., 346 Taft Ave., Glen Ellyn, IL 60137 708/858-7050

FEEZER, RANDY, Asst. Mgr., The Mine Supply Co., 1703 Shawnee St., Mt. Vernon, IL 62864 618/242-2087

FEIG, BILL, Sales/Field Serv. Superv., Long-Airdox Co., 3206 W. DeYoung, Marion, IL 62959 618/997-4335

FELMLEE, GARY, Sales, SKF Bearing Services Co., 400 Chesterfield Ctr. Suite 400-Office #33, Chesterfield, MO 63017 314/537-7834

FERGUSON, MALCOLM, Reg. Marketing Mgr., Senstar Capital Corp., One Oxford Centre, Pittsburgh, PA 15219 412/594-3007

FIENE, KENT, Plant Supt., Arch of Illinois, Captain Mine, Percy, IL 62272 618/497-2141

FINAN, TOM , Tech. Mgr., Goodyear Tire & Rubber Co., P.O. Box 15890, St. Louis, MO 63114

FINDLEY, ROGER, Repair Mgr., Mt. Vernon Electric, Inc., 1313 Harlan Rd., Mt. Vernon, IL 62864 618/244-1066

FISCHBECK, GROVER, Service Engr., J. H. Fletcher & Co., 5944 State Rte 130N, Uniontown, KY 42461-5553 304-525-7811

FISCOR, STEVE, Managing Ed., COAL Magazine, 29 N. Wacker Dr., Chicago, IL 60606-3298

FISHER, BUD, Reg. Sales Mgr., Berry Bearing Co., 100 Halsted, Chicago Heights, IL 60411-1256

FLEENER, JOHN K., Vice Pres. & Gen. Mgr., Mid-Continental Fuels, Inc., P.O. Box 1177, Marion, IL 62959 618/997-2117

FLETCHER, JIM, CEO, J. H. Fletcher & Co., P.O. Box 2187, Huntingon, WV 25722 304-525-7811

+FLETCHER, ROBERT, J. H. Fletcher & Co., Box 2143, Huntington, WV 25722

+FLETCHER, WILLIAM, Dir., J. H. Fletcher & Co., 1630 Sheridan Rd., Apt. 10N, Wilmette, IL 60091

FLORETH, BRAD, Vice Pres., Marketing, ILL-MO Welding Products Co., P.O. Box 788, Jacksonville, IL 62651 217/245-2183

FOLKERTS, JIM, Reg. Sales Mgr., Joy Technologies, Inc., #4 Industrial Park, Mt. Vernon, IL 62864 618/242-3650

FORSHEE, DIANN, Program Coord., Center for Energy & Econ. Devel., 301 N. Memorial Dr., St. Louis, MO 63102 314/342-3478

FOUST, ROBERT B., Vice Pres., Sales, ABC Industries, Inc., P.O. Box 77, Warsaw, IN 46581-0077 219/267-5166

FOX, JAMES M., Engineer, Emeritus, Tabor Machine Co., 908 Taylor Ave., Mt. Vernon, IL 62864 618/242-1048

FOX, ROBERT, Monterey Coal Co., 1004 S. Main, Box 343, Coulterville, IL 62237

FOX, RONNIE, Co-owner, Big Horn Rebuilders, Inc., 6375 Anton Rd., Madisonville, KY 42431 502/821-9975

FRANKLIN, DANNY, Shift Foreman, White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

FRESE, TONY, Asst. Warehouse Mgr., Lake Shore Mining Equip. Corp., RR4, Industrial Park Rd., Benton, IL 62812 618/435-4422

FRIBERG, MAGNUS, Reg. Mgr., Grindex Pumps, 1137 W. 175th St., Homewood, IL 60430-0920 708/957-9988

FRITZSCHE, KEN, Chief Safety Inspect., Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

GAFFNEY, GEORGE F., Dist. Sales Mgr., F. C. Mencini & Assoc., Inc., 185 Glen Cove, St. Louis, MO 63017

GALLI, BRYAN, Sales Manager, Freeman CoalUnited Coal Mining Co., RR#4, Box 115, West Frankfort, IL 62896 618/997-7614

GAMESTER, SCOTT K., Pres., Reaco Battery Service Corp., R.R. 1, BOX 48, Johnston City, IL 62951 618/983-5441

GANEY, DAN, Mgr. of Engr., Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

GANN, JIMMIE E., 753 Rozier #18, Ste. Genevieve, MO 63670

GARLAND, BILL, Reg. Sales Mgr., MacWhyte Co., 2906 14th Ave., Kenosha, WI 53141 414/654-5381

GARLAND, TIM, Mine Mgr., Delta Mine, Cyprus AMAX Coal Co., P.O. Box 730, Marion, IL 62959 618/982-2101

GARNER, BRUCE, Fuel Operations Admin., Central IL Public Service Co., 607 E. Adams, Springfield, IL 62701 217/525-5218

GARRETT, DAN, Chief Engr., White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

GARRETT, MICKEY, Driver/Salesman, Eimco Coal Machinery, Rt. 1, Box 233, West Frankfort, IL 62896 618/937-1808

GARRISON, GARY G., Pres., Garrison Engineering, Inc., 2201 E. Lakeshore Dr., Taylorville, IL 62568 217/824-6320

GARRISON, MERLE RAY, Sales, Gooding Rubber Co., 1200 S. Blakely St., Benton, IL 62812 618/435-8104

GEIS, JACK, Mfrs. Rep, Dukane Mining Products Group, 4369 Winchester Dr., Allison Park, PA 15101 412/487-5029

GEORGE, TIM, Asst. Service Mgr., J. H. Fletcher Co., P.O. Box 2187, Huntington, WV 25722 304-525-7811

GEORGINO, RICHARD A., District Sales Mgr., Bridon Amercan Corp., 351 Riverdale Dr., Rocky River, OH 44116 216/333-5144

GERDEMANN, DEAN, Sales Rep., Rud Chain, Inc., P.O. Box 8145, Cedar Rapids, IA 52408

GIBBONS, PEARL, Sales Rep., Austin Powder Co., 400 N. Bluff Rd., Collinsville, IL 62234 618/344-34111

GIBSON, DON, Supt., Burning Star #2, Consolidation Coal Co., RR #2, Box 654, Du Quoin, IL 62832 618/357-9211

GILES, WILLIAM E., Chief Mech. Engr., Freeman United Coal Mining Co., P.O. Box 62, Girard, IL 62640 217/627-2161

GILLAND, VERNON, Sales Rep., Fredonia Valley Quarries, Inc., 297 Fredonia Quarry Rd., Fredonia, KY 42411 502/545-3351

GILLES, STEVE, Product Mgr., Bixby-Zimmer Div./W.S. Tyler, P.O. Box 248, Elberfeld, IN 47613

GILLIAM, JOYCE, Accounts Payable Clerk, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208-2015

GILLIG, STEVE, Tech. Rep., Lincoln Electric Co., 1824 Lackland Hill Pkwy, Suite 300, St. Louis, MO 63146 314/993-5465

GILMARTIN, D. LEO, (Retired), Peabody Coal Co., 120 W. Adams Ave., Kirkwood, MO 63122-4080 618/295-2254

GIORDANO, PATRICK, Soil Conserv. Planner III, IL Dept. of Agric., Div. Nat. Res., IL St. Fairgnds P.O. Box 19281, Springfield, IL 62794-9281 217/782-6297

GLUSKOTER, HAROLD J., Chief Branch Coal Geology, U.S. Geological Survey, Mail Stop 956, Reston, VA 22092

GOAD, BILL, Service Mgr., J. H. Fletcher Co., P.O. Box 2187, Huntington, WV 25722 304-525-7811

GODDARD, DONALD G., Pres., Mid-Continental Fuels, Inc., P.O. Box 1177, Marion, IL 62959 618/997-2117

GODFREY, JIM, Sales, McJunkin Corp., 4505 Gilbertsville Hwy., Calvert City, KY 42029

GODWIN, PHYLLIS, Administrative Asst., Illinois Mining Institute, P.O. Box 20, Pesotum, IL 61863 217/867-2791

GOLDEN, FRANK, State Mine Inspector, IL Dept. of Mines & Minerals, P.O. Box 33, Herod, IL 62947 618/264-5711

GOODWIN, JONATHAN, Acting Chief, IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/244-

GOTT, STEVE, Sales Engr., Straeffer Sales, 2012 Raymond Dr., Vincennes, IN 47591 812/476-3075

GOUGH, DENNIS, Mine Foreman, White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

GRACE, GEORGE, Lincoln Electric, 1824 Lackland Hill, St. Louis, MO 63146

GRAHAM, DAVID, Sales Rep, Mt. Vernon Electric, Inc., 1313 Harlan Road, Mt. Vernon, IL 62864 618/244-1066

GRANINGER, PAT, Pres., Pump Consultants, Inc., 6200 Maxwell Ave., Bldg. "A", Evansville, IN 47715 812/477-0439

GRAY, RALPH J., Consultant, Coal,Coked Carbons, Ralph Gray Services, 303 Drexel Dr., Monroeville, PA 15146

GREGORY, WALT, Pres., Freeman United Coal Mining Co., 111 Airway Dr., Marion, IL 62959

GRIESEDIECK, CHRIS, Pres., American Pulverizer Co., 5540 W. Park, St Louis, MO 63110

GRIMES, JIM, Purchasing, Arclar Coal Co., P.O. Box 444, Harrisburg, IL 62946

GRIMM, ERIC S., Gen. Mine Foreman, Arch of Illinois, Inc., 1012 Arizona, Columbia, IL 62236 618/497-8333

GRITHER, CARL, Account Exec., Benetech, Inc., 1750 Eastwood Dr., Aurora, IL 60506 708/844-1300

GROGAN, LESTER T., 308 W. Adelaide, Christopher, IL 62822

GROVES, GARY, Sales, Kerco, Inc., P.O. Drawer 665, Madisonville, KY 42431 502/821-2889

GUBBINS, KENNY, Salesman, Coleman Engineering, P.O. Box 41466, Memphis, TN 38174 901/774-1234

GULLIC, R. C. (BOB), General Mgr., Sahara Coal Co., Inc., 1660 Carrier Mills Rd., Harrisburg, IL 62946 618/994-2311

GUNNOE, JIM, MC-2000/4000 Proj. Mgr., American Mine Research, Inc., P.O. Box 234, Rocky Gap, VA 24366 703/928-1712

GUNTHER, R. JAMES, Vice Pres., Gunther-Nash Mining Construction Co., 2150 Kienlen Ave., St. Louis, MO 63121 314/261-4111

GWALTNEY, BILL, Vice Pres., Webb Oil Co., Inc., P.O. Box 112, McLeansboro, IL 62859 618/643-2421

HAAS, CHARLES J., Prof. Mng. Engr., University of Missouri, Rolla, Dept. of Mining Engineering, Rolla, MO 65401

HAKE, WILLIAM D. (BILL), Vice Pres. - Operations, Kerr-McGee Coal Corp., P.O. Box 25861, Oklahoma City, OK 73125 405/270-3732

★HALBERSLEBEN, PAUL

HALL, BERT, Gen. Mine Mgr., Cyprus AMAX Coal Co., Box 144, Keensburg, IL 62852 618/298-2394

HALL, PHIL, Comm. Mgr., Hutchinson, Inc./Raben Tire, 409 Southard Str., Trenton, NJ8638

HAMBY, MIKE, T. J. Gunclach & Co., Inc., #1 Freedom Dr., Belleville, IL 62222 618/233-7208

HAMILTON, GLENN, Environ. Engr., Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

HAMMOND, JOHN P., State Mine Inspector, Dist. #1, IL Dept. of Mines & Minerals, P.O. Box 406, Rushville, IL 62681 217/322-3194

HAMRICK, BILL, Area Mgr., J. H. Service Co., Inc., P.O. Box 4315, Evansville, IN 47724 812/425-2555

HANLEY, TERRY, Sales Rep., Long-Airdox Co., 3206 W. DeYoung, Marion, IL 62959 618/997-4335

HARDMAN, DOUG, Gen. Mgr., Sales & Engr., J. H. Fletcher & Co., P.O. Box 2187, Huntington, WV 25722 304-525-7811

★ HARRELL, M. V. (DOC), V. Pres. (Retired), Freeman United Coal Mining Co., Route 2, Mt. Vernon, IL 62864 618/242-7374

HARRIS, JAMES D., Salesman, Special Mine Services, Inc., P.O. Box 188, West Frankfort, IL 62896

HART, JIMMY, Tech. Rep., Lincoln Electric Co., 1824 Lackland Hill Pkwy, Suite 300, St. Louis, MO 63146 314/993-5465

HART, RICK D., Industrial Serv. Engr., Central IL Public Service Co., 104 E. Third St., Beardstown, IL 62618 217/323-2173

HARTING, RICH, Vice Pres., Bearing Headquarters Co., 3689 E. Broadway, Alton, IL 62002 618/462-0063

HARTSTIRN, BOB, Supt. Burning Star #4, Consolidation Coal Co., RR #1, Box 39, Cutler, IL 62238 618/497-2176

HARVEY, DICK, Senior Geologist (Ret.), IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/244-0836

HARVEY, DONNA, Shop Office Mgr., Mt. Vernon Electric, Inc., 1327 Harlan Rd., Mt. Vernon, IL 62864 618/244-1066

HARWOOD, FRANK, Sales, Henry A. Petter Supply Co., P.O. Box 2350, Paducah, KY 42001 502/443-2441

HATTENDORF, WARREN, Dir., Employee Rel., Freeman United Coal Mining Co., PO Box 100, West Frankfort, IL 62896 618/932-2164

HAYDEN, JEFF, Operations Mgr., White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

HAYWOOD, GREG, Mine Engr., White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

HEAD, GEORGE, Pres., SAN-CON, Inc., P.O. Box 120, Upper Sandusky, OH 43351 419/294-2341

HEAD, P.E., H. JOHN, Vice Pres., Weir International Mining Consult., 2340 River Rd., Ste 203, Des Plaines, IL 60018 708/297-3500

HEALY, HALL, Dir. of Marketing, Patrick Engineering, Inc., 346 Taft Ave., Glen Ellyn, IL 60137 708/858-7050

HEARD, G.G., Sen. V. P., Midcont., Consolidation Coal Co., 12755 Olive Blvd., St. Louis, MO 63141 314/275-2305

HEDRICK, JOHN B., Vice Pres., Phillips Machine Service, Inc., P.O. Box 1245, Beckley, WV 25802-1245 304/255-0537

HEIN, DARRELL L., Surveyor, IL Mine Subsidence Insurance Fund, #4 Executive Dr., Suite 4, Fairview Heights, IL 62208 618/624-3350

HEINLE, RANDY, Vice Pres., Kiefer Electrical Supply Co., 1805 Hovey, Normal, IL 61761

HEINS, PHIL, Gen. Mgr., A. L. Lee Corporation, P.O. Box 2370, Mt. Vernon, IL 62864

HELFRICH, JACK, Employee Relations, Freeman United Coal Mining Co., P.O. Box 100, Waltonville, IL 62894 618/932-2164

HENKEN, CARY, Sales Rep., Power Techniques, Inc., 3812 Greenridge Rd., Alma, IL 62807 618/432-5354

HERMAN, DR. RICHARD G., Research Fellow, Lehigh University, Sinclair Lab., Bldg. #7, Bethlehem, PA 18015

HESS, JAMES, Mine Supt., Orient No. 6, Freeman United Coal Mining Co., Box 308, Waltonville, IL 62894 618/932-2164

HESSE, FRED E., Executive Vice Pres., Advanced Mining Technology, Inc., 295 Meadowlands Blvd., Washington, PA 15301 412/746-8711

HICKAM, DAN, Sales Rep., Apache Hose & Belt. Co., 2435 Rock Island Blvd., St. Louis, MO 63343 314/567-6705

HIGGINS, GEORGE, Retired, Ashby Electric, 306 Bailey Lane, Benton, IL 62812 618/439-3920

HILL, JIM, Marketing, Goodyear Tire & Rubber, 13601 Industrial Pky, Marysville, OH 43040 513/644-8989

HILL, JOHN, Gen. Mgr., Marissa Bus. Unit, Peabody Coal Co., P.O. Box 77, Marissa, IL 62257 618/443-3004

HILTABRAND, LINDA, Environ. Protect. Spec., IL Dept. of Mines & Minerals, 300 W. Jefferson St., Suite 300, Springfield, IL 62791

HINDERLITER, DAN, Prep. Plant Foreman, White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

HINES, ROGER L., Field Rep, Joy Technologies, Inc., Box 1269, Mt. Vernon, IL 62864 618/242-3650

HITPAS, COLETTE, Sr. Accountant, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208-2015

HOBBS, JEFFREY J., Dist. Sales Mgr., Lake Shore Mining Equip. Corp., 2900 Lime Ave., Mt. Vernon, IL 62864 618/244-4408

HOEMAN, JOHN M., Mgr.-Purchasing, Peabody Development Co., 301 N. Memorial, St. Louis, MO 63102 314/342-7800

HOFFERT, MARK J., Electrical Sales, Berry Bearing Co., P.O. Box 2128, E. Peoria, IL 61611-1716

HOFFMAN, FRED, Acct. Mgr., Siemens, 11775 Borman Suite 102, St. Louis, MO 63146

HOFFMANN, RON, Vice Pres., Surdex Corp., 520 Spirit of St. Louis Blvd., Chesterfield, MO 63005-1002 314/532-3427

HOFFMANN, RUSSELL D., Vice Pres., Surdex Corp., 520 Spirit of St. Louis Blvd., Chesterfield, MO 63005-1002 314/532-3427

HOFMANN, JOHN, Elec. Coord, Monterey Coal Co., P.O. Box 94, Albers, IL 62215 618/248-5121

HOFMANN, WES, Sr. Planning Engr., Un., Arch of Illinois, Inc., P.O. Box 308, Percy, IL 62272 618/497-2141

HOLDERFIELD, JOE, Parts Mgr., Fabick Machinery Co., P.O. Box 760, Marion, IL 62959 618/997-1881

HOOD, CANDY, Long Airdox Co., 3206 West DeYoung, Benton, IL 62812 618/997-4335

HOOKS, CHARLES, Agronomist, University of Illinois, 13040 Blackstump Rd., Percy, IL 62272 618/965-9651

★HOPKINS, M. E., (Retired), Peabody Coal Co., 35 Club Grounds N., Florissant, MO 63033-4110 314/342-3400

HORISZNY, A. L., Tech. Rep., Chevron, USA, Inc., 2530 Village Lane, Foristell, MO 63348 314/673-7200

HORN, DICK, Sales Mgr., Alminco, Inc., 1411 Delaware Ave., Lexington, KY 40505 606-231-7022

HOUSER, ROBERT A., (Retired),18532 Lyn Ct., Homewood, IL 60430 708/975-2693

HOWARD, JOHN MIKE, Dist. Sales Mgr., U.S.T. Inc., 311 Laura, Farmington, MO 63640

