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REPORT OF THE  
ENERGY FIELD INSTITUTE V

on

WESTERN ENERGY OPPORTUNITIES,  
PROBLEMS, AND POLICY ISSUES  
August 15-21, 1982

conducted by

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Golden, Colorado 80401

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**MASTER**

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## Summary

### Energy and Minerals Field Institute V

The fifth Energy and Minerals Field Institute program for Washington, D.C. Congressional and Executive Aides was held during August 15-21, 1982. Financial support was provided in part by the U.S. Department of Interior (Bureau of Mines, Geological Survey, Bureau of Land Management and Office of Surface Mining), U.S. Department of Energy and U.S. Environmental Protection Agency. Private funding was provided by ARCO Coal Company, W.R. Grace & Company, Chevron U.S.A., Texaco Inc., Phillips Petroleum Company, Rocky Mountain Energy Company, Exxon Company U.S.A. and the Gulf Oil Foundation.

The five-and-one-half day program was conducted through Wyoming, Colorado and Utah and consisted of visits to: an R&D tertiary petroleum production facility; an historic oil field entering secondary production; a surface uranium mine; a petroleum exploration drilling rig; a surface coal mine; an air cooled, coal-fired power plant; an oil shale site; a geothermal-electrical generating facility; an open pit copper mine and associated smelter and refinery; a petroleum refinery and an oil shale semi-works retort. During the field program, participants had opportunities to view communities affected by these activities, such as Wright City and Gillette, Wyoming, Parachute, Colorado and Milford and Cedar City, Utah. Throughout the program, aides met with local, state and industry officials and citizen leaders during bus rides, meals and site visits.

During the wrap-up session on Saturday, the participants (assigned to one of three groups) discussed the events of the weeklong field trip in terms of issues and their importance. The following statements summarize the group reports:

- The pace of development drives all other issues. Closely connected to pace is the scale (size and cost) of developments which affects impact planning among other things.
- Inconsistencies and disagreement about the role and financial responsibility of the federal/state/local governments. In general participants felt that the state should have the primary role in resource development.
- The current depressed state of the energy/mineral industries suggests

fundamental changes in these industries rather than a response to the current economic situation.

- The federal government has a role in R&D of unproven technologies, but not in proven technologies.
- Finally, land leasing for development should be coordinated between the federal government and the state--especially so that a state can plan for and manage development.

## ACKNOWLEDGEMENTS

The Fifth Energy and Minerals Field Institute was held during August 15-21, 1982. Participants represented federal agencies, U.S. Senate and House Committees and the Governors' offices in Wyoming, Colorado and Utah.

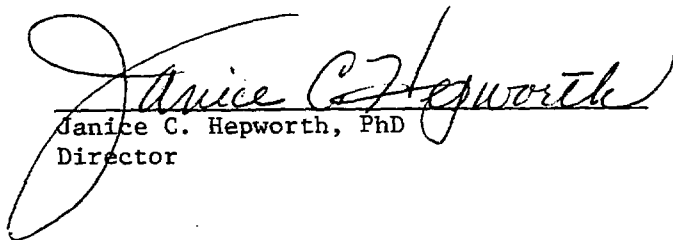
We are grateful to the following three federal agencies for continuing to support the Institute: the United States Department of the Interior (Bureau of Mines, Geological Survey, Bureau of Land Management and the Office of Surface Mining), the United States Department of Energy and the United States Environmental Protection Agency. We also appreciate the financial support of the following companies: ARCO Coal Company, W.R. Grace & Co., Chevron U.S.A., Texaco Inc., Phillips Petroleum Company, Rocky Mountain Energy Company, Exxon Company U.S.A. and Gulf Oil Foundation.

The field program is primarily based on what can be learned through the hands-on experience. We thank the many individuals who devoted time and expertise to the program: local and state leaders in Colorado, Wyoming and Utah who provided perspectives on the issues surrounding development and production, and company representatives who provided technical expertise.

We are grateful to the following companies whose representatives helped to plan and implement the program: Conoco, Big Muddy Field and South Glenrock Field; Rocky Mountain Energy Company, Bear Creek Mine; ARCO Coal Company, Wright City and Black Thunder Mine; Pacific Power & Light Company and Black Hills Power & Light Company, Wyodak; Phillips Petroleum Company and Utah Power & Light Company, geothermal site near Milford, Utah; Exeter Drilling Company and Diamond Shamrock Oil Company, #7 drill rig; Kennecott Minerals, Utah Copper Division; Bingham Mine, Smelter and Refinery; Chevron U.S.A., Chevron Refinery; Chevron Shale Oil Company and Conoco, Oil Shale Semiworks; Getty Minerals Company and Phelps Dodge, a proposed molybdenum mine.

This year's staff was new to the program and, in spite of the lack of Institute experience, planned an outstanding program which reflected the unique contributions of the members. Because the 1982 program included nonfuel minerals for the first time, the Staff faced new challenges in selecting site visits and integrating energy and nonfuel mineral issues. I wish to thank the following staff members for their considerable planning effort: Michelle Michot Foss, Michael Wilson, Hanneke Humphrey (graduate students in the Department of Mineral Economics), Jeffrey Ovian (senior in the mining engineering department) and Sharon Kirts, Institute Secretary.

The quality of the field program is dependent upon the following CSM faculty members and representatives who give the program continuity and contribute special areas of expertise: Dr. Robert J. Weimer, Getty Professor of Geology; Martin D. Robbins, Vice President for Development; Dr. George Keller, Head, Department of Geophysics; Dr. Baki Yarar, Professor, Department of Metallurgy; Dr. Samuel Romberger, Professor, Department of Geology and Dr. Thomas Sladek, Vice President, CSM Research Institute. We are especially grateful to Dr. Weimer and Mr. Robbins who have been with the Institute since its beginning and contribute to the enduring credibility of the program.



Janice C. Hepworth, PhD  
Director

## I. Introduction

The Fifth Energy and Minerals Field program was designed to anticipate and meet current information needs of the congressional and executive aides who participated in the program. For the first time, selected nonfuel minerals sites were included in the field itinerary. This inclusion enabled the staff to plan a program which reflected broader economic, policy and technology concerns in the target area (Colorado, Wyoming and Utah) than prior programs. In future programs, the broadened focus will diversify the subject matter of the field program to assure its relevance to ongoing national energy and minerals policy concerns.

During the preceding year, staff members researched the issues associated with energy and nonfuel mineral development and production. Each planning staff member was assigned a state within the target area to develop a 1-2 day field program. The program developed as a result of numerous field trips by staff members in the target area, discussions with local and company representatives and a literature review of particular issues. (See Appendix A for daily schedules and local guests.) Staff members coordinated their efforts to assure that selected issues could be demonstrated by particular field sites. Each staff member contributed to the field notebook by preparing brief papers on the issues and technology; selecting appropriate maps and articles as background information for the field itinerary.

Sites and facilities included in the 1982 program demonstrated current concern about how to maintain energy and nonfuel mineral development and production in a soft market. In this respect, the fifth program was different from prior years which focused on how to accommodate the impacts of rapid energy development. In 1982, the downturn in the mineral and energy industries posed new problems for consideration, such as possible recovery strategies, the role of state governments within the federalism philosophy and the effects of the downturn on communities and people in the affected areas.