HOWARD, JOHN L., Assoc. Dean, Mining Tech., Illinois Eastern Comm. Colleges , 2201 Toronto Rd., Springfield, IL 62707

HOWE, JANET, Research Asst., NIU, 5719 N. Kimball Ave. Apt. 1W, Chicago, IL 60659-4527 708/297-4540

HOWERY, RODNEY, Sales Mgr., Heintzmann Corp., P.O. Box 301, Cedar Bluff, VA 24609 703/964-7413

HOYT, BRIAN, RR1 Box 328, Murphysboro, IL 62966-9761 618/382-4651

HUBER, RANDY, Sales Mgr., N.E., Tricon Metals & Services, Inc., 1540 Lakewood Dr., Lexington, KY 40502-2534 606/266-2381

HUCK, JANET, Purchasing Assoc., Americoal Development Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2486

HUELSMANN, ARNOLD, CEO, Arnold Distributing Co., 123 E. Broadway, Trenton, IL 62293-1601

HUFF, STEPHANIE, Sr. Account Exec., Aaron D. Cushman & Assoc., Inc., 7777 Bonhomme, St. Louis, MO 63105 314/725-6400

HUGHES, CEIRIOG, VP, Sales & Service, Halbach & Braun Ind., 90 W. Chestnut St., Washington, PA 15301 412/225-7840

HUGHES, DENZIL, Production Foreman, Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

HUGHES, WILLIAM W., Service Engr., Continental Conveyer & Equip. Co., Inc., P.O. Box 2507, Mt. Vernon, IL 62864

HUNTER, ROBERT, Dir. of Tech. Serv., Coal Sales Co., 701 Market St., Suite 830, St. Louis, MO 63101

HUNTSMAN, LES, Pres., Special Mine Services, Inc., P.O. Box 188, West Frankfort, IL 62896

HURLEY, JACK, 3704 Diamondhead Dr., St. Louis, MO 63125 314/894-1711

HURST, ROBERT J., Pres., Geo-Con, Inc., R.R. 4, 305 Fifth Ave., Princeton, IN 47670

HURTTE, JAMES E., Safety Mgr., Peabody Coal Co., 212 Barker Rd., Henderson, KY 42420-2306 217/824-3757

HUSTEDDE, RON H., Materials Mgr., Joy Technologies, Inc., P.O. Box 1269, Mt. Vernon, IL 62864 618/242-3650

HUTCHCRAFT, DENNIS, Sales Mgr., Tri State Mine Supply, P.O. Box 732, Marion, IL 62959

HUTCHCRAFT, GARY, Shop Foreman, Cima Electrical & Mine Services, RR2, Box 320, Benton, IL 62812 618/439/7211

HUTCHCRAFT, JIM, Owner, H & H Consulting, 707 S. Monroe, P.O. Box 481, West Frankfort, IL 62896 618/937-2622

HUTCHCRAFT, JIM, Sales, Cima Electrical & Mine Services, RR#2, Box 320, Benton, IL 62812 618/439-7211

ISROW, JUDY, Sales, Ashby Electric Co., Inc., P.O. Box 55, Sebree, KY 42455 502/835-7534

IWASYSZYN, TED, Vice Pres., Sales West, Centrifugal & Mechanical Industries, 201 President St., St. Louis, MO 63118 314/776-2848

JACKSON, AARON D., Mine Supt., Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

JACKSON, ROYCE, Sales, Rees Mine Supply Sales, Inc., Box 177, Du Quoin, IL 62832 618/542-4523

JACOBS, WILLIAM, Pres., Boone Supply Co., P.O. Box 429, Sylvester, WV 25793

JACOBSON, RUSSELL J., Assoc. Geologist, IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820

JAMES, JESSE, Sales, Mine Safe Electronics, P.O. Box 163, Sturgis, KY 42459 304/568-5201

JANKOUSKY, CHARLES, (Retired), Freeman United Coal Mining Co. , 702 Sheridan Dr., Benton, IL 62812 618/438-4391

JENKINS, JON C., Pres., J&D Management Group, Inc., 2216 Young Dr., Suite 7B, Lexington, KY 40505 606/268-6991

JOHANNING, KEN, Sales, Mt. Vernon Electric, Inc., 1327 Harlkan Rd., Mt. Vernon, IL 62864

JOHNSON, CLIFF, Land Reclam. Spec., IL Dept. of Mines & Minerals, 300 W. Jefferson St., Suite 300, Springfield, IL 62791

JOHNSON, D. J., Instructor, Mining Industrial Tech., Rend Lake College, R.R. 1, Ina, IL 62846 618/437-5321

JOHNSON, KEN, Mgr., IL Facilities, American Longwall, Inc., P.O. Box 102, Whittington, IL 62897 618/629-2402

JOHNSON, SAM, Manager/Sales, Dooley Bros., Inc., 609 N. McLeansboro St., Benton, IL 62812 618/438-7831

JOHNSON, STEVE, Gen. Supt., Arclar Coal Co., P.O. Box 444, Harrisburg, IL 62946 618/252-7075

JOKERST, JERRY, Pres., Farrar Pump & Machinery Co., 1701 S. Big Bend Blvd., St. Louis, MO 63117 314/644-1050

JONES, BETSY, Accounts Payable Clerk, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208-2015

JONES, CHARLIE, Engineer, White County Coal Co., P.O. Box 457, Carmi, IL 62821 618/382-4651

JONES, DON, (Retired), Inland Steel Coal Co.(Retired), 804 S. 34th St., Mt. Vernon, IL 62864 618/242-6587

JONES, JACKIE W., Salesman, Kerco, Inc., 548 S. Main St., Madisonville, KY 42455 502/821-2889

JONES, JEFF, National Sales Mgr., Jones Marketing, 17311 Lee Highway, Abingdon, VA 24210-7831

JOYCE, KEVIN, Vice Pres. Sales, Naylor Pipe Co., 1230 E. 92nd St., Chicago, IL 60619-7997 312/721-9400

JUBINSKY, STEVE, Area Sales Mgr., Ingersoll-Rand Material Handling, 888 Industrial Dr., Elmhurst, IL 60126 708/530-3800

JUDY, JOHN, Sales, Sligo, Inc., 140 E. Prairie Ave., St. Louis, MO 63147 314/231-3050

JURICH, JOE, Sales, Mt. Vernon Electric, Inc., 1327 Harlan Rd., Mt. Vernon, IL 62864 618/244-1066

JUSTICE, J. H. (JIM), Vice Pres., Du Quoin Iron & Supply Co., P.O. Box 181, Du Quoin, IL 62832 800/535-5157

JUSTICE, LARRY, Rock Mechanics Supv., Standard Laboratories, Inc., P.O. Box 39, Freeburg, IL 62243

KACHIK, DAVID J., Sr. Assoc., Coal Industry Consultants, Inc., P.O. Box 4345, Wheaton, IL 60189-4345 708/858-8673

KAELIN, LARRY F., Pres., Marine Coal Sales Co., 645 W. Carmel Dr., #190, Carmel, IN 46032

+ KALIA, HEMENDRA N., 6425 W. Coley Ave., Las Vegas, NV 89102

+ KARNES, RALPH E., Maint. Foreman, Consolidation Coal Co., P.O. Box 1192, B enton, IL 62812-5192

KASKY, JOHN, Sales Rep, R & H Service & Supply Co., P.O. Box 250, Carterville, IL 62918 618/985-8316

KEE, GEORGE B., Vice Pres., Special Mine Services, Inc., P.O. Box 188, Country Club Rd., West Frankfort, IL 62896

KEE, VERNON, Sales Rep., Special Mine Services, Inc., P.O. Box 188, West Frankfort, IL 62896

KEITH, BOB, , Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6482

KELL, THOMAS M., Gen. Mine Mgr., Freeman United Coal Mining Co., RR #1, Box C-74, Virden, IL 62690-9511 217/227-4467

KELLER, ROBERT T., Pres., J. H. Service Co., Inc., P.O. Box 4315, Evansville, IN 47724 812/425-2555

KEMP, LYNN, Sales, M & S Fire and Safety, P.O. Box 4348, Evansville, IN 47724 812-424-3863

KENDORSKI, P.E., FRANK S., Consult. Engr., Weir International Mining Cons., 2340 Riser Rd., Suite 203, Des Plaines, IL 60018 708/305-7900

KENNEDY, JACK, Vice Pres., Jack Kennedy Metal Prods. & Bldgs., Inc., P.O. Box 138, Taylorville, IL 62568 217/287-7231

KENNEDY, WILLIAM, Pres., Jack Kennedy Metal Prods. & Bldgs., Inc., P.O. Box 138, Taylorville, IL 62568 217/287-7231

KERCH, RICHARD L., Dir., Air & Water Quality, Consol, Inc., 180 Washington Rd., Pittsburgh, PA 15241 412/831-4527

KERN, ALAN, Mine Engr. , White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

KERPERIEN, THERESA, Accts. Payable Coord., Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2465

KERR, TIMOTHY J., Development Geologist, B&B Mining, Inc., RR 1, P.O. Box 69, Cynthiana, IN 47612 812/845-2717

KIMELTON, DWIGHT, Sales, R & H Service & Supply Co., P.O. Box 250, Carterville, IL 62918 618/985-8316

KING, HAROLD, Branch Mgr., Bearings Service Co., 1607 S. Kentucky AVe., Evansville, IN 47734

KING, PAUL, Sales, Illinois Div., Roberts & Schaefer Co., 120 S. Riverside Plaza, Chicago, IL 60606 614/384-5700

KINKADE, MIKE, Maint. Supt., Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

KINNELL, HERB, Sr. Sales, Quality Engr., Joy Technologies, Inc., 6160 Cochran Rd., Solon , OH 44139 216/248-7970

KINSTLER, DONALD W., Gen. Mgr., Camp Bus. Unit, Peabody Coal Co., P.O. Box 328, Morganfield, KY 42437 502/389-6507

KIRKPATRICK, BILLY, Sales Engr., Joy Technologies, Inc., R.R. 6, Box 343, Mt. Vernon, IL 62864 618/242-3650

KITCHEN, MARK, Gen. Mine Foreman, White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

KLEMM, FRANK, Mgr.-Coal Pricing, Illinois Central Railroad, 455 N. City Front Plaza Dr., Chicago, IL 60611-5504 312/755-7893

KLINE, DANNY, Sales Rep., Ashby Electric Co., Inc., P.O. Box 55, Sebree, KY 42455 502/835-7534

KNIGHT, DAVID, Operator-Black Creek Mine, Rogers Group, Inc., 350 S. Adams, Bloomington, IN 47402 812/332-6341

KNIGHT, JOAN, Adminis. Coord., Rogers Group, Inc., 350 S. Adams, Bloomington, IN 47402 812/332-6341

KNIGHT, RAY, Area Mine Mgr., Rogers Group, Inc., 350 S. Adams, Bloomington, IN 47402 812/332-6341

KOHORST, JANE, Personnel Tech., IL Dept. of Mines & Minerals, 300 W. Jefferson St., Suite 300, Springfield, IL 62791

KOKAL, BRAD, Metallurg. Engr., Sivyer Steel, 225 S. 33rd St., Bettendorf, IA 52722 319-355-1811

KOLAR, CLAY, Land Rec. Spec., IL Dept. of Mines & Minerals, #2 Coal Development PK, Carterville, IL 62918

KOPEC, JOHN , Pres., K&E Technical, Inc., P.O. Box 165, West Frankfort, IL 62896

KORTE, JAMES, Eastern Div. Mgr., T. J. Gundlach Machine Co., P. O. Box 385, Belleville, IL 62222 618/233-7210

KOSTBADE, KEN, Sales (Branch Mgr.), Bearings Service Co., Highway 13, East, Marion, IL 62959-9808

KOSTBADE, MIKE, Salesman, Bearings Service Co., 1607 S. Kentucky Ave., Evansville, IN 47734 812/775-6276

KOSTBADE, RICHARD, Sales, Bearings Service Co., New Rt. 13 East, Marion, IL 62959-9808

KOTZSCHMAR, CHRIS, Product Mgr., Voith Transmissions, 25 Winship Rd., York, PA 17402 717/676-3200

KOVACK, MIKE, Sales/Serv. Engr., Jack Kennedy Metal Prods. & Bldgs., Inc., P.O. Box 138, Taylorville, IL 62568 217/287-7231

KOVARIK, MIKE, Sales, Gooding Rubber Co., 1200 S. Blakely, Benton, IL 62812 618/435-8104

KRITZBERGER, GENE, Product Mgr., Voith Transmissions, Inc., 25 Winship Road, York, PA 17402 717-767-3200

KROESE, OWEN, Mgr., Elect & Sys. Engr., Kerr-McGee Coal Corp., PO Box 727, Harrisburg, IL 62946 618/268-6584

KUCHARIK, TOM, Instructor, Illinois Eastern Comm. Colleges, 822 Melody Lane, Herrin, IL 62948 618/942-7025

KUDLAWIEC, ROBERT P., Project Engr., Cyprus AMAX Coal Co., P.O. Box 144, Keensburg, IL 62852 618/867-5752

KUNKEL, JOHN, Mgr. of Adminis., Old Ben Coal Co., 500 N. Du Quoin St., Benton, IL 62812 618/435-8176

KUTZ, BILL, Sales & Serv. Engr., Centrifugal & Mechanical Industries, 222A Shenandoah Pl., Henderson, KY 42420 502/826-5470

LAFFEY, MIKE, Sales Rep., Laffey Equipment Co., P.O. Box 16285, St. Louis, MO 63105 314/427-7414

LAINE, DAVID, Reg. Sales Mgr., Prince Manuf. Co., 2330 Willow Creek Dr., Evansville, IN 47711-9155

LAMBERT, JOHN, Tech. Sales, Chevron Lubricants, P.O. Box 32140, Louisville, KY 40232 800/822-5823

LAMBERT, KEITH, Sales, Minesafe Electronics, P.O. Box 163, Sturgis, KY 42459 502/333-5581

LANGE, ULRICH O., Pres., Hemscheidt America Corp., P.O. Box 500, Pittsburgh, PA 15230 412/787-7130

LANZEROTTE, JOHN, Mine Supt., Monterey Coal Co., P.O. Box 496, Carlinville, IL 62626 217/854-3291

LARSON, JOHN C., Sales Rep., Michigan Industrial Lumber, P.O. Box 612, Whiting, IN 46394 219/659-4255

LATTINA, ALAN, Serv. Engr., Centrifugal & Mechanical Industries, 201 President Str., St. Louis, MO 63118 314/776-2848

LAUER, BRIAN, Territory Mgr., Roland Equipment Co., 5920 N. Lindbergh Blvd., Hazelwood, MO 63042 314/731-1330

LAUR, KIRBY, Belt Mgr., Freeman United Coal Mining Co., Rt. 148, Waltonville, IL 62812

LAURENT, EDWARD L., Pres., Water & Oil Technologies, Inc., 52 Eastfield Rd., Montgomery, IL 60538

LAUZON, MARC, Land Rec. Spec., IL Dept. of Mines & Minerals, #2 Coal Development Pk., Carterville, IL 62918

LAWS, SAM, Prep Plant Mgr., Cyprus AMAX Coal Co., P.O. Box 144, Keensburg, IL 62852 618/298-2394

LEBLANC, TIMOTHY A., District Sales Rep., Nalco Chemical Co., 514 Earth City Expressway, Earth City, MO 63045 314/739-4969

+LEDVINA, C. T. (CHRIS), Old Ben Coal Co., 5415 N. Sheridan Rd., Suite 5511, Chicago, IL 60640-1951 312/583-4050

LEE, JAMES, Mine Mgr., Freeman United Coal MIning Co., 108 Timberridge, Springfield, IL 62702

LEHMAN, BOB C., Purchasing Agent, Arclar Coal Co., P.O. Box 444, Harrisburg, IL 62946

LEIGHTON, MORRIS W., Chief (Retired), IL State Geological Survey, 302 Sherwin Dr., Urbana, IL 61801 217/333-5111

LEMMONS, SHARON K., Claims Mgr., Lynch Coal Operators Reciprocal Assn., P.O. Box 715, Terre Haute, IN 47805

LEMONS, ARLEY, Plant Engr., Sesser Concrete Products Co., 702 N. Park St., Sesser, IL 62884 618/625-6323

LENDRUM, SHAUN P., Sales Mgr., Stamler Corp., P.O. Box 307, Main & Stamler Strs., Millersburg, KY 40348 606/484-3431

LESLIE, JOHN, Mkt., Syntech, 520 E. Woodruff, Toledo, OH 43624 314/532-0443

LETSKY, CONNIE, Geologist, IEPA, 2009 MALL ST., Collinsville, IL 62234 618/346-5120

LEVANTI, WILLIAM, Safety Insp., Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

LEWIS, LAWRENCE L., Supv. of Realty/EDP Serv., Abandoned Mines Lands Reclam. Council, 928 S. Spring, Springfield, IL 62704-2725 217/782-0588

LEY, JIM, Production Mgr., J&D Repower, Inc., 818-A South Land St., Harrisburg, IL 62946 618-253-4512

LEY, SANDI, Sec., J&D Repower, Inc., 818-A South Land Str., Harrisburg, IL 62946 618-253-4512

LIBENGOOD, HOMER, Project Mgr., MICON Products Intl., Inc., #25 Allegheny Sq., Glassport, PA 15045 412/664-7788

LINDENSCHMIDT, TERRY, Field Sales, Baker-Bohnert/Service Group, P.O. Box 169003, Louisville, KY 40256-9003 502/634-3661

\+ LINDSAY, GEORGE C., 7024 Melody Lane, Fort Wayne, IN 46804-2836

LINDSAY, MICHAEL, Shop Foreman, Freeman United Coal Mining Co., P.O. 330, Virden, IL 62690

LINDSEY, JAMES R., Mgr. of Adminis., Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

LINK, WILLIAM R., Maint. Foreman, No. 1 Mine, Monterey Coal Co., RR #4, Box 235, Carlinville, IL 62626

LITKA, ANTHONY, Program Mgr., Tecogen, Inc., P.O. Box 8995 , Waltham, MA2254-8995 617/622-1330

LITTLEFIELD, KENNETH, Pres., B & L Industrial Systems, Inc., P.O. Box 1223, Granite City, IL 62040 618/876-2128

LOESL, JOSEPH G., National Acct. Mgr., Coal, Illinois Central Railroad, 455 N. Cityfront Plaza Dr., Chicago, IL 60611-5504 312/755-7903

LONGO, PETER, Mgr. Undergr. Sales, Frazer & Jones Co., P.O. Box 4955, Syracuse, NY 13221 315/834-6413

LOUNSBURY, RICHARD E., Environ. Advisor, Monterey Coal Co. (Ret.), P.O. Box 675, Carlinville, IL 62626 217/854-3717

LOWDERMILK, SCOTT, VP, Gen. Mgr., Pempek Systems, P.O. Box 2312, Weber City, VA 24266 703/386-7806