Rocky Mountain Energy Company's Bear Creek uranium mine was included in the field itinerary because it demonstrates the adjustments the company is making to maintain reduced production in a diminishing market.

Conoco's efforts at enhanced oil recovery were viewed at Big Muddy Field and South Glenrock field near Casper, Wyoming. A drill rig operated by Exeter Drilling Company was included in the field program to illustrate the amount of

capital and risk in domestic oil exploration.

At ARCO's Black Thunder Mine, the group witnessed an enormous coal resource whose annual production falls short of the mine design production plan because of a soft coal market. A related effect was noted at Wright City, an ARCO-owned planned community, where construction aimed for a boom in 1982 and instead produced an excess of private residences. During a community dinner at Gillette, Wyoming leaders spoke optimistically about their capacity to weather what they perceive to be a temporary setback in growth.

The boom-bust cycle was well documented in Colorado, where most oil shale projects were slowed and some shutdown. The expected oil shale boom left communities with some infrastructure improvements and, in some cases, plans for future growth. In light of the slowdown in oil shale development, the Institute held a meeting at Parachute, Colorado to address the future of oil shale. Discussants included local leaders, company representatives and CSM faculty members who talked about problems in extraction and upgrading technology, the economic environment and the attitudes of local residents.

In southern Utah the theme was alternatives--in energy source, investment and land use.

While not a current national priority, a geothermal site was included in the program. The Phillips site near Milford, Utah provided a look at the results of private investment and the use of geothermal energy in a local area by Utah Power and Light Company. At Milford, Getty representatives described a molybdenum mine, the richest known deposit in the U.S. which is in a slowed planning phase, the future development of which will be determined by the world molybdenum market. Local leaders attended the dinner at Cedar Breaks, Utah to talk about the fragile relationship between national parks and mineral development in the southern part of Utah.

The Kennecott mine, smelter and refinery were selected for the field trip for several reasons. A major employer in the Salt Lake area, Kennecott has recently laid off hundreds of employees as the price of copper continues to fall. Old technology dates the Kennecott operations while the cost of modernization is prohibitive given the low-cost competition of foreign copper. The future of Kennecott is unclear, but the alternatives for recovery are tied to the economic environment and world market.

The Chevron site was selected because of the demonstration plant for



upgrading oil shale. The company plans to transport the processed shale from the Western Slope of Colorado to Salt Lake City until production increases at which time the facility will be moved to Colorado. Chevron's plan exemplifies a scale-up growth plan from a demonstration to a commercial phase.

Themes of the 1982 program included the following: general effects of the economic recession on the U.S. energy and minerals industry in the West; financial responsibility for research and development; state-of-the art mining and processing technology and future technology; community adjustments to a slowdown in development.

Program participants were nominated by staff directors of committees, division heads of agencies and by past participants. (See Appendix B for letter requesting nominations.) By July 1, the Institute program was fully subscribed with a few replacements prior to the start of the program. (See Appendix C for the list of participants.) Participants were informed about the program by two preprogram mailings. (See Appendix D.)

Similar to past programs, the 5½ day field program included briefing sessions at energy and mineral sites or in community settings. Dinners in Douglas and Gillette, Wyoming; Grand Junction, Colorado; and Cedar Breaks, Utah were hosted by local guests and included local guests. (See Appendix A for lists of local guests.) These events provided opportunities for local guests and participants to meet and speak with one another. Resource people addressed the group at sites, dinners and on the bus. (See Appendix E for the resource list.) These individuals were invited by staff members because of their expertise in particular areas.

A workshop will be held in February 1983. At that time 1982 participants will reconvene for a re-evaluation of the summer program. Program alumni will also be invited to join the group at a planned event during the day.

The following report of the week's activities is organized in a chronological way to recall the developments of each day. Tape recorders were used to document the daily activities and are used as the source of this report. From approximately 1200 hours of tape, we have prepared the following report of the field program.

## II. Energy and Minerals Field Institute Scheduled Activities

The week's schedule (page 5) summarizes the daily activities and includes logistical information of the week. The brochure, describing the week's events, includes a map of the target area as well as brief commentaries about the history of selected sites and facilities.

A field trip notebook prepared for each participant contained the following information: daily schedules (six daily schedules are included as Appendix A); several issue papers prepared by staff members designed to provide background information about the consequences of resource development to selected field sites; a list of resource specialists; resumes of participants and staff, and selected papers and articles. The following maps were also included with the briefing material: the Northern Rocky Mountain Region and Southern Rocky Mountain Region Geological Highway Maps, and highway maps of Utah, Wyoming, and Colorado.

### ON TOUR IN WYOMING -- MONDAY, AUGUST 16

Morning Briefing: Dr. Robert Weimer, CSM Department of Geology

As participants prepared to board the charter flight from Denver to Wyoming, Dr. Robert Weimer provided a background on geological events that were responsible for the abundance of fuel and nonfuel minerals in the Powder River Basin and Rocky Mountain region. Dr. Weimer focused on oil and gas resources, the first order of business for the day, then expanded his commentary to include the remainder of Day One and the week's activities as a whole. Participants arrived in Casper and boarded chartered buses for Conoco's Big Muddy Enhanced Recovery Project in Glenrock (east of Casper).

### EN ROUTE TO BIG MUDDY FIELD

Dr. Robert Weimer, CSM and Dr. David Love, U.S. Geological Survey

Pointing out surface features along the way, Weimer explained the occurrence of the Big Muddy anticline from which oil is produced. Weimer discussed