LOWE, DIANNA, Secretary, Hillsboro Coal Co., P.O. Box 280, Hillsboro, IL 62049 217/532-3969

LOYD, RON, Purchasing Mgr., Lebco, Inc., P.O. Box 656, Benton, IL 62812 618/439-6345

LUBBERT, RANDALL, Dragline Training Coord., SIU-Coal Research Center, MC4623, Carbondale, IL 62901 618/536-5521

★ LUCAS, WALTER S., Vice Pres. (Retired), Sahara Coal Co., Inc., P.O. Box 816, Harrisburg, IL 62946 618/252-1327

LUMM, D. K., Grad Student, University of Kentucky, Dept. of Geological Sciences, Lexington, KY 40506 606/257-1087

LUTZ, MICHAEL E., Sales Engr., M. L. Industrial, #1 Chisholm Trail, Columbia, IL 62236 314/343-2250

LYMAN, ROBERT M., Geologist, Sun Coal Company, 308 Timberhill Ct., Knoxville, TN 37922

LYNN, JERRY A., Sales Rep., Fabick Machinery Co., P.O. Box 760, Marion, IL 62959 618/997-1881

LYON, DAVE, Res. Engr., Mine #25, Old Ben Coal Co., 500 N. Du Quoin, Benton, IL 62812 618/439-5296

LYTLE, JOHN M., Head, Minerals Engr. Sect., IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/244-8389

MACK, THOMAS E., Sales Engr., Halbach & Braun Industries, Rt. 4, Box 449, Washington, PA 15301

MAHLER, JAMES W., Pres., Americoal Development Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2451

MALONE, JAMES (PAT), Pres., Jake's Tire Co., P.O. Box 670, Marion, IL 62959 618/997-9491

MALONEY, PAULA, Public Inform. Spec. , SIU-Coal Research Center, MC4623, Carbondale, IL 62901 618/536-5521

+MANCI, SAMUEL L., Sales Rep., Long-Airdox Co., 618/438-3821

MANN, MIKE, Sr. Marketing Mgr., Brake Supply Co., Inc., P.O. Box 447, Evansville, IN 47703-0447 812/479-6881

MANN, MITCH, Sales, Sollami Company, P.O. Box 627, Herrin, IL 62948 618/988-1521

MANNING, RANDY, General Belt Service, Inc., P.O. Box 22, Benton, IL 62812 618/439-3718

MARCH, ELIZABETH, Public Infor. Officer, IL Dept. of Mines & Minerals, 300 W. Jefferson, Springfield, IL 62791 217/782-0031

MARCUM, RONNIE, Vice Pres., IL Operations, Consolidation Coal Co., P.O. Box 566, Sesser, IL 62884-0566 618/625-2041

MARKS, HARRY, Cust. Service, Diesel Mining Equip., Rt. 34 East, Galatia, IL 62935 618/268-4446

MAROSCHER, GUS, Exec. Vice Pres., Brautigam , 820 Henderson Ave., Washington, PA 15301 618/997-5060

MARTIN, BERNARD , State Mine Inspector, IL Dept. of Mines & Minerals, RR 2, Box 170A, Taylorville, IL 62568-9802

+MARTIN, CHARLES K. EDWARD, Mgr., Human Resources, EDS, , Earth City, MO 63045

MARTIN, DARIN, Land Reclam. Specialist, IL Dept. of Mines & Minerals, #2 Coal Dev. Park, Carterv ille, IL 62918 618/985-6525

MARTIN, DEREK, Mech. Engr., Kerr-McGee Coal Corp., Rt. 142 S., Eldorado, IL 62930 618/268-6423

MARTIN, HARRY, Exec. Vice Pres, Westfalia Mining Progress, Inc., 255 Berry Road, Washington, PA 15301 412/225-4049

MARTIN, J. NEIL, Co-Owner., Heartland Pump Rental & Sales, Inc., 102 Brown Str., Carterville, IL 62918 618/985-5110

MARTIN, JAMES W., Mine Plann. Engr., Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

MARTIN, MIKE, Outside Sales, Illinois Bearing Co., 3761 Sangamon Ave., Springfield, IL 62707-9728 217/529-8515

MATUSKA, DAN, Sr. Lubrication Engr., Century Lubricants, P.O. Box 161, Marion, IL 62959 618/997-2302

MAUCK, HARVEY B., (Retired), Deep Valley Coal Co., 1107 N. Logan Ave., Danville, IL 61832-2917 217/442-9157

MAURER, ROLF, Tech. Supp. Mgr., Coal Gas, Destec Energy, Inc., 2500 City West Blvd., Suite 150, Houston, TX 77042 713/735-4454

MC ALLISTER, JIM, Sales Rep., Xteck, 2817 S. 7th St., Terre Haute, IN 47802 812/235-3222

MC BRIDE, DON, Supv., Training & Cert., IL Dept. of Mines & Minerals, 1401 JOHNSON, Johnston City, IL 62951

MC CALLISTER, CHARLES, Surface Maint. Foreman, Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

MC CANN, MICK, Sales Rep., Illinois Bearing Co., 303 Swan Ave., Centralia, IL 62801-6128

MC CANN, RON, Reg. Mrktg. Mgr., Senstar Capital Corp., 301 Grant Street, Pittsburgh, PA 15219 412/594-3003

MC CLINTICK, LARRY, Plant Manager, Eastern Electric Apparatus Repair Co., Inc., 1565 S. Vandeventer Ave., St. Louis, MO 63110 314/776-2344

MC COY, LARRY, Sr. Dist. Mgr., Esco Corp., 1017 Griggs St., Danville, IL 61832 217/446-2210

MC CULLOUGH, TRACY, Accounts Receivable Clerk, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208-2015

MC DONALD, TERRY, Maint. Supv., Cyprus AMAX Coal Co., P.O. Box 144, Keensburg, IL 62863 618/262-8937

MC DOUGAL, ELAINE, Hopcraft Electric, Inc., 606 Glen Crossing Rd., Glen Carbon, IL 62034 618/288-7302

MC DOWELL, NEAL, General Mgr., Roland Machinery Co., P.O. Box 2879, Springfield, IL 62708 217/789-7711

MC FARLAND, JOHN, Gen. Maint. Supv., Old Ben Coal Co., RR1, Box 312A, Benton, IL 62812 618/439-6025

MC GAHA, RAY, Vice President, Continental Conveyer & Equip. Co., Inc., P.O. Box 400, Winfield, AL 35594 205/487-6492

MC GILL, BENNIE, Sales, SETCO Solid Tire & Rim, P.O. Box 809, Idabel, OK 74745 405/286-6531

MC GOVERN, JEFF, Sales Rep., Power Techniques, Inc., 3812 Greenridge Rd., Alma, IL 62807 618/432-5354

MC GUIRE, BRIAN, Branch Mgr., American Excelsior Co., 2329 Chaffee, St. Louis, MO 63146 314/993-5540

MC KAY, JEFFREY, Geotechnical Specialist, A.S.P. Enterprises, Inc., 1546 Fenpark Dr., Fenton, MO 63026 314/343-4357

MC LAUGHLIN, GENE, Sales, Hagendorn & Gannon Co., 550 Axminister, Fenton, MO 63026 314/349-3370

MC MAHAN, RONALD, President, Resource Data International, 1320 Pearl St. #300, Boulder, CO 80302-5279 303/444-7788

MC NULTY, JAMES E., Sr. Assoc., Coal Industry Consultants, Inc., P.O. Box 4345, Wheaton, IL 60189-4345 708/858-8673

MC PEAK, CARLOS, District Sales Mgr., Westfalia Mining Progress, Inc., 103 E. Perkins, Mt. Vernon, IL 62864

MC PEAK, ROBERT, Mgr. Materials & Admin., Americoal Development Co., 50 Jerome Place, Fairview Heights, IL 62208 618/624-3600

★MC REAKEN, C. DAYTON (WORM), (Retired), Zeigler Coal Co., 701 E. 4th St., West Frankfort, IL 62896 618/932-3378

MC WHORTER, "Judge", Gen. Sales Mgr., Phillips Machine Service, Inc., P.O. Box 1245, Beckley, WV 25802-1245 304/255-0537

MELCHER, RICHARD W., Chief Engr., Brushy Creek Coal Co., Inc., 4270 N. America Rd., Galatia, IL 62935 618/252-8633

MELCHOR, M. JOSEPH, Senior V. Pres. / Engr., Gunther-Nash Mining Construction Co., 2150 Keinlen Ave., St. Louis, MO 63121 314/261-4111

MELVIN, CALVIN, Maint. Supt., Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

MENSER, BO, Costain Coal Co., Box 289, Sturgis, KY 42459

MERCKEL, NANCY, Payroll Clerk, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208-2015

MERIDETH, ELMO, Mgr. of Sales, Special Mine Services, Inc., P.O. Box 188, Country Club Rd., West Frankfort, IL 62896

MERLINO, FRED, Sales Mgr., J. H. Fletcher Co., P.O. Box 2187, Hungtington, WV 25722 304-525-7811

MERRIFIELD, NEAL H., VP, Underground Ops., Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

MESSMER, JOE, Acct. Executive, Azcon Corp., P.O. Box 616, Alton, IL 62002 618/413-3770

MEYERS, AL, Environ. Protect. Spec., IL Dept. of Mines & Minerals, #2 Coal Development Pk., Carterville, IL 62918

MIDGETT, DON, Sales, Gauley Sales Co., P.O. Box 155, Providence, KY 42450

MILLARD, TIM, Sales, Central Illinois Steel Co., Box 78, Carlinville, IL 62626

MILLER, JOHN J. (IKE), Mgr.-Sales/Service, Roberts & Schaefer Co., 120 S. Riverside Plaza, Suite 400, Chicago, IL 60606 312/236-7292

MILLER, RICK, Sales Rep., Mohler Technology, Inc., P.O. Box 669, Boonville, IN 47601-0669 812/897-2900

MILLER, VICTOR A., Regional Mgr., WIKA Instrument, 519 Oak Park AVe., Watertown, KY 53094 414/261-0421

MILLER JR., RICHARD G., 1420 Sheridan Road, Wilmette, IL 60091

MINER JR., JAMES A., Pres., Kerco, Inc., P.O. Drawer 665, Madisonville, KY 42431 502/821-2889

MINICHBAUER, ROBERT , Branch Mgr., Rudd Equipment Co., 4679 New Baumgartner Rd., St. Louis, MO 63129 314/487-8925

MISSAVAGE, ROGER J., Asst. to the Dean, Engr., Southern IL University, 207 S. 7th St., Herrin, IL 62948 618/453-7744

MITCHELL, CARL, Reg. Mgr., Austin Powder Co., 400 N. Bluff Rd., Collinsville, IL 62234-4149 618/344-3111

MITCHELL, WILLIAM, Gen. Mgr., St. Louis Div., Roland Equipment Co., 5920 N. Lindbergh Blvd., Hazelwood, MO 63042 314/731-1330

MOHLER, ERIC, Sr. Buyer, Americoal Development Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2400

MONARCH, DENNIS D., Division Mgr., Gooding Rubber Co., 1200 S. Blakely, Benton, IL 62812 618/435-8104

MONTGOMERY, BOB, Mgr., Engr. Services, Kennamental, Inc., P.O. Box 231, Latrobe, PA 15650 412/539-5342

MOORE, DON, Dist. Lub. Engr., Texaco Lubricants Co., 1714 Deer Tracks Trail, 2nd Floor, St. Louis, MO 63131 314/965-3341

MOORE, JOE, Costain Coal Co., Box 289, Sturgis, KY 42459

MOORE, MARVIN R., Mine Engr., Old Ben Coal Co., RR1, Sesser, IL 62884 618/439-5204

MORGAN, GARY, Regional Parts Mgr., Long-Airdox Co., 3206 W. DeYoung, Marion, IL 62959 618/997-4335

MORGAN, GEORGE H., Morgan & Associates, 401 Tyler Ave., Evansville, IN 47715-3243 812/476-4065

MORGAN, MARK S., Dist. Sales Mgr., J. H. Fletcher & Co., 411 E. Geiger St., Morganfield, KY 42437 502/389-1626

MORK, JOHN W., Pres. & CEO, Gooding Rubber Co., P.O. Box 729, La Grange, IL 60525

★MORONI, E. T. (GENE), (Retired), Old Ben Coal Co. (Retired), P.O. Box 477, Herrin, IL 62948 618/942-5048

MORRISON, SCOTT D., Pres. & CEO, Commercial Testing & Engr. Co., 1919 S. Highland Ave., 210B, Lombard, IL 60148

MORRISON, TONY, Vice-Pres, Ford Steel Co., P.O. Box 54, Maryland Heights, MO 63043 314/567-4680

MORSE, RONALD E., Dir. , IL EPA, 2309 W. Main, Marion, IL 62959

MORTON, R. C., Fuels & Mining Contract Mgr., Public Service of Indiana, 1000 E. Main, Plainfield, IN 46168

MORVICH, JOHN, Mgr. Inventory Control, Americoal Development Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2400

MOSBY, ROGER C., Gen. Mgr., Cora Terminal, L.P., Rt. 1, Box 125, Rockwood, IL 62280 618/763-4798

MOTLEY, P. D., Marketing Mgr., Southern Explosives, Box 698, Glasgow, KY 42141

MOYERS, GLORIA, Accounts Payable Clerk, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208-2015

MULLINS, W. H., Consultant, Freeman United Coal Mining Co. (Retired) , 1019 Election Dr., Benton, IL 62812 618/439-3864

MURPHEY, LLOYD, Sales Mgr., Lummez Sales Company, 1059 Jennings Station Road, St. Louis, MO 63137 314/867-8725

MURPHEY, MARY-ELLEN, Owner, Lummez Sales Company, 1059 Jennings Station Road, St. Louis, MO 63137 314/867-8725

MURPHY, E. LOUIS, Retired, 74 Quail Valley, Princeton, WV 24740

MURRAY, ROBERT E., 32 Cotswold Ln., Moreland Hills, Chagrin Falls, OH 44022

MUSKO, JR., MICHAEL J., Sales, Fosroc, Inc. - Celtite Mining & Tunneling Div., Route 7, Box 453, Marion, IL 62959

MUTCH, DON, Safety Foreman, Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

MYERS, WARREN, District Sales Mgr., Bridon American, 1135 670th Place, Downers Grove, IL 60516

MYLDER, CHUCK, Ex. Vice Pres., Index Industries, 1645 Eastern S.E., Grand Rapids, MI 49507 616/245-0269

NALLEY, GARY, 3rd. Maint. Foreman, White County Coal Corp., P.O. Box 457, Carmi, IL 62821

NARUP, VIVIAN, Zeigler Coal Holding Co., 50 Jerome, Fairview Heights, IL 62208

NASH, BILL, Vice Pres. Ops., Black Diamond Coal, R.R. 3, Box 170A, Jasonville, IN 47438 812/648-0008

NAWROT, J.R., Assoc. Scientist, Southern IL University, Coop. Wildlife Res. Lab, Carbondale, IL 62901-6504 618/536-7766

NEELY, ROD, Owner, Control Valve Service, P.O. Box 9940, St. Louis, MO 63122 800/249-CVSI

NEILAN, PETE, Minesafe Electronics, P.O. Box 281, Sturgis, KY 42459

NELSON, JACK, Sales & Service Rep., Kennametal, Inc., 100 Dame Rd., Hanson, KY 24213-9771

NELSON, LONNIE G., Engr. Mgr., Cyprus AMAX Coal Co., P.O. Box 730, Marion, IL 62959 618/982-2101

NELSON, W. JOHN, Senior Geologist, IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820

NEMECEK, MONA L., Petroleum Geologist, IDNR-Div. Oil & Gas, 4849 Hillside Ave., Indianapolis, IN 46205 317/251-1244

NEUBAUER, ROBERT J., , Consultant, 1008 S. Butternut Circle, Frankfort, IL 60423

NEWMAN, FREDERICK G., Consulting Geologist, R.R. 1, Box 151A, Gillespie, IL 62033 217/839-3297

NEWTON, WADE, Service Technician, Long Airdox Co., 3206 W. DeYoung, Marion, IL 62959 618/997-4335

NIEBRUEGGE, PAUL E., Sales, Hopcroft Electric, Inc., 606 Glen Crossing Rd., Glen Carbon, IL 62034 618/288-7302

NIELSEN, CHRIS, Instructor, Rend Lake College, RR #1, Ina, IL 62846 618/437-5321

NIENHAUS, CHRIS, Reg. Mgr., Interroll Corp, 1207 Summerhawk Lane, Fenton, MO 63026 314/861-3500

NOAH, LARRY G., Owner, Raben Tire Co., 709 S. Commercial, Harrisburg, IL 62946 618/252-8638

NOEL SR., W. E. (BILL), Dis. Sales Cons., Long-Airdox Co., 3206 W. DeYoung, Marion, IL 62959 618/997-4335

NOEL, JR., BILL, Dist. Manager, Long-Airdox Co., 3206 W. DeYoung, Marion, IL 62959 618/997-4335

NOLEN, JR., JACK, Service Technician, Long-Airdox Co., 3206 W. DeYoung, Marion, IL 62959 618/997-4335

NORMAN, MACK, Monitor, Benetech, Inc., P.O. Box 193, Freeburn, KY 41528

NORRIS, DALE, Prep. Plant Mgr., Galatia Mine, Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6483

NORTON, GARY, Chief Internal Auditor, IL Dept. of Mines & Minerals, 300 W. Jefferson, Springfield, IL 62791

O'BRYAN, DAVE , Consultant (Retired), Peabody Coal Co., R.R. 2, Box 665, Linton, IN 47441

O'CONNELL, DANIEL, Branch Mgr., Illinois Bearing Co., 3761 Sangamon Ave., Springfield, IL 62707-9728

O'DOWD, MICHAEL A., Engr., FLEXCO, 7313 Kohler Dr., Barnhart, MO 63012

O'KEEFE, A. (MIKE), Mine Mgr., Arch of Illinois, Inc., 11317 Crystal Springs Rd., Sparta, Il 62286 618/443-4566

O'LEARY, WILLIAM, Land Reclamation Spec., IL Dept. of Mines & Minerals, #2 Coal Development Pk., Carterville, IL 62918 618/985-6525

O'TOOLE, HAROLD, Sales Engr., Camber Corp., P.O. Box 11041, Pittsburgh, PA 15237 412/367-8626

OAKLEY, KEN, Sales, Fairmont Supply Co., P.O. Box 1388, Mt. Vernon, IL 62864 618/244-5344

OAKS, STACEY, Purchasing Clerk, Americoal Development Co., 50 Jerome Lane, Fairview Heights, IL 62208

OBENHAUS, MARK, Sales, Fabick Power Systems, 101 Fabick Dr., Fenton, MO 63026 314/349-5500

ODLE, JERRY, State Mining Inspector, IL Dept. of Mines & Minerals, Rt. 1, Box 58A, Thompsonville, IL 62890