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Sunday (August 15)	Monday (August 16)	Tuesday (August 17)	Wednesday (August 18)	Thursday (August 19)	Friday (August 20)	Saturday (August 21)
<b>ACCOMMODATIONS</b>	<b>WYOMING</b>	<b>WYOMING</b>	<b>COLORADO</b>	<b>UTAH</b>	<b>UTAH</b>	<b>UTAH</b>
Twin Towers (303) 273-3926  Douglas Holiday Inn (307) 358-9790  Gillette Holiday Inn (307) 686-3000  Grand Junction Ramada Inn (303) 243-5080  Salt Lake City Airport Hilton 801-539-1515 Racquet Club 801-649-8080	5:30-Breakfast, CSM 6:00-Bus to Stapleton 7:30-Flight to Casper, WY 9:00-9:30-Briefing 9:30-10:30-Bus to Glenrock 10:30-12:00-Tour Conoco/DOE Big Muddy Enhanced Recovery Project	6:30-Breakfast & briefing Holiday Inn-Douglas 7:30-8:30-Bus to Black Thunder Mine 8:30-11:30-Tour coal mine operation 11:30-12:30-Bus to Wright City	6:00-Breakfast & briefing Holiday Inn, Gillette 7:00-Flight from Gillette to Rifle, CO 9:00-12:30-Tour oil shale country	6:00-Breakfast & briefing Ramada Inn, Grand Junction 7:00-Flight to Milford, UT 9:00-12:00-Tour Phillips/ UP & L Geothermal Site	7:00-Breakfast and briefing Airport Hilton, Salt Lake 7:30-8:30-Bus to Bingham Canyon 8:30-12:00-Tour Kennecott Copper Mine	7:00-10:15-Breakfast and wrap up session at the Racquet Club 10:30-Leave Park City for Salt Lake City Airport departures
<b>NOON</b>	12:00-1:30 Lunch en route	12:30-1:30 Lunch/Wright City	12:30 Lunch/Parachute	12:00-1:30 Lunch in Milford	12:30-1:30-Lunch/Copper Club	12:20 United Airlines Flight #200
<b>Discussion Leaders for the week are:</b>  Mr. Martin Robbins CSM Hanneke Humphrey Grad. Res. Asst.  Michelle Foss Grad. Res. Asst. Jeffrey S. Oviian Professional Staff  Janice C. Hepworth Director Michael Wilson Grad. Res. Asst.	1:00-Briefing on uranium solution mining (Rocky Mountain Energy) 1:30-4:00-Tour RME Bear Creek Uranium Mine 4:00-4:30-Bus to drill rig site 4:30-5:30-Tour Exeter #7 oil & gas drill site (Diamond Shamrock) 5:30-6:00-Bus to Douglas  Review of day's activities Discussion Leaders	1:30-2:30-Bus to Wyodak Power Plant; drive through Wright City as departing 2:30-4:30-Tour Wyodak 4:30-5:30-Bus through community of Gillette to lodging  Review of day's activities Discussion Leaders	1:00-Oil shale seminar 1:30-Bus to Grand Junction 2:30-Free afternoon  Review of day's activities Discussion Leaders	1:30-2:00-Flight to Cedar City 2:00-4:00-Bus to Cedar Breaks 4:00-4:30-Bus from Cedar Breaks to Cabin 4:30-Program on land use and development issues in the region; cook-out dinner at Cabin  Review of day's activities Discussion Leaders	1:30-3:00-Bus to Chevron Refinery 3:00-4:30-Tour refinery and oil shale semi-works 4:30-5:30-Bus to Park City  Review of day's activities Discussion Leaders	
<b>RECEPTION/DINNER</b>	<b>DINNER</b>	<b>DINNER</b>	<b>DINNER</b>	<b>DINNER</b>	<b>DINNER</b>	
6:00-Dinner and Briefing, CSM Student Center (Deck & Fireside Room)	6:30-Cash Bar 7:30-Dinner, informal evening program. Wyoming energy/mineral overview Lodging: Douglas Holiday Inn, Douglas, WY	7:00-Cash Bar 7:45-Dinner & evening program with local citizens Lodging: Gillette Holiday Inn, Gillette, WY	7:30-Dinner and Lodging in Grand Junction (Ramada Inn) Grand Junction, CO	7:45-Bus to Cedar City, flight to Salt Lake City Lodging in Salt Lake City, Airport Hilton	6:30-Cash Bar 7:00-Dinner, program wrap up session assignments. Lodging Park City, Racquet Club	

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the difference between structures such as domes and anticlines, and basins. Casper's history and role as a petroleum industry supply center (as well as the current economic situation due to mining and petroleum industry slowdowns) were also addressed.

Dr. Dave Love provided a colorful and detailed history of the petroleum industry in Casper. "The oil industry started here when the Oregon Trail came through in the 1840s. Jim Bridger and a few other entrepreneurs found some oil seeps in the anticlines just to the southwest (of Casper) and they mixed the oil with flour and sold it as axle grease to the immigrants. They made over a dollar a can--that was a lot of money in those days." A more sophisticated industry emerged in the 1880s when drilling, although unsuccessful, began south of Casper along oil seeps there. In the early 1900s Salt Creek Field, north of Casper, was discovered. This was eventually the site of the Teapot Dome scandal of the 1920s. By that time, Casper was a booming oil town with all of the associated repercussions, good and bad. (In the late 1940s and early 1950s it also became a uranium center, and coal increased in prominence as well.)

Casper is on the south margin of the Powder River Basin which is the largest structural downwarp in Wyoming. Like a "soup bowl skewed on one side" it is not the deepest basin in Wyoming, Love explained, but is the most prolific, producing oil, gas, coal and uranium.

The petroleum refining industry which grew up in Casper prospered for about 75 years in spite of Casper's remoteness from petroleum markets. With the construction of pipelines to transport crude products to refineries in other states, Casper's refining center has diminished in importance.

Love commented that the petroleum industry's boom in Wyoming has leveled off. The drill rig count is down and associated industries are also feeling the drop in activity. Love stated that the slowdown is temporary and activity should pick up again.

Jim Sidwell, Supervising Engineer and Glenn Schaaf, Project Engineer, Big Muddy Enhanced Recovery Project, Conoco, Inc.

Sidwell and Schaaf briefed participants on the buses prior to arrival at the Big Muddy site. Big Muddy is a "surfactant play" with oil literally

"washed off" of the rocks. The two Conoco representatives used oil saturated sandstone samples from a drill core to show participants how petroleum actually occurs in the pore spaces between sand grains.

Between 15 and 30% of oil in the ground in a new field is recovered by primary production. Water flooding or secondary production, will recover another 20 to 30% and additional processes like steam injection or burning can be used to enhance recoveries in later stages of production (tertiary recovery). At Big Muddy a detergent solution is used. The process is an expensive one. To date Conoco has spent \$40 million to recover 900,000 barrels of oil. The cost of the chemicals used in the process is approximately \$18 per barrel. Total cost of production is about \$40 per barrel-more than the current market price of oil. "Much of the current research being done is predicated on the price of oil going up so it (Big Muddy) ultimately will become a viable project," Sidwell commented.

The process consists of injection of a surfactant polymer "slug." These chemicals alter surface tensions between the oil and host rock. In 1980, the current commercial-scale project began with an initial water flooding to establish a water-flood oil rate and to adjust salinities of the reservoir fluids to the proper levels for the remainder of the process. Oil production was approximately 35 barrels per day at that time. In March of 1981 injection of the surfactant polymer mixture with alcohol began. That phase continued until April of 1982. Current rates of production are about 135 barrels per day of "tertiary oil." Maximum production should reach 450 barrels per day.

Big Muddy was discovered in 1916. Approximately 31 million barrels of oil were produced with primary and secondary methods leaving roughly half of the oil in the field. A ten acre pilot project was conducted from 1972 until 1977 with 13,000 barrels of oil recovered, a rate that met Conoco's target of recovering 25% of the 50% of oil still in place in the field. It was the intent of that project to prove the process was viable. The current project of 90 acres with 9 injection and 16 recovery wells will be operated another two to three years to determine commercialization but it will be another five years before Conoco will know how useful the process is, depending upon economic conditions.

Other potential sites for the process have been identified by Conoco with some located in the Rockies. Many reservoirs exist where the methodology

used at Big Muddy could be applied. Other companies, mostly majors, employ enhanced recovery and some are looking at processes similar to Conoco's. The Big Muddy process has some proprietary aspects but since there is DOE involvement in the project (the agency contributed \$9 million) much of what is done is public domain.