ODLE, JOE, Sales Rep., Rudd Equipment Co., 4679 New Baumgartner Rd., St. Louis, MO 63129 314/487-8925

OLDSEN, JOHN, Asst. VP - Sales, Jennmar Corp., 1330 Old Freeport Rd., Pittsburgh, PA 15238

OLTZ, DONALD, Sr. Geologist & Head, EMRG, IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/244-5116

OPOLKA, BRUCE, Warehouse Mgr., Peabody Coal Co., RR1, Box 135D, Marissa, IL 62257 618/295-2374

ORLANDI, WILLIAM J., Pres., Carbon Coal Co., 1525-35th Ave., Vero Beach, FL 32960 407/569-9756

OTT, PHILIP, Staff Engr., Freeman United Coal Mining Co., 3805 Brandenshire 203, Springfield, IL 62704 708/297-3500

OTTEN, MIKE, Parts Service Manager-Carterville, Roland Equipment Co., RR2, Box 220A, Carterville, IL 62918 618/985-3399

★ PACE, E. MINOR, (Retired), Inland Steel Coal Co., 700 Lake Park Dr., Mt. Vernon, IL 62864 618/242-3144

PAGLIAI, PAUL, V. Pres., Lay's Mfg., Inc., P.O. Box 457, 1121 S. 10th, Mt. Vernon, IL 62864

PANNELL, DON, District Sales Mgr, CSE Corporation, 330-C Harper Industrial Park, Beckley, WV 25801 304/255-0541

PAOLINI, ALFRED P., Dir., Mining Products, Jeffrey Mining Machinery Div., INDRESCO, 274 E. 1st Ave., Columbus, OH 43201 614/297-3428

PARKS, RAY, Pres., J. H. Fletcher Co., P.O. Box 2187, Huntington, WV 25722 304-525-7811

PARR, DAVE, Vice Pres., Decatur Industrial Electric, P.O. Box 1188, Decatur, IL 62525 618/244-1066

PASCHEDAG, Dr. Ulrich, V.P. Marketing & Dev., Westfalia Mining Progress, Inc., 255 Berry Road, Washington, PA 15301 412/833-9140

PASTOR, DENNIS, Product Sales Rep., Hancor, Inc., R.R. 3, Box 392, Pana, IL 62557 217/562-3435

PATEL, RAVJI M., Vice Pres., Roberts & Schaefer Co., 120 S. Riverside Plaza, Chicago, IL 60606 312/236-7292

PATTERSON, ANITA, Sec., Kerco, Inc., P.O. Drawer 665, Madisonville, KY 42431 502/821-2889

PATTERSON, BILL, Mgr. of Mines, Old Ben Coal Co., RR1, Box 166, Pinckneyville, IL 62274 618/758-2323

PATTERSON, R. KEITH, Mgr. of Engr., Jeffrey Division of INDRESCO, Inc., P.O. Box 387, Woodruff, SC 29388

PATTERSON, TOM, State Mine Inspector, IL Dept. of Mines & Minerals, 1670 Galatia Rd., Galatia, IL 62935

PATTON, KENNETH, Gen. Mgr., Mainline Power Products, P.O. Box 306, West Frankfort, IL 62896

PAYNE, JOHN W., Co-Owner., Heartland Pump Rental & Sales, Inc., 102 Brown Str., Carterville, IL 62918 618/985-5110

PEAK, STEVE, St. Louis Branch Mgr., Commercial Testing & Engr. Co., P.O. Box 15932, St. Louis, MO 63114 618/439/7211

PEARLMAN, PHYLLIS, Secretary, Women in Mining, 12400 Olive Blvd., Suite 402, St. Louis, MO 63141

PEARSON, JOE, Vice Pres., Sales, Arclar Coal Co., P.O. Box 444, Harrisburg, IL 62946

PEEBLES, EVELYN, Trans. Supv.-IL, Franklin Coal Sales, 500 N. DuQuoin, Benton, IL 62812

PENSONEAU, TAYLOR, Vice Pres., IL Coal Association, 212 S. Second St., Springfield, IL 62701 217/528-2092

PETERSON, EDWIN, Area Partner, Martin Engineering, One Martin Way, Neponset, IL 61345

PETERSON, PATRICK J., Sr. Mining Engr., Freeman United Coal Mining Co., PO Box 100, West Frankfort, IL 62896 618/932-2164

PETTER, ROBERT P.(BOB), Pres., Henry A. Petter Supply Co., Box 2350, Paducah, KY 42012-2350 502/443-2441

PHIFER, STEVEN C., Environ. Engr., Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

PHILLIPS, JIMMY D., Exec. Vice Pres., Phillips Machine Service, Inc., P.O. Box 1245, Beckley, WV 25801 304/255-0537

PIEFER, KENT, Sales Rep, Woodruff Supply Co., Inc., P.O. Box 426, Madisonville, KY 42431 502/821-3247

PIKE, ROCKY, Mgr., Maintenance, Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

PINCOMB, ART, Sr. Geologist, Rust Environmental and Infrastructure, 1240 E. Diehl Rd., 5th Floor, Naperville, IL 60563 708/955-6669

PINTO, GREG, Envir. Prot. Engr., IL Dept. of Mines & Minerals, 300 W. Jefferson, Springfield, IL 62791 217/782-4970

PIRCON, JOSEPH J., Pres. & CEO, Benetech, Inc., 1750 Eastwood Drive, Aurora, IL 60506 708/844-1300

PIRCON, RON, Benetech, Inc., 1750 Eastwood Dr., Aurora, IL 60506 708/844-1300

PISANESCHI, PETER R., Engr. Adv., Monterey Coal Co., P.O. Box 496, Carlinville, IL 62626

PLATT, MARC, Reg. Sales Rep., Kuriyama of America, Inc., 1221 Landmeier Rd., Elk Grove Village, IL 60007 708/228-0300

PLETKA, CHARLES S., Sales, Service Machine Co., P.O. Box 880, Barboursville, WV 25504-0880 304/736-8933

PLETT, TERRY, Sales, Sivyer Steel, 225 S. 33rd St., Bettendorf, IA 52722 319-355-1811

+POLING, GILBERT,

POLITO, MARCO A., Vice Pres. Sales, B. P. Tracy Co. (Div. Washington Mould), P.O. BOX 518, Washington, PA 15301 412/228-2160

POLLACK, TOM, Owner & President, Associated Supply Co., P.O. Box 86, West Frankfort, IL 62896 618/932-3114

POND, ROBERT A., Vice Pres., Frontier-Kemper Constructors, Inc., P.O. Box 6548, Evansville, IN 47712 812/426-2741

POPP, JOHN T., Geologist, MAPCO Coal, Inc., 2525 Harrodsburg Rd., #300, Lexington, KY 40504-3331

PORTER, DICK, Division Pres., Austin Powder Co., 400 N. Bluff, Collinsville, IL 62234 618/344-3111

PORTER, JOHN B., Mining Engr., Old Ben Coal Co., P.O. Box 721, Coulterville, IL 62237-9999 618/758-3089

POWLES, B. L., Traffic Trans. Consult., Azcon Corp., P.O. Box 616, Alton, IL 62002 618/413-3770

PRESLER, DONALD, Mfgs. Rep., Don Presler & Assoc., 4501 Urbana Road, Millstadt, IL 62260 314/567-6705

PRICE, TIM, Outside Sales Rep., McJunkin Corp., 3108 Blackberry St., Mt. Vernon, IL 62864 618/242-8272

PRIOR, GINGER, Pres., General Belt Service, Inc., P.O. Box 22, Benton, IL 62812 618/439-3718

PRIOR, IVAN, General Belt Service, Inc., P.O. Box 22, Benton, IL 62812 618/439-3718

PRIOR, MATT, General Belt Service, Inc., P.O. Box 22, Benton, IL 62812 618/439-3718

PRITCHETT, RODNEY R., Sales Mgr., Du Quoin Iron & Supply Co., P.O. Box 181, DuQuoin, IL 62832 800/535-5157

PTASNIK, LEE, Pres., Mine & Process Service, Inc., P.O. Box 484, Kewanee, IL 61443 309/852-6529

PUCKETT, RANDY, Vice Pres. Sales, Lebco, Inc., P.O. Box 656, Benton, IL 62812 618/439-6345

PURNELL, MICHAEL, Coal Res. & Development, IL DENR, 325 W. Adams, Room 300, Springfield, IL 62704-1892 217/782-6370

QUAM, R. ERIC, Mgr. of Engr., Old Ben Coal Co., 500 N. Du Quoin, Benton, IL 62812 618/435-8176

RABEN, TOM, Owner/Pres., Raben Tire Co., 2100 N. New York Ave., Evansville, ILN 47711 812/424-9600

RAINES, GARY, Mgr. Reclamation, Consolidation Coal Co., P.O. Box 566, Sesser, IL 62884 618/625-2041

RALPH, DOUG, Sales Coord., Morgantown Machine & Hydraulics, P.O. Box 191, Nashville, IL 62263 618/327-3095

RALSTON, DAVID S., Agronomist, Cyprus AMAX Coal Co., 20 N.W. First St., Evansville, IN 47708 812/421-3983

RAMER, RALPH W., Pres., Screenco, Inc., 3003 Brainard Rd., Pepperpike, OH 44124 800/323-0606

RAMIREZ , MIKE, Mgr. Prep Plants, Old Ben Coal Co., 500 N. DuQuoin St., Benton, IL 62812 618/435-8176

RAMSEY, DANNY R., Mine Mgr, Mine 26, Old Ben Coal Co., 500 N. Du Quoin, Benton, IL 62812 618/439-5360

RAUZI, KEN, Dist. Mgr., ILL-MO Welding Products Co., P.O. Box 2219, Mt. Vernon, IL 62864 618/242-8716

REA, RICHARD, Mgr. Fuel Acquisitions, Tennessee Valley Authority, 1101 Market Str., Chattanooga, TN 37402 615/751-2651

READY, DALE, Owner, Ready Drilling Co., R.R. 1, Box 201B, Mason, IL 62443 618/238-4306

REED, CHARLES E. , Vice Pres., Kerco, Inc., P.O. Drawer 665, Madisonville, KY 42431 502/821-2889

REES, BEN H., Sales, Rees Mine Supply Sales, Inc., P.O. Box 296, Du Quoin, IL 62832

REEVES, JEFF, KY Sales & Service, American Mine Tool Co., 2350 Anton Road, Madisonville, KY 42431

REIDELBERGER, JIM, Pres., Midwest Drives, 4000 Ind. Dr., St. Peters, MO 63376 314/928-9555

REILLY, MICHAEL K., Chairman & CEO, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2401

REILLY, WILL, Gen. Mgr., American Longwall Rebuild, Inc., 1250 Industrial Park Rd., Bristol, VA 25201

REIMER, BOB, Sales Rep., Fabick Machinery Co., Box 760, Marion, IL 62959 618/997-1881

REINERTSEN, DAVID L., Senior Staff Geologist, EmeritusEmeritus, IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/333-7372

RESNIK, WILLIAM L., Sales Rep.-Marion Div., Birmingham Bolt Co., 809 Skyline Dr., Marion, IL 62959 618/993-2611

REYNOLDS, MARK, Regional Sales Mgr., Georgia Duck & Cordage Mill/Long Air, 2757 Brighton Ct., Geneva, IL 60134

RICE, C. ARTHUR, Adminis. Asst., IL Dept. of Mines & Minerals, 503 E. Main St., Benton, IL 62812

★ RICE, FRED, (Retired), Peabody Coal Co., 202 Miller St., Beaver Dam, KY 42320

RICE, JIM, Pres., Southern IL Retreading, Hwy. 51 South, DuQuoin, IL 62832 618/542-4741

RIGDON, BOB, Sales Manager, Flanders Electric of Illinois, 1000 N. Court St., Marion, Il 62959 618/993-2681

RIGGS, LLOYD E., Maint. Supv., Cyprus AMAX Coal Co., Box 144, Keensburg, IL 62852 618/298-2394

RILEY, LARRY, Catalog Admin., Peabody Development Co., 301 N. Memorial Dr., St. Louis, MO 63102 314/342-7666

RILEY, ROY, Sales, J&R Manufacturing Co., Rt. 2, Box 173F, Bluefield, VA 24605 703/322-5431

RIMSTIDT, DAN, Fuels Procure. Mgr., PSI Energy, Inc., 1000 E. Main St., Plainfield, IN 46168 317/838-1864

RING, JEFF, Buyer, Americoal Development Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2400

RIPP, BRYAN, Geological Engr., Weir Internl. Mining Consults. Ltd., 2340 River Road, Suite 203, Des Plaines, IL 60018 708/297-3500

ROBBINS, DENNIS, Surface Maintenance Supt., Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6592

★ ROBERTS, E. H., (Retired), 6 Lincoln Drive, Mt. Vernon, IL 62864

ROBERTSON, JOE A., SURVEYOR, IL Mine Subsidence Insurance Fund, 4 Executive Dr., Suite 4, Fairview Hts., IL 62208 618/624-3350

ROBINSON, MARK, Plant Manager, Eagle Seal Mine Sealant, P.O. Box 283, McLeansboro, IL 62859 618/643-2588

ROBINSON, MARY, Eagle Seal Mine Sealant, P.O. Box 283, McLeansboro, IL 62859 618/643-2588

ROBINSON, ROGER D., Product Support Mgr., Construction Machinery Corp., P.O. Box 97, Marion, IL 62959 618/993-2299

ROBISON, RONALD, Supv., Experimental Mine, University of Missouri, Rolla, 226 McNutt Hall, Rolla, MO 65401 314/341-4753

ROGERS, JOE C., Purchasing Agent, Brushy Creek Coal Co., Inc., 4270 N. America Rd., Galatia, IL 62935-9694

ROHDE, C. M. (CHUCK), Dist. Mgr., Continental Conveyer & Equip. Co., Inc., P.O. Box 2507, Mt. Vernon, IL 62864

ROMAN, GEORGE H., Mining Information Services, 29 N. Wacker Dr., Chicago, IL 60606

RONALD, GARY, Surface Mgr., Freeman United Coal Mining Co., Box 337, Virden, IL 62640

ROOF, JEFF, Warehouse Mgr., Lakeshore Mining Equip. Corp., Industrial Park Rd. RR4, Benton, IL 62812 618/435-4422

ROPER, ROGER D., Mine Supt., Old Ben Coal Co., Rt. 1, Box 759, Sesser, IL 62884 618/439-5201

RORICK, ANDREW H., Forest Geologist, Shawnee National Forest, 901 S. Commercial, Harrisburg, IL 62946 618/253-7114

ROS, TONY, Sales Engr., Hagedorn & Gannon, 550 Axminister, Fenton, MO 63026 314/349-3370

ROTH, AL, Mgr. of Engr., Cyprus AMAX Coal Co., P. O. Box 144, Keensburg, IL 62852 618/298-2394

ROTTGERING, JOHN, Supv., Henry A. Petter Supply Co., 117 S. First, P.O. Box 2350, Paducah, KY 42001 502/443-2441

ROTTMAN, BERNARD, Regulatory Affairs Mgr., Black Beauty Coal Co., P.O. Box 312, Evansville, IN 47702 812/665-7881

ROTZ, SCOTT, Mgr., Repair Services, Decatur Industrial Electric, P.O. Box 1188, Decatur, IL 62525 618/244-1066

ROWLAND, STEVE S., Gen., Mgr., Galatia Mine, Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

ROWLEY, LARRY W., Mfg., Mining Controls, Inc., P.O. Box 1141, Beckley, WV 25801 304/252-6243

ROYE, STEVE, Maint. Foreman, Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

RUCH, RODNEY R., Assist Branch Chief, Mineral Res.& Engr. , IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/244-2431

RUDZINSKI, JOE, Sales, Tabor Machine Co., Box 3037 Bluewell Station, Bluefield, WV 24701 304/327-2431

RUPPEL, TOM, Somerville Coal Mining Corp., 2310 Decker Dr., Vincennes, IN 47591

RUSYNIAK, JOHN, Acct. Mgr., Reliance Electric Co., 467 Fox Trail Drive, Lake St. Louis, MO 63367 314/625-2206

RUTLAND, RANDY, Vice Pres., Construction Machinery Corp., P.O. Box 97, Marion, IL 62959 618/993-2299

RYAN, JAMES T., Vice Pres., Freeman United Coal Mining Co., 111 Airway Drive, Marion, IL 62959 618/997-7608

RYAN JR., JOHN T., Chairman of Exec. Comm., Mine Safety Appliances Co., P.O. Box 426, Pittsburgh, PA 15230 412/967-3272

★SADLER, THOMAS B., (Retired), Old Ben Coal Co. (Ret.), RR2, Box 00, Benton, IL 62812-9802 618/439-4945

SAILLIEZ, GASTON, Warehouse, Truck Driver, Fansteel VR/Wesson, P.O. Box 511, West Frankfort, IL 62896

SANCHEZ, R. RAYNETTE, Buyer, Monterey Coal Co., P.O. Box 496, Carlinville, IL 62626 217/854-4221

SANDBERG, CHARLES, State Program Mgr., OSMRE, 511 W. Capitol #202, Springfield, IL 62704 217/492-4495

SANDERS, BILL, State Mine Inspector, IL Dept. of Mines & Minerals, 308 W. Parker, Apt. A, Pinckneyville, IL 62274

SANDERS, NEDA, Legis. Liaison, IL Dept. of Mines & Minerals, 503 E. Main St., Benton, IL 62812

SANDUSKY, EARL E., Field Rep., Joy Technologies, Inc., Box 73, Benton, IL 62812 618/439-6409

SANTOPIETRO, MARK, Chemist, Kennedy Metal Products, P.O. Box 138, Taylorville, IL 62568 217/287-7231

SARVER, BARRY, Factory Rep., J&R Manufacturing Co., Rt. 2, Box 173F, Bluefield, VA 24605 703/322-5431

SATTERFIELD, STEVE, Illinois Land Mgr., Old Ben Coal Co., 500 N. Du Quoin, Benton, IL 62812 618/435-8176

SAUNDERS, ALAN, Mine Engr., White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

SAWYER, THOMAS H., Owner, Tom Sawyer Electric Sales, Inc., P.O. Box 921, Marion, IL 62959 618/997-4735

SAXTON, BOB, Sales & Marketing Mgr., American Mine Research, Inc., P.O. Box 234, Rocky Gap, VA 24366 703/928-1712

SCHARP, ROBERT C., Pres. Operations, Kerr-McGee Coal Corp., P.O. Box 25861, Oklahoma City, OK 73125 405/270-2591

SCHAUBLE, ROY, National Acct. Mgr.-Mining, Texaco Lubricants Co., 1714 Deer Tracks Trail, 2nd Fl, St. Louis, MO 63131 314/965-3341

SCHERRER, JOHN C., Midwest Mgr., Guyan Machinery Co., 226 E. 9th St., Owensboro, KY 42303

SCHMEIDERER, MARJORIE, Consultant, 2051 Beckman Rd., RR1, Lenzburg, IL 62255 618/295-2374