#### AT BIG MUDDY FIELD

As participants toured the facilities at Big Muddy they learned that production depths ranged from 2,800 to 3,200 feet. The filtration processes used for injection and production fluids are the same as those used in food industries. In addition to questions on the technology and methodology at Big Muddy, discussions between the aides and Conoco personnel focused on what enhanced recovery techniques mean to the industry as a whole. Speculation was rampant on how sophisticated and more efficient recoveries of domestic oil would affect imported petroleum quotas. Participants also questioned what the proper role of the federal government in pilot projects like Big Muddy should be. In Conoco's opinion, government participation there has served a good purpose. Should the field ever become commercially profitable with the recovery methods used, some of the federal government's investment will be returned.

#### AT SOUTH GLENROCK FIELD

Skip Curry, Consulting Geologist

Following the tour of Big Muddy Field, participants boarded the charter buses for South Glenrock Field. Along the way, Dr. Weimer briefly reviewed the geological aspects of subtle stratigraphic traps, where petroleum is confined in a reservoir created by lateral changes in the host formation rather than structural anomalies like those associated with anticlines. South Glenrock is a stratigraphic trap type of reservoir. Weimer also described how a geologist explores for oil and gas, by investigating the structure and stratigraphy of an area, looking at possible "source rocks," units that are high enough in organic content due to the environments in which they were deposited to generate petroleum, and characteristics of potential reservoirs, like porosity and

permeability into which the oil or gas may migrate.

When participants arrived at South Glenrock, they were given a colorful account by Skip Curry of how the field was discovered. It was, in essence, the saga of the "independent oil man." The discovery of South Glenrock originated with Skip's father, Bill Curry. As Bill was traveling the old highway between Casper and Glenrock he stopped at a drill rig where a core was being "pulled." Although the 30-foot core was saturated with oil, the well had tested only water. Curry returned to Casper and pulled out a map of the area compiled by D.H. Barnett, a USGS geologist who had mapped the anticline that eventually became Big Muddy Field. Curry located the well he had visited near Glenrock and "he got to thinking about it, because the oil (in the core) was in the Dakota Sandstone and there had been Dakota oil produced up in Big Muddy, and they never really had drilled down into the water. There were some tight wells that wouldn't produce oil but the holes were not Dakota water wells," Skip related.

Bill Curry had an idea, ("and I think it's fair to say it's just an idea," Skip commented), that maybe the Dakota oil high on the anticlinal structure that produced at Big Muddy also extended down onto the flank of the anticline, where it could be trapped stratigraphically.

Skip emphasized the word "idea," because "at that stage, it was a very fragile thing. If, for example, he had approached any of you and said I think this whole flank of the anticline is going to be one big oil field, all you would have had to say was 'baloney' and the idea would have been shot down. "If you can't find anyone to believe the idea, and put up money to back it, then an idea is just an idea," said Skip.

But Bill Curry did find backers in Conoco, who were preparing to drop the leases obtained on the property that was to become South Glenrock Field. Curry proposed that if Conoco could get the leases back, he would drill an exploration well for interest in the venture. The rest, as they say, is history. Approximately 60 million barrels of oil have been produced from South Glenrock, a production, at today's price of \$30 a barrel, worth \$2 billion.

"Today, in order to find a field of this size, say 50 million barrels... it takes about 1,800 wildcat wells. For 1,800 wildcat wells you could expect to find one discovery like this that would produce 50 million barrels of oil. If you scale that back to the size of one million barrels of oil, you could

find that with only 54 wildcat wells." To find a \$2 billion field, the 1,800 wildcats must be paid for. "Risk must be paid for," Skip said.

People tend to segregate in their minds the spectacular discoveries from the "misfits and dry holes" that are drilled in the process of making, or not making, a discovery. I've got several mistakes in this area myself," admitted Skip, in response to a participant's question.

South Glenrock is now past its peak of production and is being water flooded for secondary recovery. Skip explained that fields like South Glenrock are developed with secondary and tertiary production because the costs of risk are low. Big Muddy "is not a money making project. They're spending more money than they're making. That's the sort of thing that only a major can do. It also emphasizes the difference between the large company team efforts and the fact that they have unique roles in this business, versus the wildcatters, the independents, the consultants where it's more of a personal thing, really. It's one man, one project, up or down, win or lose. And yet all of them together have some role to play--in the exploration of this area, for instance."

#### EN ROUTE TO BEAR CREEK URANIUM MINE

The story of South Glenrock Field left participants enthusiastic to know more about the roles entrepreneurs play in fuel and non-fuel minerals development. Skip Curry, Dr. Weimer and Dr. Love continued to answer many questions on that facet of the petroleum industry as the buses rolled into Glenrock at noon. Lunches were picked up at a familiar stop for the Institute and the group proceeded on to Bear Creek. Along the way, the technical aspects and pros and cons of developing uranium through in situ leach processes were examined.

John Yellich, Project Manager - Uranium, and Rick Iwanicki, Environmental Coordinator for Uranium, Rocky Mountain Energy Company

In 1979 when the Institute first made the trek from Casper to the Bear Creek Mine, RME's Nine Mile Lake In Situ Leach (ISL) Project was expected to produce up to 500,000 pounds of uranium per year. Since that time, with the downturns



in the uranium market and difficulties encountered with the operation's cost effectiveness, Nine Mile Lake has entered a holding phase.

Halliburton, RME and Mono Power formed a partnership in 1976 to develop two in situ leach sites, one of which was Nine Mile Lake, nine miles north of Casper. Leaching tests and groundwater restoration have been completed and a final decommissioning plan is being completed for the Nuclear Regulatory Commission (NRC) and the Wyoming Department of Environmental Quality (DEQ).

Participants were given a brief outline of uranium in situ leach technology. Although Nine Mile Lake was not visited, a site developed by another operator was pointed out to the participants en route to Bear Creek. While the minimal amount of surface disturbance related to ISL was emphasized, in contrast to the open pit operations at a mine like Bear Creek, a major concern surrounding ISL techniques is maintaining the integrity of aquifer systems. Using displays, Yellich and Iwanicki illustrated how operators attempted to reduce potential impacts with current technology. Questions and discussions focused on geological characteristics of the Mesa Verde Formation, from which uranium in the Teapot Sandstone member was to be mined, that could result in groundwater contamination. Communication via fractures, for example, can cause fluids in the aquifer mined for uranium to invade other, uncontaminated aquifers.

With the current downturn in the uranium industry, the price of yellowcake has declined from \$44 a pound to about \$18.25 a pound over a period of two to three years. Along the way to Bear Creek, uranium mines affected by poor market conditions were pointed out to participants. In spite of the present state of the industry, ISL operations are doing quite well. Ten or eleven active operations in Texas and Wyoming generate about 10% of the uranium produced in the U.S.

#### AT BEAR CREEK MINE

John Benitez, Director of Government Affairs and Manager of Uranium Sales,  
John Yellich and Rick Iwanicki, RME

Prior to a wrap-up on the technical aspects of ISL mining operations, participants were provided with their first "corporate viewpoint" on how Washington policies affect western energy and minerals developments. Benitez

concentrated in particular on two recent pieces of proposed legislation being considered by Congress, one related to mill tailings management and another on uranium import restrictions.

"This latter policy is particularly interesting because...the consideration of it has been brought about as a result of the condition of the U.S. uranium industry," said Benitez. Most of the uranium industry in the U.S. has suffered significant setbacks. In response to this "deterioration," industry took its case to Congress, asking that all policies pertaining to the industry be reviewed and revised where possible in order to encourage a revitalization of the domestic uranium industry. Benitez commented that RME was fortunate to be operating in the capacity they are at Bear Creek, which is attributed to adjustments made by mine management to compensate for conditions in the domestic uranium market.

Using slides, Yellich demonstrated both surface mining and ISL operations. This portion of the program helped the participants to "put in perspective" the different technologies and operations dealt with. Economics of ISL versus surface mining were discussed in light of the current situation in the industry and domestic markets.

Bill Bauman, Resident Manager, Bear Creek and Mine and Mill Personnel

At the conclusion of the program, Bauman prepared participants for their tour through Bear Creek's mill and mine. Several RME personnel accompanied participants during the tour to answer questions and describe what the aides saw.

Participants learned that capacity of the Bear Creek mill is 2,000 tons per day; current production is 1,000 tons per day. At the time of the tour the mill was shut down for a two-day maintenance schedule. Bear Creek is supplying uranium only to Southern California Edison through a long-term contract agreement.

After walking through the mill, participants were taken to one pit in which overburden was being removed. Approximately 70 feet of overburden remained above the ore zone. Overburden is removed at the rate of about 30,000 yards per day by electric trucks and shovels. "There's not really much to it once you get started," remarked a mine engineer. Overburden is stockpiled for use

in backfilling and reclamation.

Participants next visited a pit where ore was being extracted, sampled for U<sub>308</sub> (uraninite) and trucked to the mill. During the course of the tour, the various aspects of reclamation, relationships between operators like Bear Creek (RME) and state regulating agencies such as Wyoming's DEQ, and health and safety aspects of radiation control and tailings management were covered. Pervasive throughout participants' discussions with Bear Creek personnel was the topic of the status of the industry, when, how and whether it would improve.

#### EN ROUTE TO EXETER #7 DRILL RIG SITE

Skip Curry and Rick Robitaille, Executive Director, Petroleum Association of Wyoming

The focus of the day's activities returned to the petroleum industry as participants embarked for a tour of an active drill rig site. As the charter buses retraced the route from Bear Creek Mine south towards Douglas, Skip Curry pointed out the vastness and emptiness of the terrain, something participants could not help noticing. "You'd think with all the coal, oil and gas, and uranium Wyoming is a behemoth of activity," Skip remarked. "But there's more antelope than people and more wide open spaces than anything else." This viewpoint was to be expressed again many times as participants spoke with the many independent-thinking developers of energy in Wyoming. Addressing the Exeter drill site, Skip noted that the area being explored is a frontier for that part of the Powder River Basin. Exploration is difficult because drilling must penetrate a 7,000-foot section before reaching potential pay zones.

Wyoming has the highest levels of drilling, producing and refining activities of any state in the Rocky Mountain region, said Robitaille. Wyoming produces 50% of the oil, more than 50% of the gas and has about one third of the refining capacity in the region. "Oil in Wyoming is very big, and oil in Wyoming is very big to the economy of this region," Robitaille stated. Production in 1981 was 120 million barrels of oil. Peak production was reached in the early 1970s. Natural gas production increased over that decade but

dropped slightly in 1981 due to lag time in completing major projects in the Overthrust Belt. In 1980, Wyoming led the nation in adding to proven reserves of natural gas, and was fifth of only ten states that showed increases in oil reserves, "healthy indicators" for the industry. However, fewer drilling rigs are operating now than at any time in the past 4½ years, so some setbacks are being experienced.

"Wyoming is somewhat unique," Robitaille said, "and one of our constant problems is the amount of land owned by the federal government." Access and especially federal ownership of minerals with private ownership of the surface are the two main difficulties that arise. Approximately 50% of surface lands and two-thirds of the subsurface are federally owned. "We have a lot of conflicts and a lot of problems when we (the oil industry) obtain a lease on a piece of property which the landowner has no interest in, said Robitaille. Although drilling rigs disturb a relatively small area of land, three acres per drill site, "it is somewhat of a disruption to have a drill rig move into the middle of your wheat field." These types of situations, where first use of the land must be satisfied, are encountered primarily in eastern Wyoming. In western Wyoming, access is the major problem and involves issues surrounding national parks, forests, wilderness areas and other federally managed lands. The Petroleum Association does support the Wyoming delegation's positive stand on the 1982 wilderness bill which states that drilling will be prohibited in wilderness areas. The source of conflict between industry and those opposing drilling activities are those areas designated for wilderness study.

About 40% of the production in Wyoming is primary. Secondary, tertiary, and even "oil mining" techniques are used for the remaining 60%. "We're trying everything we can to get oil out of the ground," Robitaille stated enthusiastically. About 50% of the oil produced in Wyoming comes from 10 fields that average 60 years in age.

For the past few years, the new reserves found equaled the amount of oil produced. Projections in Wyoming are usually based on seven and one-half to eight years. That is, if no more oil were found now, production of existing reserves would span that amount of time. No projections have been made beyond 1982, Robitaille said because of the uncertain economy and current excess supply of petroleum.

In addition to wilderness study areas, a BLM environmental assessment of

the area including the Exeter rig would prevent drilling on 200 feet either side of intermittent drainages. Robitaille remarked that in the four county area involved, 600,000 acres more than the acreage in Wyoming's wilderness system would be removed. "Pretty soon we're running out of spots to drill," Robitaille added.

Other topics the aides discussed with Robitaille included natural gas decontrol and alternative fuel sources.

AT EXETER #7

Tom Bower, Toolpusher, Exeter Drilling Company and Arne Arneson, Petroleum Engineer, Diamond Shamrock Oil Company

As a culmination to the day's focus on the petroleum industry, Exeter #7 lived up to all of which that industry is famous. Even after a long, well-traveled day, participants excitedly clambered up to the drill rig floor to watch in fascination as drillers "tripped" (pulled up) pipe from the more than 11,000-foot deep hole to replace a worn diamond bit.

"What we're doing here is digging a hole in the ground," Bower explained pragmatically to participants' amusement. As the group gathered at a vantage point away from the rig, Bower explained the ongoing activities and described the rig, equipment and "how it worked." Arneson expanded on the location of the rig with respect to older producing areas to the north of that location (southern edge of the Spearhead Ranch Field, discovered in 1973) and explained briefly the engineering involved in drilling operations that produce high pressured gas, in this case from the Frontier Formation.

As the buses departed the site Skip Curry and Rick Robitaille answered many questions on the rig workings and continued their dialogue on Wyoming's petroleum industry. Dr. Weimer and Dr. Love also contributed from their years of experience researching petroleum geology in Wyoming.

On a broader perspective, Skip pointed out that many financial problems have been generated by extensive borrowing to buy rigs. The decline in rig activity resulted in debacles such as that experienced by the Penn Square Bank in Oklahoma earlier in 1982. Softening of the oil market is responsible for much of the decline in activity, along with unfavorable personal income tax

revisions that have caused a decrease in the number of investors willing to finance drilling ventures. Curry also attributed many other factors to the decline as well, including foreign markets and currency exchanges that have hurt companies producing oil overseas. Declines in earnings of oil companies results primarily in a decline of exploration activity.