SCHMITZ, SCOTT, Supv. Land Reclam., IL Dept. of Mines & Minerals, 300 W. Jefferson St., Suite 300, Springfield, IL 62791

SCHNAKE, J. STEVE, Project Mgr., Old Ben Coal Co., 500 N. DuQuoin St., Benton, IL 62812-1224 618/435-8176

★ SCHONTHAL, JOSEPH, Pres., J. Schonthal & Assoc., Inc. (Retired), 1220 Rudolph, Apt. 2N, Northbrook, IL 60062 618/480-7359

SCHROEDER, JOE, Sales Engr., Industrial Process Equip., P.O. Box 2800 Locust St., St. Louis, MO 63103

+SCHUBERT, R. R.,Vigor & Billings , P.O. Box 1239, Ashland, KY 41101

SCHULTZ, WALLY, Mgr. Contracts Adminis., Americoal Development Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2400

SCOLAN, TOM, Product Mgr., Hummer of Naperville, 3300 Ogden, Lisle, IL 60532 708/505/8282

SCOTT, ALAN, Section Foreman, White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

SCOTT, JAMES J., Pres., Scott M.T.S., Inc., HCR 33, Box 36, Rolla, MO 65401 314/364-4008

SEAMAN, GEORGE, Res. Engr., Old Ben Coal Co., 500 N. Du Quoin, Benton, IL 62812 618/439-5265

SEAVERS, WAYNE, Mine Surveyor, Old Ben Coal Co., 8269 Knox Road, West Frankfort, IL 62896-9802 618/937-1220

SEAY, BILL, Sr. Buyer, Americoal Development Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2400

SEBASTIAO, A. BUDDY, Mgr. of Marketing, Centrifugal & Mechanical Industries, 146 President Street, St. Louis, MO 63118 314/894-1711

SERADERIAN, PASCAL, Pres., Hutchinson, Inc./Raben Tire, 460 Southard Str., Trenton, NJ8638

SEVIM, HASAN, Assoc. Prof., Southern IL University, Dept. of Mining Engr., Carbondale, IL 62901

SHANKS, ROBERT W., Pres., Arch of Illinois, Inc., P.O. Box 308, Percy, Il 62272 618/497-2141

SHARP, STEPHEN E., Supt., Cutler Mining Co., Route 4, Box 347, Benton, IL 62812 618/439-4108

SHAULIS, JERRY, Sales Mgr., Gauley Sales Co., P.O. Drawer C, Hico, WV 25854 304/568-5201

SHEFFER, JERRY, Constr. Supv., Peabody Coal Co., 627 S. Morgan St., Morganfield, KY 42437

SHELBY, BARRY C., Owner, Shelby Spray Systems, P. O. Box 24, Greenville, KY 42345 502/338-4476

SHIELDS JR., MARVIN, Vice Pres., Engr., Tabor Machine Co., Box 3037, Bluewell Station, Bluefield, WV 24701 304/327-2431

+ SHIMKUS, ERVIN L., Safety Mgr., Peabody Coal Co., 609 Christopher Lane, New Baden, IL 62265-2002

★ SHOCKLEY, RICHARD R., Director, IL Clean Coal Institute, P.O. Box 8, Carterville, IL 62918-0008 618/985-3500

SHREWSBERRY, JOE, Sales Engr., American Mine Research, Inc., P. O. Box 234, Rocky Gap, VA 24366 703/928-1712

SHULTZABARGER, TIM, Acct. Rep., DuPont, 7221 Rucker Rd. #1, Henderson, KY 42420

SHUMATE SR., MACK H., Sr. V. P./Engr. & Plan. (Retired), Zeigler Coal Co., 6425 Longmeadow, Lincolnwood, IL 60646 708/677-6198

SIEMGLUSZ, MARY E., Sr. Engineer, Marston & Marston, Inc., 13515 Barrett Pkwy. Dr., St. Louis, MO 63021 314/984-8800

SIGMUND, DALE E, Pres., Sligo, Inc., Box 171, 140 E. Prairie Ave., St. Louis, MO 63166 314/231-3050

SIHLER, STEVE, Acct. Mgr., Texaco Lubricants Co., 1714 Deer Tracks Trail, St. Louis, MO 63131 314/965-3341

SILLIMAN, BOBBY, Sales Engr., A. L. Lee Corporation, PO Box 2370, Mt. Vernon, IL 62864

SILVERMAN, MARC S., Mgr.-Geologic Services, Peabody Development Co., 301 N. Memorial Dr., St. Louis, MO 63102 314/342-7652

SIMMONS, STEVE, Office Mgr., Mainline Power Div., J. H. Service Co., Inc., P.O. Box 306, West Frankfort, IL 62896

★ SIMON, JACK A., Retired Chief Emeritus, IL State Geological Survey, 502 W. Oregon, Urbana, IL 61801 217/367-3462

SIMPSON, JAMES M., Supt., Spartan Mine, Old Ben Coal Co., P.O. Box I, Sparta, IL 618/758-2312

SIMS, STEVE, Parts Mgr., Construction Machinery Corp., P.O. Box 97, Marion, IL 62959 800/993-2299

SINK, BARRY F., Supv., Project Engineering, Old Ben Coal Co., 500 N. DuQuoin, Benton, IL 62812 618/435-8176

SITTER, PHILLIP , Chief Fiscal Officer, IL Dept. of Mines & Minerals, 300 W. Jefferson, Springfield, IL 62791 217/782-6791

SKILLINGTON, DAN, Acct. Mgr., Texaco Lubricants Co., 1714 Deer Tracks Trail, St. Louis, MO 63131 314/965-3341

SLACK, CLAYTON F., Pres. (Retired), CLUES Corp., 1602 Matthew Lane, Marion, IL 62959 618/992-6988

SLATE, STEVE D., Factory Rep., J&R Manufacturing Co., Rt. 2, Box 173F, Bluefield, VA 24605 703/322-5431

SLEDGE, CAROL, Office Mgr., Joy Technologies, Inc., #4 Industrial Park, Mt. Vernon, IL 62864 618/242-3650

SLOAN, WALTER E., (Retired), 1885 Linneman Rd., Cincinnati, OH 45238

SLOAT, DAVID G., Sr. Mech. Proj. Engr., Sargent & Lundy, Inc., 55 E. Monroe St., Chicago, IL 60603-5780 312-269-2784

SLYGH, PHIL, Mine Sales Rep., Raben Tire Co., 709 S. Commercial St., Harrisburg, IL 62946 618/252-8638

SMART, MICHAEL, Gen Mgr., Franklin Co. Mines, Old Ben Coal Co., 500 N. DuQuoin St., Benton, IL 62812 618/435-8176

SMITH, CECIL, Maint. Supv. Mine 21, Old Ben Coal Co., P.O. Box 346, Benton, IL 62812 618/439-6792

SMITH, GREG, Territory Mgr., PLEXCO, 1050 Busse Rd., Suite 200, Bensenville, IL 60106-1000 708/350-3727

SMITH, GREGORY C., Vice Pres., Geology, Stagg Engineering Services, Inc., P.O. Box 7028, Cross Lanes, WV 25356 304/776-6660

SMITH, HOWARD, Parts & Service Rep., Fabick Machinery Co., P.O. Box 760, Marion, IL 62959 618/997-1881

SMITH, LINDA, Accounts Payable Clerk, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208-2015

SMITH, MICHAEL J., Director of Engr., Zambrana Engineering, Inc., 710 N. Tucker, Suite 601, St. Louis, MO 63101 314/244-4744

SMITH, SHANNON K., Sales, Mgr., S & S Urethane, Inc., Rt. 185, Farina, IL 62838

SMITH, SONNY, S&S Distributors, P.O. Box 186, Farina, IL 62838 618/245-6476

SMOCK, PAUL, Supt. Undergr. Ops., Brushy Creek Coal Co., Inc., 4270 N. America Rd., Galatia, IL 62935-9694 618/252-8633

SNEED, DWIGHT L., Material Recovery Supv., Americoal Development Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2482

SNYDER, DUKE, Dist. Mgr., Morgantown Machine & Hydraulics, P.O. Box 191, Nashville, IL 62263 618/327-3095

SNYDER, JOHN, Maint. Supt., Brushy Creek Coal Co., Inc., 4270 North America Rd., Galatia, IL 62935 618/252-8633

SOLLAMI, JIM, Vice Pres., Sollami Co., P.O. Box 627, Herrin, IL 62948 618/988-1521

SOLLAMI, PHILLIP, Pres., Sollami Co., P.O. Box 627, Herrin, IL 62948 618/988-1521

SORRELL, SHERWOOD W., (Retired), Peabody Coal Co. (Retired), 201 Joseph Dr., Fairview Heights, IL 62208 618/632-4395

SOWELL, JERRY, Sales, Dayco Corp., 403 Blue Bird St., Troy, IL 62294 618/667-2971

SPEDDING, PAUL, Reg. Sales Mgr., Meco Belts/American Longwall, P.O. Box 102, Whittington, IL 62897 618/629-2402

SPENCER, JOHN E., Sales Rep., Patterson, 835 Twin Pine Dr., St. Louis, MO 63122 314/965-0770

SPINDLER, DEAN, Reclam. Specialist, IL Dept. of Mines & Minerals, P.O. Box 10197, Springfield, IL 62791-0197

SPIVEY, JOSEPH S., Pres., IL Coal Association, 212 S. 2nd St., Springfield, IL 62701 217/528-2092

SPOTTE, WALTER V., Pres., Lincoln Hydraulics, Inc., 20 Museum Rd., Washington, PA 15301-6134 412/222-2700

SPRAGUE, JIM, Sales Rep, The Sollami Co., P.O.Box 627, Herrin, IL 62948

SPRESSER, ROGER, State Mine Inspector, IL Dept. of Mines & Minerals, 47 Illini Drive, Taylorville, IL 62568

SPURLING, GARY A., Asst. to Pres., Jack Kennedy Metal Prods. & Bldgs., Inc., P.O. Box 138, Taylorville, IL 62568 217/287-7231

SROGI, ART, Application Spec., WINCO, Inc., 225 Western Dr., Chesterfield, IN 46017 317-378-5035

SROGI, WIN, Pres., WINCO Sales, P.O. Box 251, Chesterfield, IN 46017

STAGG, ALAN K., Pres.-Principal Geol., Stagg Engineering Services, Inc., P.O. Box 7028, Cross Lanes, WV 25356-0028 304/776-6660

STANLEY, JERRY, Survey Party Chief, Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

STATLER, DAN, Reg. Sales Mgr., Kennametal, Inc., P.O. Box 231, Latrobe, PA 15650 412/539-5342

STEELE, DEREK JOHN, Principal, Dames & Moore, 7717 Stonehenge Dr., Cincinnati, OH 45242 513/651-3440

STEELE, TOMMY JOE, Safety Mgr., White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

STEEPLE, JIM, Product Mgr., Bunkers, American Longwall, Inc., 13 Hillcrest, Pittsburgh, PA 15202 412/766-4243

STEIMEL, BOB, Mgr. Sales, S. Cohn & Son, Inc., RR#4, Box 353A, Washington, IN 47501

STEINKE, MICHAEL P., Mgr. MRO Acquisition, Americoal Development Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2400

STEINKE, MIKE, Sales, Sligo, Inc., 140 E. Prairie Ave., St. Louis, MO 63147 314/231-3050

STEPHENS, KEVIN, Mgr., S. Cohn & Son, Inc., RR #4, Box 353A, Washington, IN 47501

STERNER, ROBERT M., Staff Mine Engr., Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6582

STEWARD, LARRY, Dir. Materials Management, Peabody Coal Co., P.O. Box 1990, Henderson, KY 42420-1990 502/827-6901

STEWART, J. R. (BOB), Sales, Better Belt Wiper Service, Inc., P.O. Box 485, Royalton, IL 62983 618/984-2074

STEWART, MICHAEL, Sales Mgr., K&E Technical, Inc., Box 165, West Frankfort, IL 62896

STILLEY, RICHARD, Surface Min. Prod. Spec., Century Lubricants, P.O. Box 161, Marion, IL 62959 618/997-2302

STOKER, STEVE, Mgr., MMS, 21 Country Lakes Lane, Waterloo, IL 62298-2901

STOMBERSKI, TOM, Regional Mgr., Kiefer Electrical Supply Co., RR#3, Rend City Rd., Benton, IL 62812 618/724-2415

STREET, HOMER, Opers. Mgr., Heintzmann Corp., P.O. Box 301, Cedar Bluff, VA 24609 703/9643-7413

STROTHMANN, KRIS, Sales Rep., Kennametal, Inc., P.O. Box 231, Latrobe, PA 15650 412/539-5342

SUBLETTE, WILLIAM F., Sales Mgr., Hemscheidt America Corp., 115 Industry Dr. P.O. Box 500, Pittsburgh, PA 15230 412/787-7130

SUBOLESKI, STANLEY C., A. T. Massey Coal Co., P.O. Box 26765, Richmond, VA 23261 814/867-7882

SUMMERS, KEITH, A/R & Billing Supv., Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208-2015

SUMMERS, MARY J., Secretary, IL Dept. of Mines & Minerals, 503 E. Main St., Benton, IL 62812

TABOR, HOLLIS, Pres., Norris Screen, 403 S. Wickham Ave., Princeton, WV 24740 304/487-2478

TABOR, LINDY, Pres., Tabor Machine Co., Box 3037, Bluewell Station, Bluefield, WV 24701 304/327-2431

TAIE, DARRELL, Reg. Sales Mgr., Laffey Equipment Co., P.O. Box 16285, St. Louis, MO 63105

TALBERT, TIM, Production Mgr., A. L. Lee Corporation, P.O. Box 2370, Mt. Vernon, IL 62864

TASSA, JOHN, Mgr.-Anchorage Sys., DuPont Co., Hoffman Rd., Falling Waters, WV 25419

★ TAUCHER, R. A., (Retired), Consolidation Coal Co., 20 Patton Dr., Pinckneyville, IL 62274 618/357-5173

TAYLOR, GAIL, GIS Spec., IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/244-6949

TAYLOR, JIM B., Special Account Adminis., Continental Conveyer & Equip. Co., Inc., Box 400, Winfield, AL 35594 205/487-6492

TAYLOR, JIMMIE, Lab Mech. Exp. Mine, University of Missouri, Rolla, 226 McNutt Hall, Rolla, MO 65401 314/341-6406

TAYLOR, MARK S., Mgr, Minesafe Electronics, P.O. Box 163, Sturgis, KY 42459 502/333-5581

TAYLOR III, LLOYD W., Central Div. Mgr., Commercial Testing & Engr. Co., 16130 Van Drunen, South Holland, IL 60473 618/439/7211

TEISA, EMIL J., R.R. 1, Box 5, Coffeen, IL 62017 217/534-2275

THEYS, TERRY, Engr. Supv., Cyprus AMAX Coal Co., P.O. Box 144, Keensburg, IL 62852 618/298-2394

THOMAS, CHRIS, Asst. Branch Mgr., Commercial Testing & Engr. Co., P.O. Box 752, Henderson, KY 42420 502/827-1187

THOMAS, JOE, Sales Mgr., Voest Alpine, 4853 Campbell's Run, Pittsburgh, PA 15205 412/787-7527

THOMASSON, EDWIN M., Adjunct Assist. Prof., SIU Dept. Mining Engr., RR1, Box 399, Carbondale, IL 62901

THOMPSON, FRED, Sales Rep., Hydrodynamics Corp., 1420 N. Stockwell Rd., Evansville, IN 47715

THOMPSON, KRISTIE K., Buyer, Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

THOMSON, MICHAEL L., Gen. Sales Mgr., Fosroc, Inc. - Celtite Mining & Tunneling Div., P.O. Box 2600, Georgetown, KY 40324 502/863-6800

THOROGOOD, STEVE, Div. Gen. Mgr., American Longwall Rebuild, Inc., 1250 Industrial Park Rd., Bristol, VA 24201

TIEN, JERRY, Assist. Prof., University of Missouri, Rolla, 226 McNutt Hall, Rolla, MO 65401 314/341-4753

TILLSON JR., CHARLES B., Consultant, 1920 SE 32nd Terr., Cape Coral, FL 33904-4429 813/945-3071

TOLBERT, DARYL, Gen. Foreman, Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

TOMPKINS, DAVE, Indus. Tire Market Mgr., Hutchinson Co., 460 Southard St., Trenton, NJ8638 609-394-1010

TORRES, JOHNNY P., Environ. Engr., Arch of Illinois, Inc., P.O. Box 308, Percy, IL 62272 618/497-2141

TOWERS, RICK, Pres., Towers Mine Tool, Inc., Box 133, Christopher, IL 62822 618/724-4967

TOWERS, TOM, Consultant, Towers Mine Tool, Inc., Box 133, Christopher, IL 62822 618/724-4967

TRACY, BILL, Sales Rep., M&S Fire & Safety, P.O. Box 4348, Evansville, IN 47724 812/424-3863

TRAVELSTEAD, CHAS., Pres., Eidson Steel Products, 8301 Broadway SE, Albuquerque, NM 87105 505/873-0160

TREWORGY, COLIN, Geologist, IL State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820 217/244/2422

TRIPLETT, THEODORE L., Civil Engr., Twin Cities Res. Center, 5629 Minnehaha Ave. S., Minneapolis, MN 55417

TROWBRIDGE, MARK, Sales, Kerco, Inc., P.O. Drawer 665, Madisonville, Ky 42431 502/821-2889

TRUE, RANDY, Sales Rep, R & H Service & Supply Co., P.O. Box 250, Carterville, IL 62918 618/985-8316

TRUEBLOOD, TED, Pres., Trueblood Oil Company/Chevron, P.O. Box 18, Farmersburg, IN 47850

TRYGSTAD, JOHN, Gen. Supt., Brushy Creek Coal Co., Inc., 4270 N. American Rd., Galatia, IL 62935 618/252-8633

TUCKER, JOHN B., Sales Mgr., Conex, Inc., 233 Bon Harbor Cove, Owensboro, KY 42301

TUCKER, RON, Sales Engr., A. L. Lee Corporation, P.O. Box 2370, Mt. Vernon, IL 62864

TUPPER, LESTER H., Illinois Sales Mgr., Strata Products (USA), Inc., Rt. 4, Box 290, Mt. Vernon, IL 62864 618/662-2163

TUREK, STEVE, Branch Mgr., Fabick Machinery Co., P.O. Box 760, Marion, IL 62959 618/997-1881

TURNER, JAMES E., IL Sales, American Mine Tool Co., 305 S. Logan, West Frankfort, IL 62896 618/932-3379

TURREL, JOHN D., Pres., Hydrocarbon Survey, Inc., R.R. 2, Box 238, Mt. Vernon, IL 62864 618/242-6549

UGO, JOHN A., Sales, Coldwell & Co., Inc., Box 42, Terre Haute, IN 47808 812/232-0276