In spite of the "scarcity" of some kinds of oil, for example "anticlinal" and shallow oil, in Wyoming the state has not been drilled extensively. Thus, overall, oil has not become more scarce. Skip referred to the "truly unbelievable" discoveries of 100 million barrels of gas equivalent in the Overthrust, some of which are only in the very early stages of development. "So I really don't think you could say oil is scarce," Skip concluded. "It's just that you find it in different settings at different times."

#### AT DINNER IN DOUGLAS

Gary Glass, State Geologist, Wyoming Geological Survey

Glass commented on the "decimated" state of the uranium industry in Wyoming, citing decline from 5,000 workers to about 1,500 in one year. The uranium industry is troubled by many ills, not just the recession, Glass reminded the aides. The coal industry is also experiencing a "delayed reaction" to the recession with 550 layoffs and 3 mine closings in southern Wyoming. Coal there is more expensive to that section of the state was the first to feel the economic downturn.

Bentonite operations are depressed due to setbacks in the oil industry, gypsum because of the housing slump, and trona because of all the related consequences of recession. Commenting on his responsibility of projecting fuel and nonfuel mineral production in Wyoming, Glass said, "This will be the worst year ever. Even oil and gas is not going to be too easy." Glass added that in 1981, Wyoming did not produce the contracted demand for coal, with production at about 7% less than total contracted amounts. This has been due to contractors renegeing on agreed production quotas and refusing to buy all of the coal produced under contract. Glass noted that situations like this are symptomatic of depressed cycles in the minerals industry.

Glass remarked that the coal-to-gasoline plant proposed by Hampshire Energy and the ETSI coal slurry pipeline appear to be moving forward in spite of declines in production. Synfuels projects have cycled through various stages but "we're down to where we may actually have a synfuels plant," Glass said. Financing and especially water use are major considerations.

In response to a question on where coal for the conversion plant would

be obtained, Glass stated that "there is no problem buying coal in Wyoming right now." Most coal mines are at excess production, so the plant would not need its own mine. Although coal production has eased, projections still stand at 185 million tons per year by 1990, which Glass feels is an optimistic figure. Production was 103 million tons per year in 1981 and with the forecasted 9% increase, could reach 112 million tons per year for 1982.

When asked where coal shipped out of Wyoming went, Glass referred to two handouts provided to participants by the Wyoming Geological Survey. The "big market areas" are south-central states and the Chicago-Indiana-Ohio area. The only new market expected may be the West Coast. No foreign markets are expected before 1990.

Dr. Dave Love, USGS

Love reviewed some of the historical aspects of the development of the petroleum industry in Wyoming presented earlier in the day. Between 1910 and 1920, a map of Wyoming was produced showing the major oil and gas fields of the state, as delineated by surface anomalies. These fields were not discovered for another 10 to 50 years, thus the author showed a remarkable foresight of the growth of the industry in Wyoming. A similar situation involved a USGS map and the southwestern Wyoming oil fields.

Love used slides to illustrate the geological features of the major oil and gas producing areas in Wyoming including the areas visited that day. He also related geological features to the occurrence and trapping of hydrocarbons and exploration techniques.

ON TOUR IN WYOMING--TUESDAY, AUGUST 17

Morning Briefing: Gary Glass, WGS

Glass, speaking from his broad experience in coal geology and as Wyoming's State Geologist, provided the participants with a clear, concise picture of what they would encounter during the day. The strip mines that snake northward in Campbell county to Gillette and just north of Gillette produce about 75% of the coal in Wyoming. Black Thunder is one of the two largest mines in the state. Production there is expected to exceed 17 million tons for 1982. "For comparison, when I got here in 1971 the largest mine in the U.S. was seven million tons per year," said Glass. Thickness of the coal seams is much greater than in eastern coals, up to 80 feet thick in places at Black Thunder. Some seams will reach 100 feet in thickness and the Wyodak coal bed near Gillette is about 300 feet thick. Nomenclature of coal beds in the basin is very complex. For example, the "Wyodak" is actually comprised of seven beds that come together with no, or very little, parting. Coal mines in the basin are located where beds come together in single units. Coals in the basin are Paleocene, about 70 million years old. They were formed when organic materials, trapped in a basin where water circulation was restricted, accumulated and formed peat bogs. With compaction over time, the coals were generated.

Participants were asked to notice the progression of concrete silos along the way. Each silo holds enough coal to load one unit train (about 12,000 tons), and different mines have different numbers of silos to meet their particular operating schedules. Some of the mines which have contracted to supply coal for the slurry pipeline are building facilities at their operations.

Wyodak, the last site visit that day, and the only air-cooled power plant in the U.S., used Wyodak coal and very little water is consumed in the operation.

"The estimated reserves of coal that you're going to be driving over are around 20 billion tons of strippable coal," said Glass. These reserves make Campbell County the largest coal producing county in the state. Wyoming ranks third in U.S. coal production, though in the early 1970s it was unranked and "half the time they didn't even include us as a coal-bearing



state," Glass remarked. Production then was around one million tons per year, in contrast to 100 million tons now.

A difference between the Powder River Basin mines and eastern mines is that no energy is spent, for example at Black Thunder, in removing rock. This results in some reclamation problems because of a shortage of material for backfilling mine pits. Only one underground coal mine exists in the state.

The BTU content of Powder River Basin coal is approximately 8,000, versus 12,000 to 14,000 for eastern coals. Most of the coal being mined in the basin averages about 0.5% sulfur.

Coal mining itself does not raise the environmental issues now that it did when the activity in eastern Wyoming began. Concern has become focused on projects like the slurry pipeline and synfuels because of the underlying problem to all of development in Wyoming, water. Coal mines do not consume much water and most of the issues surrounding Powder River Basin mines are longer term: e.g. conflicts with municipal and agricultural uses of groundwater and water availability for operations like the proposed Hampshire Energy project. Other issues, such as air quality, pale in importance. "It's all settled down to water," Glass said, "which most of us figured it would end up anyway."

#### EN ROUTE TO BLACK THUNDER

Walter Ackerman, Administrator, Wyoming Department of Environmental Quality (DEQ), Land Quality Division

Following the briefing, the charter buses departed Douglas for the trek across Wyoming's lonely plains to the Black Thunder Mine. Ackerman, a controversial figure in the state because of his philosophy on regulating coal mine operations, talked about the history of coal development in the basin.

The present activity is quite different from the early 1960s when only three mines operated in the entire state. "You couldn't give this coal away in the early 1960s," said Ackerman. "If you came in for a lease you could pick it up for \$1.25 an acre."

In 1965, Wyodak Power Plant applied for a coal lease near Gillette. When

attempting to obtain additional acreage, Kerr-McGee bid up the standing price of \$1.25 to \$15 per acre. "This broke the entire situation here in Wyoming," commented Ackerman, "and the coal leasing really got started." In 1967 leases were being bid at \$167 per acre and in 1971 a lease taken by Sun Oil Company was \$505 per acre. Royalty rates to the U.S. Government also escalated, from 9¢ or 10¢ a ton in 1962 to 17 to 17.5¢ a ton in 1971. The last lease in the basin was issued in December 1971. Subsequent actions by the Sierra Club prevented any additional leasing until April 1976. Royalties then were 10% of the gross selling price. The minimum now is 12.5% or roughly 80¢ to the dollar per ton of coal.

In the 1960s, all the coal leased in the basin was for liquefaction and gasification. What changed the ultimate use of the coal was unavailability of water and competing development of lignite in North Dakota. Overnight, Powder River Basin coal became suitable only for dry shipping. The AMAX Belle Ayr Mine was the first to open, loading coal for \$1.72 per ton that now goes for \$6 a ton. Freight rates on the new Burlington Northern railroad also increased, from \$6 per ton in the early 1970s to \$26 a ton for some mines now.

Ackerman stressed a point that had not been brought up in earlier discussions, that of the water content of coals in the basin. With a 30% moisture content, 33 cars of a 100 car unit train "carry water." In addition, one-half to one-third of the coal in a power plant using Powder River Basin coal is actually used to "cook out" the moisture.

Reclamation costs in Campbell County run 2¢ to 3¢ per ton which, according to Ackerman, are very low compared to other costs. Wyoming's DEQ is a demanding agency and many operators feel reclamation costs and the agency's approach to permitting are overboard. According to Ackerman, the mine permit for Black Thunder is approximately 28 volumes. Commenting on his toughness, Ackerman said, "My mines run 40 to 60 years and have to last through ten administrations. What is a coal company that's got to last 40 years out here going to have to do when another administration gets in? A company cannot afford to be vascllating all over the board every four years. They'd rather have you tough and stringent in your regulations and know where you stand."

Ackerman's main concern is federal ownership of lands in western states.

Fifty percent of the total land area (surface and minerals) in Wyoming is federally owned, and another 22% is federal minerals only. "In other words, the U.S. Government owns 72% of the mineral estate and 50% of the surface estate. So we're really a colonial empire." said Ackerman comparing growth and wealth in Wyoming to that of Texas, where private enterprise benefits from mineral wealth. "Money generates money (in Texas)," Ackerman said, "whereas this money goes into some federal program. The wealth doesn't stay here."

Discussion turned to federal land ownership and conflicts between surface and subsurface uses, which Ackerman feels is a major problem in the basin. Private owners of surface lands, whose ownership stemmed from the 1916 Homesteading Act, had to deal with federal leasing of minerals below their property for extraction. Conflicts also arose between different federal agencies over surface versus subsurface management, as in the case of the Thunder Basin National Grassland where the Forest Service manages the surface and BLM the minerals. An additional land use issue in this prolific basin is competing development (oil and gas, mining, pipelines) often resolved only through long and tedious negotiations between companies.

Asked to comment on the bonus bid approach to leasing, Ackerman replied, "I don't know whether I should comment on it, because we sure didn't get any competition this last go around. Those coal leases practically went for a minimal price." When the state should have earned \$75 million from the April 1982 lease sale it only made \$25 million. Asked how he would have handled the controversial sale Ackerman replied, "I would have rejected all the bids." Ackerman feels that with the present coal surplus capacity of 40 million tons per year and leases issued in the 1960s that have not yet been developed the 1982 lease sale was unnecessary. According to Ackerman, if the low bids received had been rejected and the Department of Interior (DOI) waited until a healthier economic environment generated a higher demand for coal, the lease sale would have been more successful. Responding to a question on effects of development in the basin, Ackerman stated that community impacts was the real issue. Affected communities that had to generate money for public improvements are having difficulties with indebtedness because of the slow economy.

Oscar Swan, Commissioner of Public Lands, State of Wyoming

Swan, who manages state trust lands in Wyoming, gave participants some insight into how the state handles its own lands. Referring to conflicting developments, Swan cited as an example an oil field north of Douglas which "is over some of the best strippable coal" in the area. The state has adopted a policy that will provide for arbitration and resolution to such emerging conflicts, said Swan

"We can afford to be patient," commented Swan on his view of the state's land management philosophy; "We welcome the mineral development but we insist that it be pretty much on our own terms." Swan feels that communities and the state have done well at handling associated impacts.

Swan also emphasized the problems associated with federal ownership of surface lands and minerals. Where minerals are federally owned the situation is not so bad, Swan said, since the state receives 50% of the royalties. With the windfall profits tax, however, the state's portion of mineral royalties is taxed before being returned to Wyoming. "That's still a sore point with us," remarked Swan. Swan commented that where privatization involves release of lands that the federal government cannot manage efficiently, it would be successful. He doubts whether a more substantial release would be enacted because of pressure from environmental groups. With reference to debate surrounding a proposed drill site in the Gros Ventre Range near Jackson, Swan commented that many people in Wyoming felt the state should have had a stronger voice in wilderness legislation than was given by Washington. Some groups, Swan said, argued in Washington against the states having any voice at all and "that's about the way it ended up." On the other hand, the state cannot take action against projects on federal lands unless adjacent state lands are affected.

In Wyoming, state trust lands were those given to Wyoming just before or upon statehood; many for public schools, the so-called "school sections." The state still owns most of those lands and receives a substantial royalty income from their use. Should the state desire to develop some of those lands, the legislature must seek to purchase them from the school trust, Swan commented.

Jeff Hulse, U.S. Forest Service, Thunder Basin National Grassland

As the charter buses traveled on to Black Thunder, Hulse described the history and current use of the Thunder Basin National Grassland, namesake of Black Thunder's operator, Thunder Basin Coal Company. In the Powder River Basin, the grassland constitutes the only surface federal land ownership. It originated in 1937 under the Bankhead-Jones Act, when the federal government purchased the grasslands for agricultural conservation and grazing leases. The Forest Service became surface manager in the 1950s, and administers grazing permits through three grazing associations.

Hulse described various operations that are on the grasslands, four coal mines (including Black Thunder, of which 40 to 45% is on national grassland with the remainder on state lands) and railroads. One-sixth of the pronghorn antelope population in North America is located in Campbell and adjoining Converse Counties.

Some of the management problems and conflicts encountered by the Forest Service are related to energy development. Mining and railroad construction inhibit antelope migration which makes wintering very difficult for the herds. Since ranching must be in "economic units"--blocks of land of certain acreages --in order to be profitable, ranchers and developers have locked horns in many instances. The result is that ranchers must often accommodate the land demands for mining and railroads. Ranchers also became concerned that the great amount of geophysical activity, seismic crew operations for oil and gas exploration, would result in groundwater contamination in the basin. Ranching is not faultless either when it comes to generating conflicts. Competition between wildlife and domestic grazing has raised environmental considerations, said Hulse.

#### AT BLACK THUNDER MINE

Approximately five by three miles in size with roughly 12,000 acres in the permit area, Black Thunder is claimed to be the largest surface coal mine in the U.S. The first train was loaded in December, 1977 and since then about 40 million tons of coal have been shipped from the mine. Presently, production is cited at 17 million tons per year of "compliance coal"--coal that meets

Clean Air Act standards--with a sulfur content averaging 0.33% and a heat content of about 8,866 BTUs.