UNAL, DR. AHMET, Assist. Prof., University of Missouri, MO, 226 Mc Nutt Hall, Rolla, MO 65401 618/549-2817

URMSTON, WALTER W., Owner, OKI Padgett Systems, #2 Simons Lane, Fairfield, OH 45014 513/870-0220

URTSO , LEONARD R., Pres., A. L. Lee Corporation, P. O. Box 99, Lester, WV 25865

VALETT, GENE L., Project Mgr., MK-Ferguson, 7295 Highway 94 S., St. Charles, MO 63303 314/441-8086

VAN CLEVE, MIKE, General Maint. Foreman, White County Coal Corp., P.O. Box 457, Carmi, Il 62821 618/382-4651

VAN DERVEER, DICK, Exec. VP, Ocenco, Inc., 10225 82nd Ave., Kenosha, WI 53142-7737 414/947-9000

VAN ROOSENDAAL, DAN , Geol. Engr., Weir Internol. Mining Consultants, 2340 River Rd., Suite 203, Des Plaines, IL 60018 708/305-7900

VANCIL, J.B. (SAM), Asst. Dir., IL Dept. of Mines & Minerals, 503 E. Main, Benton, IL 62812

VEHIGE, MIKE, Sales Rep., Laffey Equipment Co., P.O. Box 16285, St. Louis, MO 63105 314/427-7414

VEHLOW, PAUL E., Sup. of Design/Reclam., Abandonened Mines Reclam. Ccl., 928 South Spring Str., Springfield, IL 62704 217/782-0588

VEIZER, CARLA, Secretary, Arch Coal Sales, City Place One, Suite 300, St. Louis, MO 63141

VETTER, KEN, Dist. Mgr., Falk Corporation, 180 Weidman Rd., Manchester, MO 63021 314/256-7600

VITUCCI, LOU, Dist. Mgr., Lincoln Electric Co., 1824 Lackland Hill Pkwy, Suite 300, St. Louis, MO 63146 314/993-5465

WAGNER, DUANE, Sales, Mt. Vernon Electric, Inc., 1327 Harlan Rd., Mt. Vernon, IL 62864 618/244-1066

WALDEN, FRED E., Land Reclamation Spec., IL Dept. of Mines & Minerals, P.O. Box 10197, Springfield, IL 62791-0197

WALKER, CLIFF, Supt., Old Ben Coal Co., 500 N. Du Quoin, Benton, IL 62812 618/758-2395

WALKER, JOHN, Sales Mgr., General Steel Contractors, P.O. Box 1078, Hopkinsville, KY 42241 502/886-8857

WALKER, MICHAEL, SALES, National Mine Service Co., P.O. Box 1766, Mt. Vernon, IL 62864

WALL, RONALD B., Chief Engr., Freeman United Coal Mining Co., P.O. Box 100, West Frankfort, IL 62896 618/932-2164

WALLACE, HARVEY, Sales, Cima Electrical & Mine Services, Rt. 2, Box 320, Benton, IL 62812 618/439/7211

WALLACE, JEFFREY SCOTT, Electrical Maint. Engr., Old Ben Coal Co., 500 N. DuQuoin St., Benton, IL 62812 618/439-5300

WALLACE, ROD, Pres., Wallace Auto Parts, P.O. Box 68, Raleigh, IL 62977-0068

WAMPLER, BILL, Prest, Clinch River Corp., Rt. 6, Box 60, Tazewell, VA 24651

WARNSMAN, MIKE, Mine Planning Engr., Old Ben Coal Co., 500 N. Du Quoin, Benton, IL 62812 618/435-8176

WARREN, RONALD B., Gen. Mgr., Jennmar Corp., P.O. Box 70, Flora, IL 62839

WATKINS, JERRY, Purchasing Mgr., White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

WEADOCK, G. W. (MICK), District Sales Mgr., Stephens-Adamson Co., P.O. Box 832, Itasca, IL 60143-0832

+ WEARLY, WILLIAM L., Chairman of Board, Ingersoll-Rand Co., , Woodcliff Lake, NJ7675

WEAVER, RONALD B., Sales Rep., ABC Industries, Inc., Rt. 2, Box 422, Greenville, KY 42345

WEBB, DAVID L., Gen. Supt., Freeman United Coal Mining Co., Crown Complex, P.O. Box 337, Virden, IL 62572 217/965-5461

WEBB, DON, Supply Supv., Freeman United Coal Mining Co., Box 32, Waggoner, IL 62572

WEBB, JAMES J., Asst. Mine Supt., Planning, Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6564

WEBSTER, BRIAN, Sales, Kerco, Inc., P.O. Drawer 665, Madisonville, KY 42431 502/821-2889

WECKLER, BILL, Marketing & Sales Mgr., Mc Nally Wellman, 4800 Grand Ave, Pittsburgh, PA 15225 412/269-5002

WEGMAN, BRUCE E., Production Supv., Monterey Coal Co., 507 N. Pin Oak, Trenton, IL 62293 612/224-7223

+ WEIR, CHARLES R., (Retired), 9534 Normandy Ave., Morton Grove, IL 60053

+ WEIR, JOHN P., Consultant, Paul Weir Co., 2730 W. Lake Ridge Shrs, Reno, NV 89509-5736 708/446-9156

WELLINGER, THOMAS, Mgr., TMW & Associates, Inc., 2129 Barrett Sta. Rd. #245, St. Louis, MO 63131-1606 314/230-5547

WESLEY, SHANE, Shift Foreman, White County Coal Co., P.O. Box 457, Carmi, IL 62821 618/382-4651

WESTERHEIDE, JACKIE, Payroll Supervisor, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2466

WESTERHOUSE, CHUCK, Sales Engr., Du Quoin Iron & Supply Co., Box 181, Du Quoin, IL 62832 800/535-5157

WETZEL, JOE, Supt., Rend Lake Mine, Consolidation Coal Co., P.O. Box 566, Sesser, IL 62884 618/625-2071

WHEAT, SAUNDRA, T. J. Gundlach Machine Co., #1 Freedom Dr., Belleville, IL 62222 618/233-7208

WHEATLEY, CHARLES N., Pres., Sahara Coal Co., Inc., 3 First National Plaza, Chicago, IL 60602 312/782-2690

WHEELER, ROBERT E. , Outside Sales, Fairmont Supply Co., 1525 Herbert Street, Mt. Vernon, IL 62864 618/244-5344

WHITE, JOHN R., Pres., Hydro Power, Inc., P.O. Box 2181, Terre Haute, IN 47802 812/232-0156

WHITEHEAD, RICHARD, Sr. Vice Pres., Black Diamond Coal Co., RR2, Box 338, Sullivan, IN 47882 812/268-3778

WHITLEY, PERRY, Lead Safety Supv., Cyprus AMAX Coal Co., PO Box 144, Keensburg, IL 62852

WIFORD, LARRY, Branch Mgr., The Mine Supply Co., 1703 Shawnee, Mt. Vernon, IL 62864 618/242-2087

WILBURN, RICHARD L., IL Div. Mgr., Standard Laboratories, Inc., P.O. Box 39, Freeburg, IL 62243

WILKINSON, KEITH, Sales Rep., Brake Supply Co., Inc., P.O. Box 447, Evansville, IN 47703-047 812/479-6881

★ WILL, W. E., (Retired), Peabody Coal Co., 309 Ridgemont, Collinsville, IL 62234 618/345-5099

WILLIAMS, ARTHUR JOE, State Mine Inspector, IL Dept. of Mines & Minerals, 715 Susan Esther St., Benton, Il 62812 618/439-0901

WILLIAMS, DAVE, Gen. Mgr., Leeco Steel, Inc., 500 E. Marceau, St. Louis, MO 63111 800-234-5970

WILLIAMS, J. SCOTT, Pres., Egyptian Energies, Inc., P.O. Box 127, West Frankfort, IL 62896-0127 618/439-0305

WILLIAMS, MICHAEL G., Sales, Tricon Metals & Services, Inc., 1540 Lakewood Drive, Lexington, KY 40502 606/266-2381

WILLIAMS, STU, Sales Rep., Lebco, Inc., P.O. Box 656, Benton, IL 62812 618/439-6345

WILLIAMS, JR., ROBERT L., Reg. Mgr., Roberts & Schaefer Co., 120 S. Riverside Plaza, Chicago, IL 60606 312/236-7292

WILLIAMSON, KEMAL, Gen. Mgr., Cyprus Shoshone Coal Corp., P.O. Box 802, Hanna, WY 82327-0802 307/325-9531

WILLIAMSON, TOM, Sales Rep., Fosroc, Inc. - Celtite Mining & Tunneling Div., 7985 Coiltown Rd., Nebo, KY 42441-9564

WILLIARD, COLIN, Control Room Supv., Kerr-McGee Coal Corp., P.O. Box 727, Harrisburg, IL 62946 618/268-6584

WILLIS, GENE, Vice Pres. Sales, Joy Technologies, Inc., 120 Liberty St., Franklin, PA 16323

WILSON, JOHN W., Chairman, Mining Engr., University of Missouri, Rolla, 226 McNutt Hall, Rolla, MO 65401 314/341-4753

WILSON, LARRY, Mgr. of Engr., Old Ben Coal Co., 500 N. Du Quoin, Benton, IL 62812 618/435-8176

WINTER, DALE M., Maint. Supervisor, Arch of Illinois, Inc., RR 1, Box 242, Pinckneyville, IL 62274

WOIJECK, DAVID, Indus. Sales Mgr., Mt. Vernon Electric, Inc., 1327 Harlan Road, Mt. Vernon, IL 62864 618/244-1066

WOOD, T. C., V. Pres., Gen. Mgr., Midco Sales & Service, P.O. Box 28729, St. Louis, MO 63146 314/872-8440

WOOD, WALTER, Maint. Foreman, White County Coal Corp., P.O. Box 457, Carmi, IL 62821 618/382-4651

WOODALL, MIKE, Territorial Mgr., Roland Machinery Co., RR2, Box 220A, Carterville, IL 62918 618/985-3399

WOODS, DAVE, Pres., Twin Mills Timber & Tie Co., Inc., P.O. Box 34, West Frankfort, IL 62896

WOODS, GEORGE, Dean, Mining, Illinois Eastern Comm. Colleges, 1001 E. Clark St., Marion, IL 62959 618/985-3741

WOOLBRIGHT, CHARLES, Vice Pres. & Gen. Mgr., Joy Technologies, Inc. , #4 Industrial Park, Mt. Vernon, IL 62864 618-242-8509

WOOTON, DAN G., Gen. Mgr., Operations, MAPCO Coal, Inc., P.O. Box 911, Henderson, KY 42420 502/827-4996

WORLEY, BRIAN, Project Engr., Cyprus AMAX Coal Co., P. O. Box 144, Keensburg, IL 62852

WORSEY, PAUL N., Assoc. Prof., University of Missouri, Rolla, 226 McNutt Hall, Rolla, MO 65401 314/341-4753

WRIGHT, JAMES H., General Sales Mgr., Allied-Locke/Moline, 300 N. State Str., Chicago, IL 60610 312/467-1348

WRIGHT, RAY, Managing Dir., Frazer & Jones Co., P.O. Box 4955, Syracuse, NY 13221 315/468-6251

YANCIK, JAMES R., Prep. Engineer, Freeman United Coal Mining Co., Box 100, West Frankfort, IL 62896 618/932-2164, x247

YARKOSKY, ROBERT R., Sr. Mine Engr., Marston & Marston, Inc., 13515 Barrett Pkw. Suite 260, St. Louis, MO 63021 314/984-8800

YATES, LARRY, Dir. Materials Mgt., Eastern Associated Coal Corp., P.O. Box 1233, 800 Laidley Twrs, Charleston, WV 25324 304/344-0300

YEKNIK, MATT, Industry Spec, SKF Bearing Services Co., 8686 N. Central Ave, Phoenix, AZ 85020 602/997-9434

YOCUM, KEVIN L., Asst. General Counsel, Zeigler Coal Holding Co., 50 Jerome Lane, Fairview Heights, IL 62208 618/394-2616

YOUNG, BOB, Vice Pres., Webb Oil Co., Inc., P.O. Box 112, McLeansboro, IL 62859 618/643-3424

ZEC, JANET, Benetech, Inc., 1750 Eastwood Dr., Aurora, IL 60506 708/844-1300

ZWAHLEN, JAMES A., Purch. Coord., Monterey Coal Co., PO Box 235, Carlinville, IL 62626 217/854-3291

ZYWICKI, ROBERT A., Exec. Vice Pres., A-Z Industries, Inc., 3651 Commercial Ave., Northbrook, IL 60062-1822 708/291-9009

The Sincere

Thanks

of the Officers and Members of the

ILLINOIS MINING INSTITUTE

go to

THE 1994 ADVERTISING COMMITTEE

John Payne and Larry Steward, *Co-Chairmen*

Kenneth Barker
Amax Coal Co.

Fred Bauer
Americoal Services Co.

Lanny Bell
Roberts & Schaefer Co.

Randy D. Brown
Fairmont Supply Co.

Kenneth Creehan
Arch Mineral Corp.

Terry Hanley
Long-Airdox Co.

Jim Justice
DuQuoin Iron & Supply

John J. Miller, Jr.
Roberts & Schaefer Co.

Dave Parr
Mt. Vernon Electric, Inc.

John W. Payne
R&H Service and Supply Co.

Joe Pileggi
Freeman United Coal Mining Co.

Joe C. Rogers
Brushy Creek Coal Co., Inc.

Thomas B. Sadler
Independent

Bill Seay
Americoal Services Co.

Dwight Sneed
Americoal Services Co.

Larry Steward
Peabody Coal Co.

Kristi Thompson
Kerr-McGee Coal Corp.

Jerry Watkins
White County Coal Co.

Ed Whitwam
Consolidation Coal Co.

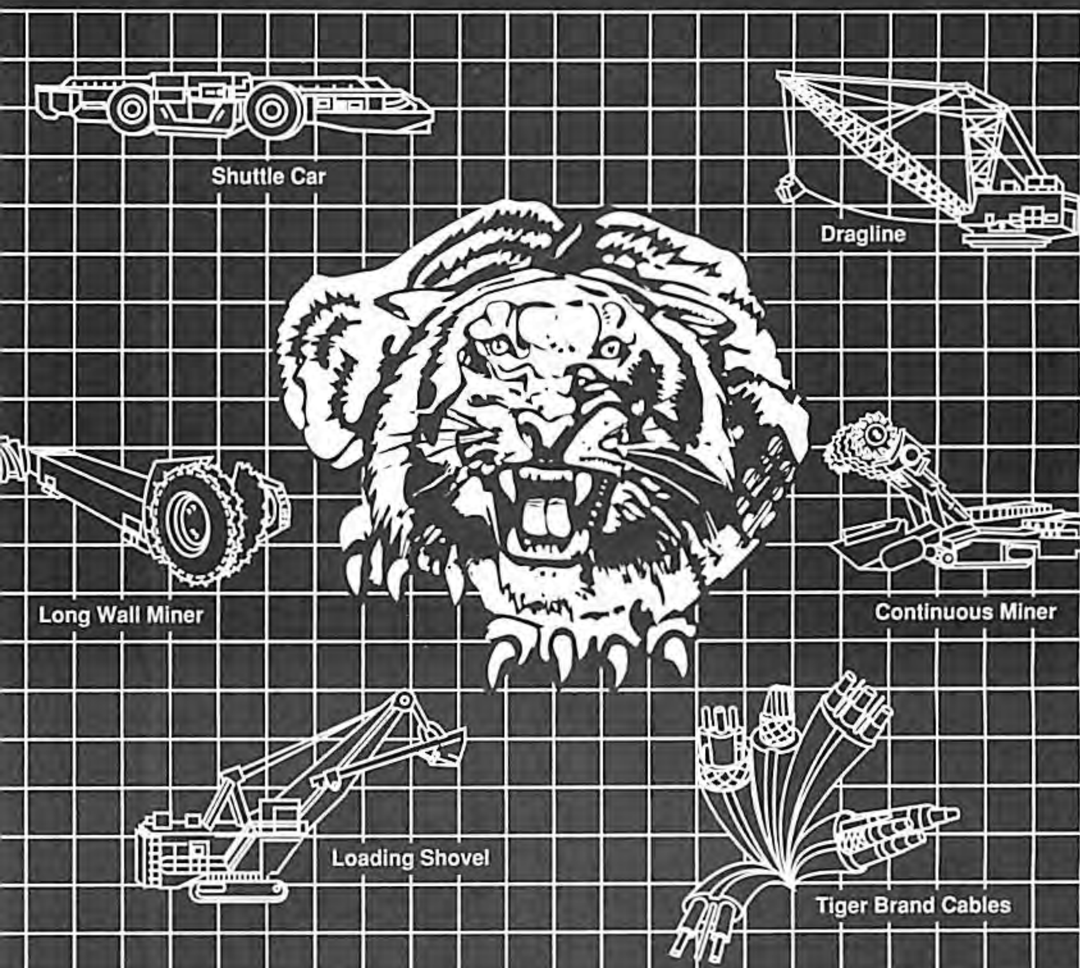
Their willingness and efficient cooperation help to assure the financial stability of the Illinois Mining Institute

Some exhibitors at the Annual Meeting

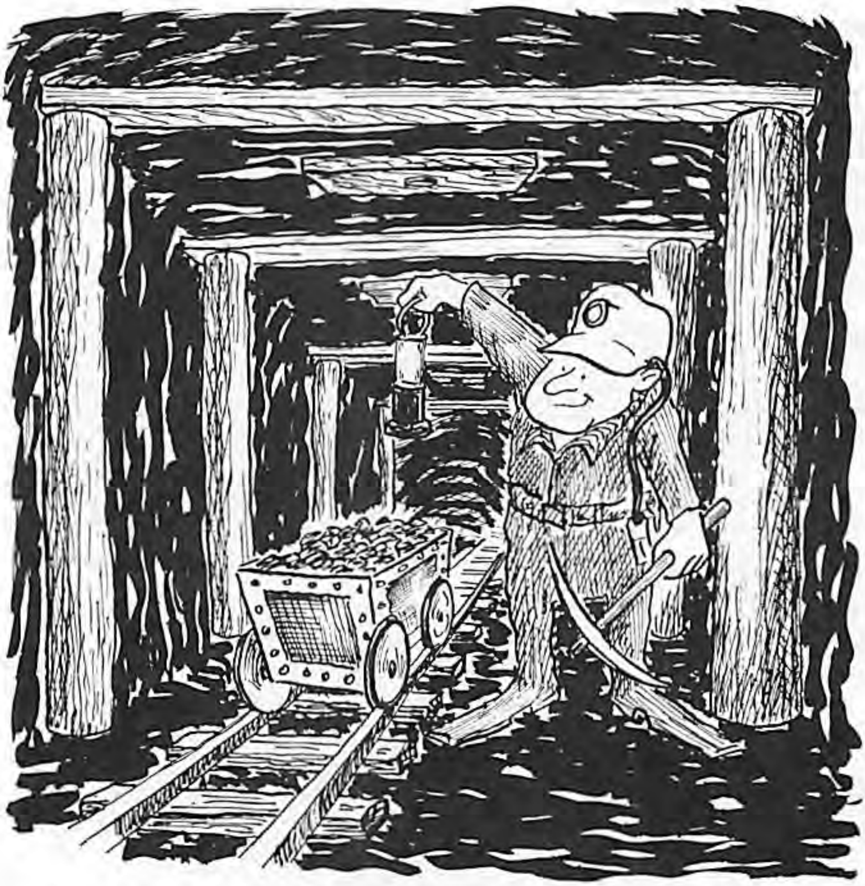
TRADE EXHIBITORS AT THE 1994 ANNUAL MEETING

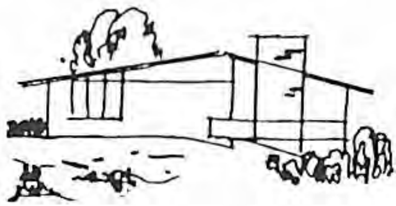
A. L. Lee Corporation, Lester, WV
A.S.P. Enterprises, Inc., Fenton, MO
Alminco, Inc., Lexington, KY
American Excelsior Co., St. Louis, MO
American Longwall, Whittington, IL
American Mine Research, Inc., Rocky Gap, VA
American Mine Tool, Inc., West Frankfort, IL
Austin Powder Co., Collinsville, IL
Benetech, Inc., Aurora, IL
Berry Bearing Co., Lyons, IL
Century Lubricants, Marion, IL
Chevron Lubricants, Inc., Louisville, KY
Cima Electrical & Mine Services, Benton, IL
Commercial Testing & Engr. Co., Henderson, KY
Continental Conveyor & Equipment Co., Winfield, AL
CSE Corporation, Beckley, WV
Du Quoin Iron & Supply Co., Du Quoin, IL
Eagle Enterprise, Inc., McLeansboro, IL
Fairmont Supply Co., Mt. Vernon, IL
General Steel Contractors, Hopkinsville, KY
Gooding Rubber Co., Benton, IL
Grindex Pumps, Homewood, IL
Hancor, Inc., Pana, IL
Heintzmann Corp., Cedar Bluff, VA
Henry A. Petter Supply Co., Paducah, KY
Hopcroft Electric, Inc., Glen Carbon, IL
Hummer of Naperville, Lisle, IL
Illinois Department of Mines and Minerals, Springfield, IL
J & D Repower, Inc., Harrisburg, IL
J. H. Fletcher Co., Huntington, WV
Joy Technologies, Inc., Mt. Vernon, IL
Kennametal, Inc., Latrobe, PA
Kerco, Inc., Madisonville, KY
Kiefer Electrical Supply Co., Benton, IL
Lebco, Inc., Benton, IL
Lincoln Electric Co., St. Louis, MO
Long-Airdox Company, Marion, IL
Lummez Sales Co., St. Louis, MO
M & S Fire Safety, Evansville, IN

Mainline Power Prods. Div. JH Service, Evansville, IN
Mc Junkin Corp., Mt. Vernon, Il
Mine Supply Co., The, Mt. Vernon, IL
Minesafe Electronics, Sturgis, KY
Morgantown Machine & Hydraulics, Inc., Nashville, IL
Mt. Vernon Electric, Inc., Mt. Vernon, IL
National Mine Service Co., Mt. Vernon, IL
Naylor Pipe Company, Chicago, IL
Patrick Engineering, Glen Ellyn, IL
Phillips Machine Service, Inc., Greenville, KY
Pump Consultants, Evansville, IN
R & H Service & Supply Co., Carterville, IL
Raben Tire Co., Harrisburg, IL
Reaco Battery Service Corp., Johnston City, IL
Roberts & Schaefer Company, Chicago, IL
Rud Chain, Inc., Marion, IL
SETCO Solid Tire & Rim, Idabel, OK
SIU-Coal Research Center, Carbondale, IL
Sligo, Inc., St. Louis, MO
Sollami Company, Herrin, IL
Standard Laboratories, Inc., Freeburg, IL
Texaco Lubricants Co., St. Louis, MO
TriCon Metals & Services, Inc., Lexington, KY
Voith Transmissions, York, PA
Webb Oil Co., Inc., McLeansboro, IL
Westfalia Mining Progress, Inc., Washington, PA
Women in Mining, Arch Mineral Corp., St. Louis, MO
Woodruff Supply Co., Inc., Madisonville, KY



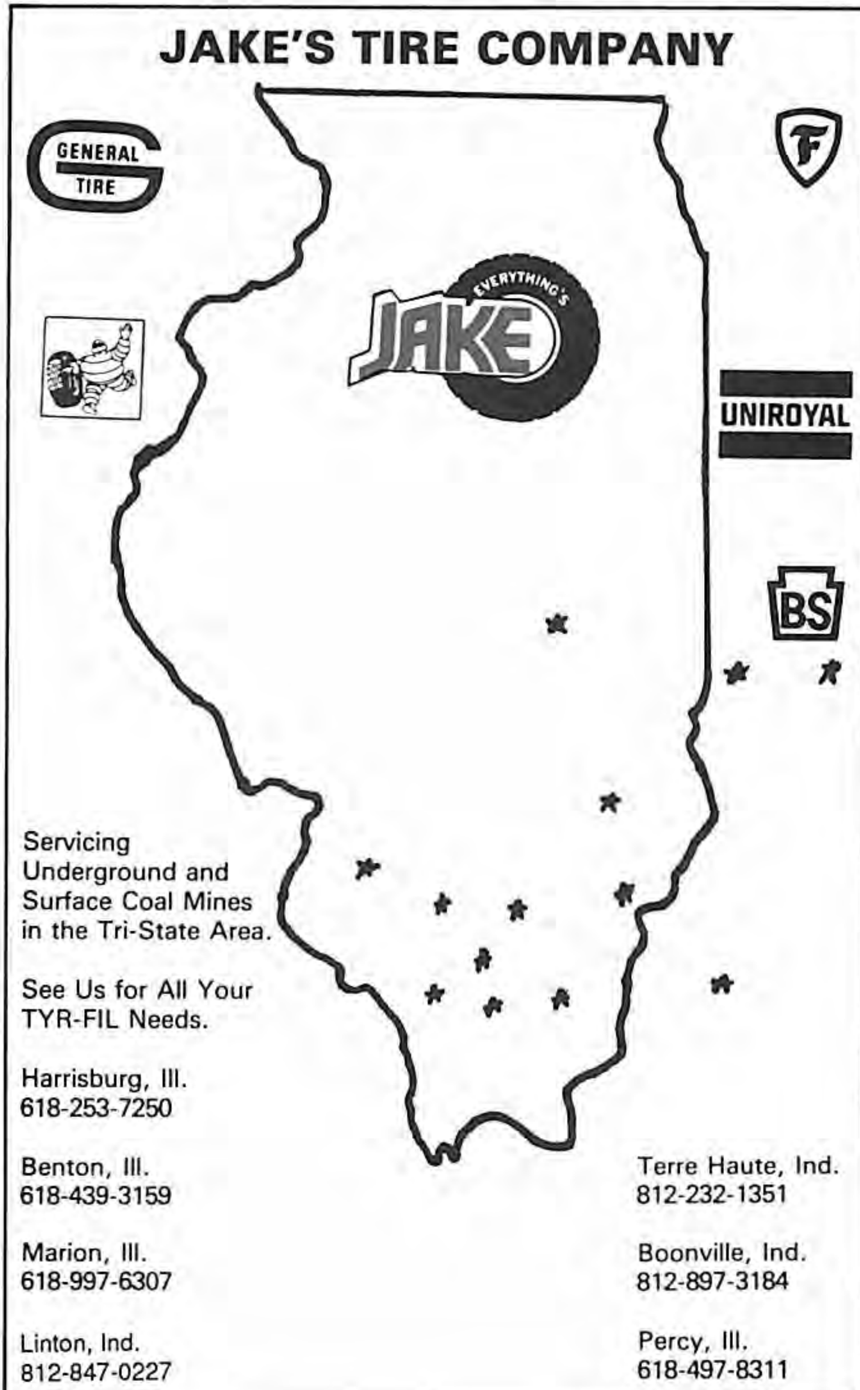
Shuttle Car
Dragline
Long Wall Miner
Continuous Miner
Loading Shovel
Tiger Brand Cables






a
good
bit
better
Let us prove it.
Contact:
Kennametal Inc.
Mining and Construction Division
PO Box 231
Latrobe, PA 15650
phone 800/458-3608
KENNAMETAL®
B94-87


The Wescott Bushing
Makes the Difference.
...because it's
forged, not cast,
from 11-14%
Manganese Steel.
Specify
The Wescott Bushing
for dragline and shovel repairs.
Send for our literature on the finest wrought
Manganese Steel Bushings available anywhere.
Wescott Steel Inc.
425 Andrews Rd., Trevose, PA 19047 (215) 354-3636
800-223-3887 FAX: (215) 322-5785


JAKE'S TIRE COMPANY
GENERAL TIRE
EVERYTHING'S JAKE
UNIROYAL
BS
Servicing Underground and Surface Coal Mines in the Tri-State Area.
See Us for All Your TYR-FIL Needs.
Harrisburg, Ill. 618-253-7250
Benton, Ill. 618-439-3159
Marion, Ill. 618-997-6307
Linton, Ind. 812-847-0227
Terre Haute, Ind. 812-232-1351
Boonville, Ind. 812-897-3184
Percy, Ill. 618-497-8311

Jennmar technology has developed two 9″×9″ donut-embossed plates to hold the roof and distribute this load over a broader area. One plate is rated for minimum bolt-load of 20,000 lb/force; the other is rated at 35,000 lb/force.

These embossed plates are designed for use with Jennmar high-strength bolt systems including: (1) torque tension rebar (2) patented INSTáL™ I, II, III Systems (3) patented Combination Bolt™ System.

Jennmar 9″×9″ plates offer these important advantages:

- High strength, light weight, low profile, uniform embossment with deep compression ring around bolt hole protect roof bolt head
- Distributes roof bolt load evenly in all directions and will not buckle or dog-ear down under high-load conditions
- Manufactured under rigid quality-control conditions
- Two header-plate manufacturing facilities and four distribution locations

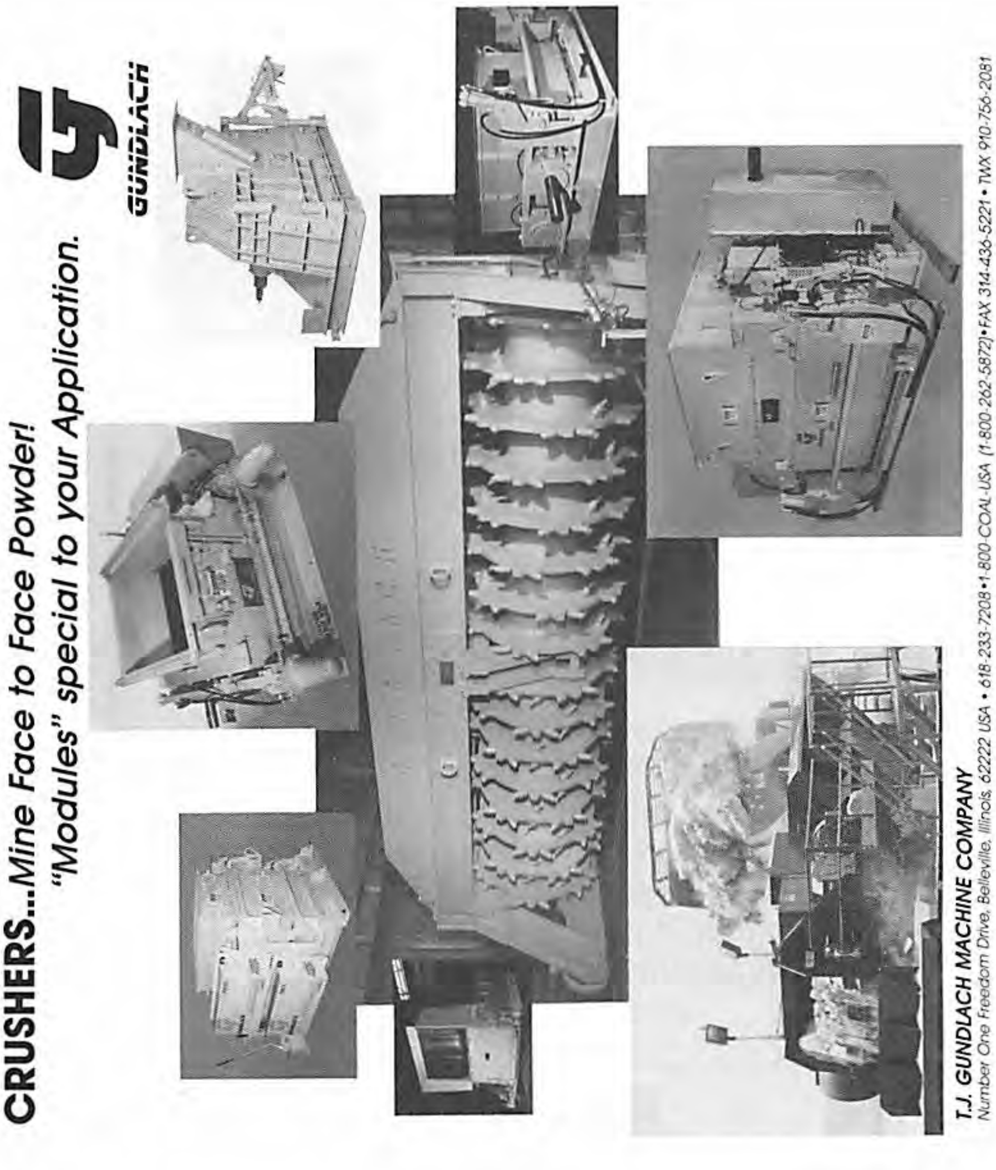
Why have a weak link in your point anchor system? Use Jennmar 9″ × 9″ high-strength bearing plate. Write or call for complete information.

9-87

Jennmar Corp.,

1330 Old Freeport Road
Pittsburgh, PA 15238
Phone: 412 963-9071
Telex: 559979 JEN PGH
FAX: 412 963-6809

Sales Offices and Plants: Pittsburgh, PA 412 963-9071; Cresson, PA 814 886-4121; Reedsville, WV 304 864-3601; Winchester, KY 606 744-9600; Flora, IL 618 662-2163; Helper, UT 801 472-3436.

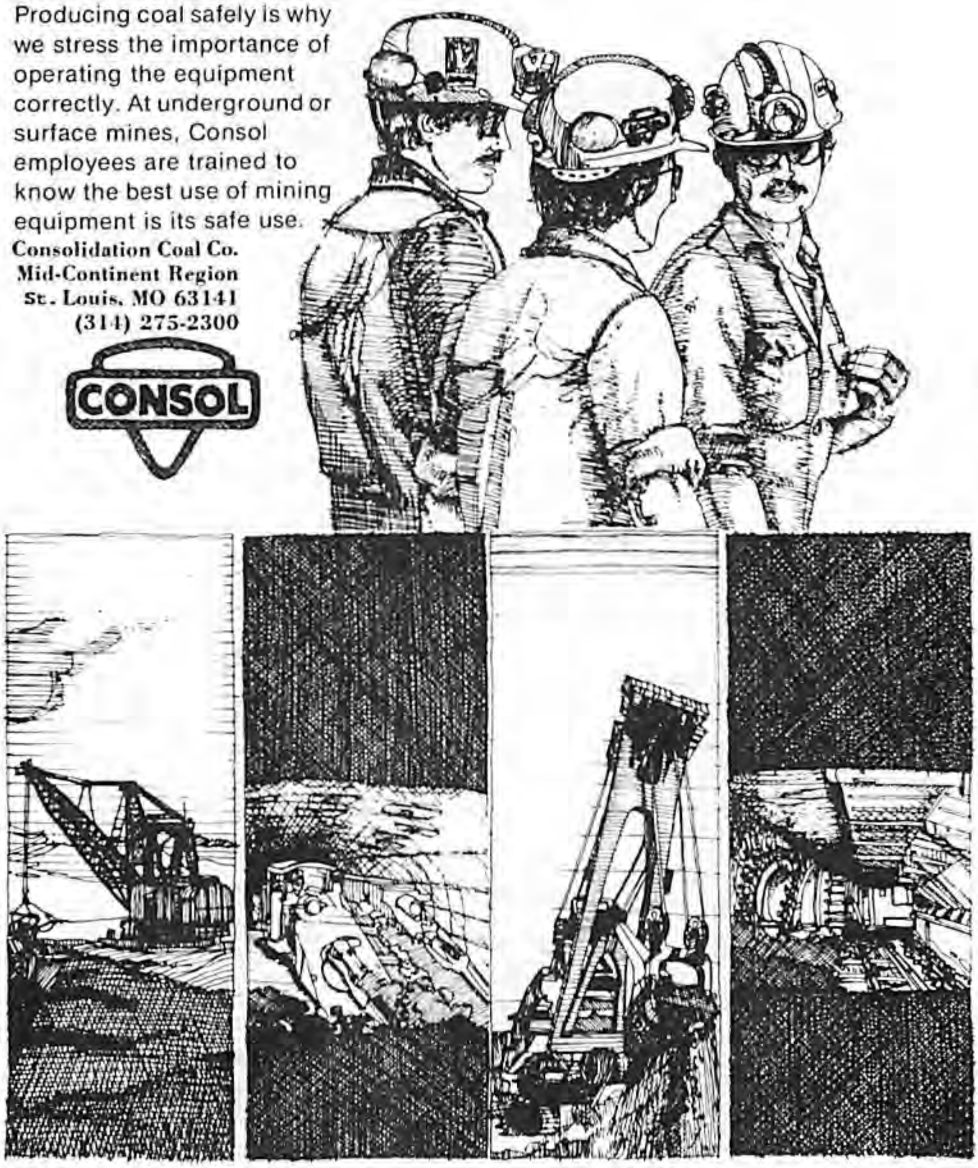

CRUSHERS...Mine Face to Face Powder!
"Modules" special to your Application.
GUNDLACH
T.J. GUNDLACH MACHINE COMPANY
Number One Freedom Drive, Belleville, Illinois, 62222 USA • 618-233-7208 • 1-800-COAL-USA (1-800-262-5872) • FAX 314-436-5221 • TWX 910-756-2081

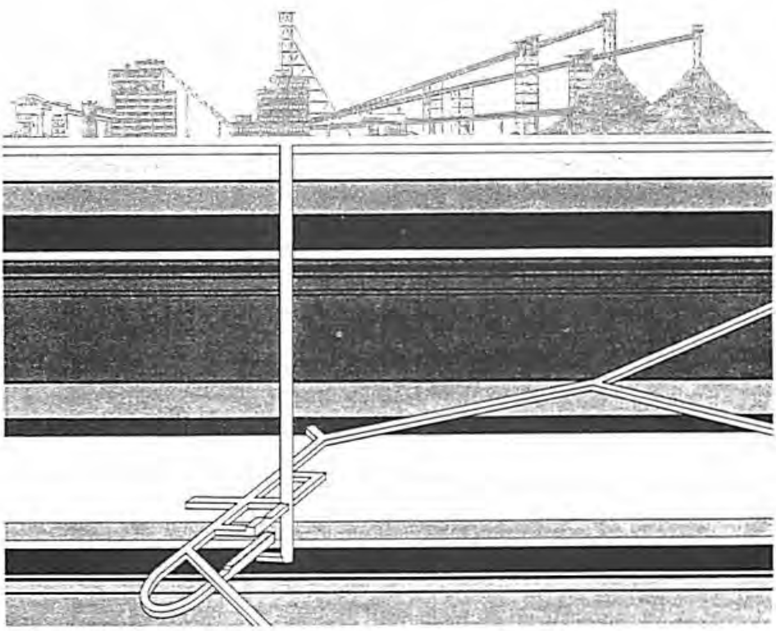
ADVERTISERS

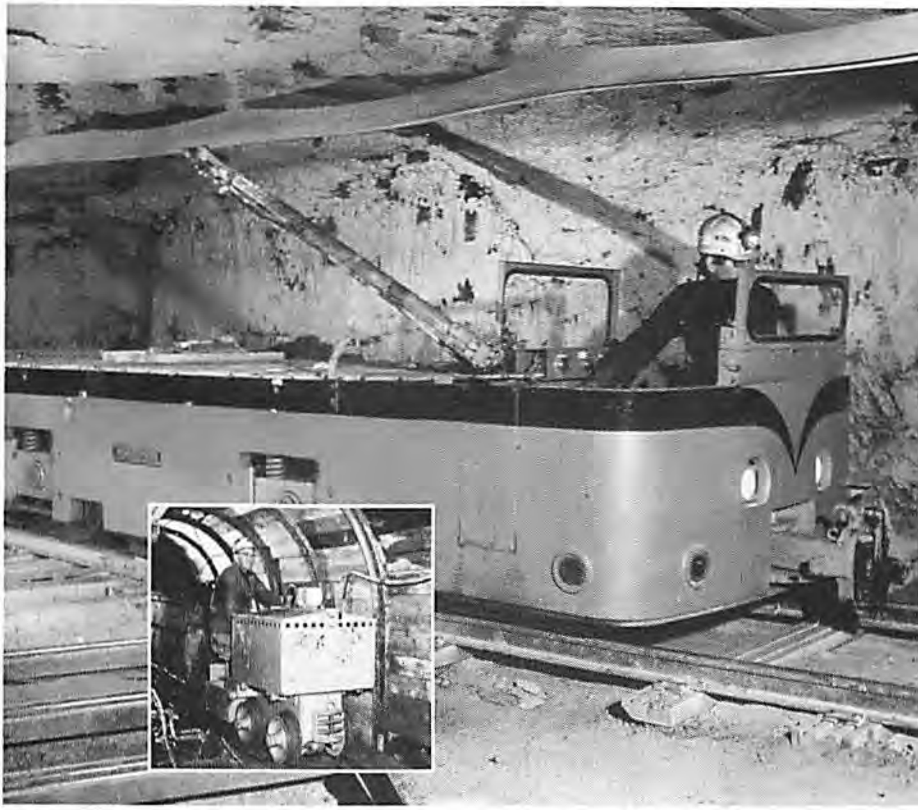
TOLERANCES FOR SHAFT ALIGNMENT

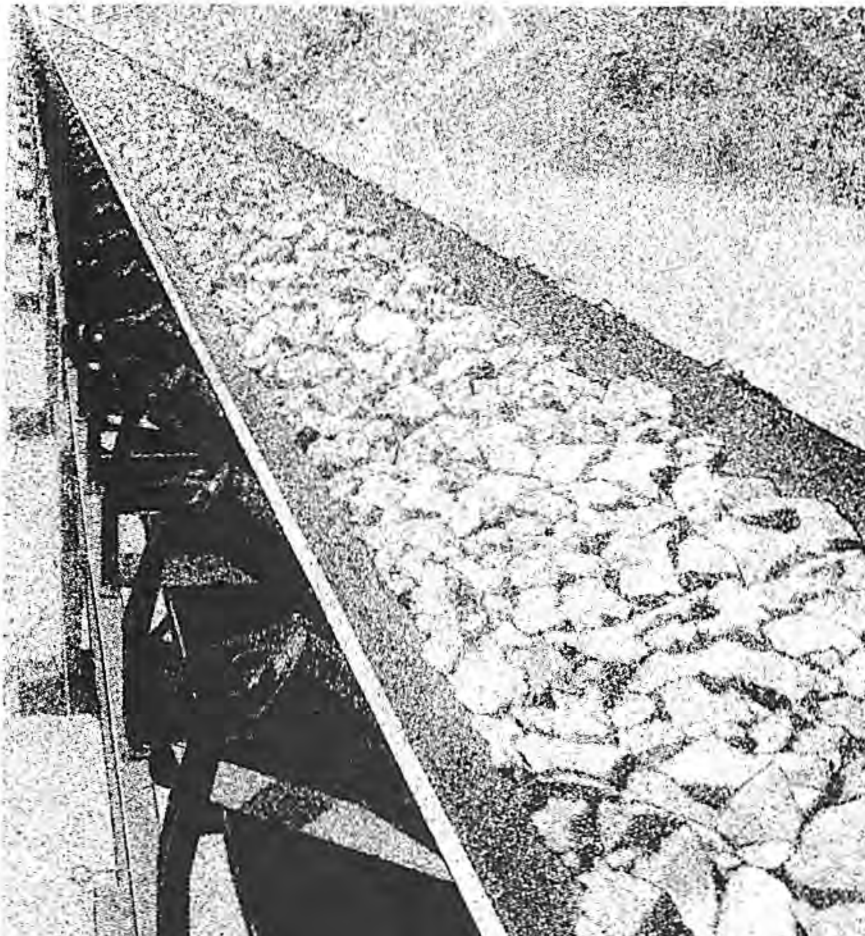
RPM	OFFSET (mils) Excellent	Fair	GAP (mils/10") Excellent	Fair	SPACER SHAFT (mils/in.) Excellent	Fair
600	5.0	9.0	10.0	15.0	1.8	3.0
900	3.0	6.0	7.0	10.0	1.2	2.0
1200	2.5	4.0	5.0	8.0	0.9	1.5
1800	2.0	3.0	3.0	5.0	0.6	1.0
3600	1.0	1.5	2.0	3.0	0.3	0.5
7200	0.5	1.0	1.0	2.0	0.15	0.25
All Speeds: Maximum Soft Foot Reading 2.0 Use OEM or in-house tolerances if available						

ALIGNMENT SYSTEMS









Motor Skills

We've got 'em

In Illinois Mining Country your total source for electro-mechanical equipment, repair and service is Decatur/Mt. Vernon Industrial Electric.

With two strategically placed service centers and 24-hour emergency service, DIE/MVE support is always minutes away from any Illinois mining site.

DIE/MVE engineers can inspect and repair your electro-mechanical equipment on-site, or carry your equipment to the nearest DIE/MVE center for repair and return it to your operation fast.

Decatur/Mt. Vernon Industrial Electric is a distributor for most of the electro-mechanical equipment you use now. So you should never suffer a delay while waiting for parts.

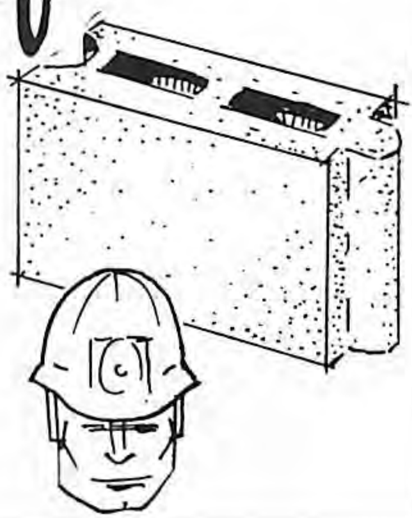
For complete, dependable, electro-mechanical service. . .your total source is **Decatur/ Mt. Vernon Industrial Electric.**

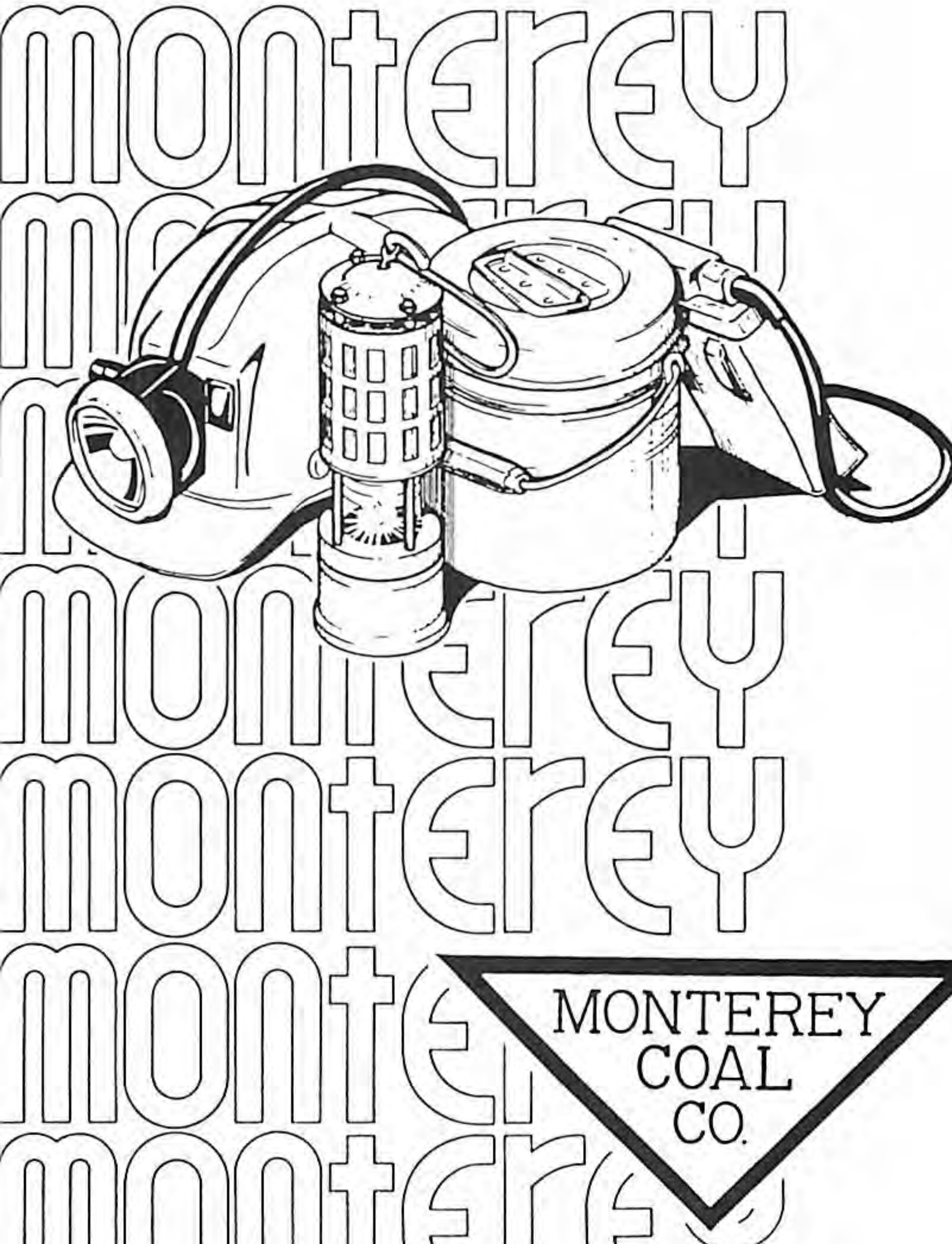
- A/C Motor Repair and Testing
  Mush and Form Coil Rewinding
  Surge, High Pot and Megger Testing
  Full Voltage Test Thru 4160V
- D/C Motor Repair and Testing
  Field Interpole and Armature Rewinding
  Surge and High Frequency Testing
  Full Voltage Testing Thru 500V
- Mechanical Service
  Complete Machine Shop
  IRD Analysis/Dynamic Balancing
  200T Horizontal Press • 30T Crane Bay
- 24-Hour Service

DECATUR / MT. VERNON
industrial electric

YOUR
TOTAL ELECTRO-MECHANICAL
SOURCE

DECATUR Industrial Electric — 1500 N. 22nd Street • Decatur, Illinois 62525 • 1-800-252-1598 • 217-428-6621
MT. VERNON Electric — 1313 Harlan Road • Mt. Vernon, Illinois 62864 • 1-800-233-8830 • 618-244-1212


TCT


monterey
monterey
monterey
monterey
MONTEREY
COAL
CO.

ADVERTISER PRODUCTS AND SERVICES INDEX

Building Materials and Construction

Contractors and Professional Services

(consultants, engineers, drilling, etc.)

Electrical Equipment

(supplies, motors, cables, lamps and repairs)

Mining and Industrial Supplies

Mining and Industrial Supplies, *cont'd.*

Mining Companies

Arch of Illinois, p. 171
Consolidation Coal Co., p. 258
Freeman United Coal Mining Co., p. 181
Kerr-McGee Coal Corp., p. 192
Monterey Coal Company, p. 287
Peabody Coal Co., pp. 266, 267
White County Coal Co., Pattiki Mine, p. 235
Zeigler Coal Holding Co., pp. 200, 201

Petroleum Products and Chemicals

Century Lubricants Co., p. 242
Du Quoin Iron & Supply Co., p. 274
Fairmont Supply Co., p. 259
Nalco Chemical Co., p. 290
Pennzoil Products Co., p. 264
Stamler Corporation (An Oldenburg Group Co.), p. 212
Woodruff Supply, Inc., p. 188

Power Transmission Equipment
(services and parts)

American Pulverizer Co., p. 170
Baker-Bohnert/Service Group, p. 225
Bearing Headquarters, Inc., p. 240
Berry Bearing Co., p. 229
Bowman & Associates, Inc., pp. 251, 252, 253
Fairmont Supply Co., p. 259
Flexible Steel Lacing Co., p. 234
General Belt Service, Inc., p. 199
Gooding Rubber Co., p. 219
Gunther-Nash Mining Construction Co., p. 269
Henry A. Petter Supply Co., p. 272
Hydro-Power, Inc., p. 270
IBT, Inc., p. 263
John Benson Electric Co., p. 249
MacWhyte Wire Rope Co., p. 238
Mine & Process Service, Inc., p. 215
Miner News, p. 191
OKI Padgett Systems, p. 244
Phillips Machine Service, Inc, p. 206
Power Torque, Inc., p. 294
SEMCOR, p. 192
Woodruff Supply, Inc., p. 188

Preparation Plants and Equipment

(services and parts)

American Pulverizer Co., p. 170
Bearing Headquarters, Inc., p. 240
Berry Bearing Co., p. 229
Bowman & Associates, Inc., pp. 251, 252, 253
Centrifugal & Mechanical Ind., Inc., p. 189
Duraline, Inc., p. 273
Fairmont Supply Co., p. 259
Ford Steel Co., p. 263
General Belt Service, Inc., p. 199
Gunther-Nash Mining Construction Co., p. 269
Heath Engineering, Inc., p. 277
Hennessey-Forrestal Machinery Co., p. 256
Henry A. Petter Supply Co., p. 272
James A. Redding Co., p. 220
John Benson Electric Co., p. 249
Kerco, Inc., p. 236
Krebs Engineers, p. 223
Mine Supply Co., The, p. 198
National Mine Service Co., p. 187
OKI Padgett Systems, p. 244
Power Torque, Inc., p. 294
Roberts & Schaefer Co., p. 281
Roland Machinery Co., p. 210
Stamler Corporation (An Oldenburg Group Co.), p. 212
Tabor Machine Co., Inc., p. 286
West Virginia Electric Corp., p. 292
Woodruff Supply, Inc., p. 188

Pumps

(all kinds, pipe valves, fittings, hydraulics)

Bearing Headquarters, Inc., p. 240
Berry Bearing Co., p. 229
Brake Supply Co., Inc., pp. 246, 247
Du Quoin Iron & Supply Co., p. 274
Fairmont Supply Co., p. 259
Farrar Pump & Machinery Co., p. 270
Heartland Pump Rental & Sales, Inc., p. 261
Heath Engineering, Inc., p. 277
Hennessey-Forrestal Machinery Co., p. 256
Henry A. Petter Supply Co., p. 272
Hydro-Power, Inc., p. 270

Pumps, *cont'd.*

Industrial Process Equipment Co., p. 279
John Benson Electric Co., p. 249
Kerco, Inc., p. 236
McJunkin Corp., p. 222
Mine Supply Co., The, p. 198
Morgantown Machine & Hydraulics, Inc., p. 213
Mt. Vernon Electric, Inc., p. 283
Woodruff Supply, Inc., p. 188

Reclamation, Erosion Control, Ground Stabilization

A.S.P. Enterprises, Inc., p. 173
Associated Supply Co., p. 220
Baker-Bohnert/Service Group, p. 225
Kerco, Inc., p. 236
National Mine Service Co., p. 187
Ready Drilling Co., p. 241
Woodruff Supply, Inc., p. 188

Rubber Products

(tires, belting, and hose)

Apache Hose & Belting Co., Inc., p. 175
Baker-Bohnert/Service Group, p. 225
Berry Bearing Co., p. 229
Brad Ragan, Inc., p. 249
Continental Conveyor & Equipment Co., p. 275
Du Quoin Iron & Supply Co., p. 274
Fairmont Supply Co., p. 259
General Belt Service, Inc., p. 199
Gooding Rubber Co., p. 219
Goodyear Tire and Rubber Co., Inc., p. 182
Hennessey-Forrestal Machinery Co., p. 256
Henry A. Petter Supply Co., p. 272
IBT, Inc., p. 263
Jake's Tire Co., p. 195
Kerco, Inc., p. 236
Power Torque, Inc., p. 294
Raben Tire Co., p. 231
SEMCOR, p. 192
Southern IL Retreading, Inc., p. 214
Woodruff Supply, Inc., p. 188

Steel and Steel Fabricators

(screens, rail, etc.)

Surface Mining Equipment

Surface Mining Equipment, *cont'd.*

Transportation

(railroads, trucking, barge)

Underground Mining Equipment

(equipment, replacement parts and rebuilds)

Underground Mining Equipment, *cont'd.*

Underground Roof Support, Safety and Ventilation

Underground Roof Support, Safety and Ventilation, *cont'd.*

Users of Coal

(utilities, industry, etc.)

Other

ADVERTISER ALPHABETICAL INDEX

J

K

L

M

N–O

P

R

S

T

W

Z