At the observation deck over the main pit, participants stared in awe at the giant coal seam. Commented Jerry Nettleton, a mine engineer for Black Thunder, "The USGS has estimated reserves of the Powder River Basin at 23 billion tons." The Black Thunder tour leaders went on to explain the truck and shovel operation. Mine life at Black Thunder is expected to be forty years; total reserves are 750 million tons less the 40 million tons mined to date. Pointing to the puffs of grey smoke participants had observed emanating from the highwall, Nettleton explained that the high moisture content and oxidation potential of the coal often resulted in coal fires in the pit. Burned coal becomes "clinker," continued John Maberry, a USGS geologist traveling through Wyoming with the Institute. Maberry went on to tell tales of mine fires in Wyoming as Walter Ackerman spoke about the difficulty often encountered in putting them out.

A truck and shovel operation enhances reclamation, aides learned at the revegetation sites, because material is removed in the same sequence in which it occurs. This makes backfilling and revegetation easier and more successful. The overburden has a 10% swell factor over the long term. At one site, about 220 feet of fill was required for backfilling. Many participants, quoting Walt Ackerman's concerns regarding reclaiming mine pits in the basin, questioned the success of reclamation at Black Thunder and how the related problems of shallow overburden would be solved. According to mine personnel, restoration of drainage patterns is the primary constraint on reclamation. Reclamation costs were quoted as being about \$6,400 per acre, \$4,000 for recontouring, \$1,600 for seed beds and the rest for revegetation and maintenance.

In the sophisticated control room at the loadout participants received an explanation of how the mine operates. At the loadout area, they learned that Black Thunder had about 110,000 tons of storage capacity. Four trains are loaded per day at approximately 11,000 tons of coal per train. Powder River Basin coal was not actively mined until 1922 when Wyodak opened, reflected a Black Thunder employee. Then came the "coal boom" of the 1970s and now eleven mines are operating in the basin, some at capacities similar to Black Thunder's. These remarks stirred up discussions among participants and staff of where the industry and coal markets may be headed. After viewing the

crusher, several participants climbed up the huge 1,200 to 1,600 horsepower trucks used in the mining operations, each one capable of hauling about 150 tons of coal. Dave Sinkbeil, Senior Mining Engineer, described the labor requirements at Black Thunder and types of skills necessary to operate the kind of equipment used. As the tour of Black Thunder concluded, participants reluctantly departed the impressive operation to continue the journey northward.

#### ON ARRIVAL IN WRIGHT CITY

Walt Wierzbicki, Supervisor, Wyoming Projects, and Gary Vandenburg, ARCO Coal Company Community Development

The next stop was lunch in Wright City, the well-known effort by Atlantic-Richfield (ARCO), parent company of Thunder Basin Coal, to assist employees with housing. Since 1979, the last time Wright City was visited by the Institute, quite a bit of growth has occurred in the little wind-swept community on Wyoming's vacant plains. During a short tour of the settlement, participants learned that ARCO's intent was to eventually completely withdraw from any ownership or participation in Wright. Things are moving slowly because of the general state of the economy; Wright's present population is about 1,500 and the community was planned for an ultimate population of 7,000.

Although the majority of the residents work for Thunder Basin Coal at ARCO's two mines in the basin, Black Thunder and Coal Creek to the north of Wright, employees for other mine operators also live there. A great deal of civic and community pride is evident in the "company town." "We're blessed with a group of people in Wright that care about the community. They're young, developing families, they try to keep their property well-maintained," said Wierzbicki. "They don't like you to make mistakes. If they have something to say they're not a bit bashful about it." Wierzbicki gave a lively commentary on the community and the involvement of its citizens in everything from "dogs to weeds."

Wright grew out of an anticipated need for housing, outside of Gillette, that was closer to the mining activity in that part of the basin. Because of the lack of state or federal money to remedy the problem, private investment was necessary. Wierzbicki and Vandenburg viewed this approach as contributing to the success of Wright, in contrast to some other unsuccessful approaches taken in communities impacted by energy development in Wyoming.

#### EN ROUTE TO WYODAK

Dick Sandgren, Assistant Vice President of Economics and Research, Coal and Business Unit, Burlington Northern

On the last leg of the journey up the Powder River Basin to Gillette,

participants heard the story of railroad activity in the basin from BN's point of view. Sandgren's group at BN monitors pricing and indirect operations of the unit trains used for coal haulage. Discussion opened with some comments by Sandgren on possible rail competition by Chicago Northwestern, which primarily services the southern basin.

"I'd like to welcome you to unit train country," Sandgren said, as participants once again viewed a long, snaking train bound northward. Burlington Northern has attempted to standardize unit train operations and tariffs, Sandgren said. In general, the trains are 100 to 110 cars, loading 100 tons of coal per car, with 10,500 to 11,000 tons capacity per train. The cars are constructed to meet specifications of each utility with regard to how the coal should be dumped once the train reaches the utility. The main rail interchange points for unit trains from the basin are Kansas City, Dallas-Ft. Worth and the Chicago area. The longest haul for BN is the 1,600 miles into Texas, longer than any other coal haulage in the country.

Railroads first arrived in Gillette in 1891 as the CBNQ, which became part of BN in 1970. The Northern Pacific, in southeastern Montana, also served the region and merged in 1970 to become part of BN. "I think it's been known for a long time that there's plenty of coal out here. The problem was there wasn't a particular market for the coal that was in the ground," Sandgren remarked. Little rail movement existed in the Powder River Basin prior to the 1970s. Sandgren attributed accelerated coal development in the basin to three factors: Utilities began to build for coal firing, environmental requirements encouraged use of low sulfur coal to meet air emissions standards and the Arab embargo of 1973.

Sandgren told participants that coals have "market characteristics," (physical parameters) that influence which type of coal will be shipped to any one market. "All of the coal out here is steam coal," Sandgren said. "Secondly, it's all surface mined. Most of the coal in the Powder River Basin is less than a half of one percent of sulfur, and basically most of it is compliance coal with respect to the Clean Air Act standards of 1970." Because of the large reserves and capacities of the surface mines in the basin, the price of that coal is relatively low. "Today, it's probably in an area of \$8 to \$9 a ton," Sandgren said. In the early 1970s, Powder River Basin coal was being sold for less than \$2 a ton. "Because of the excess capacity out here the



price simply hasn't increased," Sandgren remarked. Some of the disadvantages of Powder River Basin coal are its low BTU (which affects coal use in older power plants), high moisture content (which affects shipping costs and efficiency), and distance (BN's average haul is 800 miles).

Coal haulage for all of BN's operations has increased from 20 million tons per year in the early 1970s to 112 million tons per year, largely due to the Powder River Basin. The coal is shipped to about 21 destination states. Burlington Northern, as sole transporter of coal out of the basin, began to upgrade its rail system in the mid 1970s to accommodate the increased traffic. Coal in the southern part of the basin moves south, in the northern part north.

Sandgren moved on to address issues related to possible alternative methods of shipping coal from the basin. In 1972, BN and Chicago Northwestern applied for permission to build the trackage between Gillette and Douglas, along which the Institute buses were traveling on Highway 59. The applications were held up in court until 1977 because of action by environmental groups. Energy Transportation Systems, Inc. (ETSI) entered the picture with attempts to obtain eminent domain authority for construction of the coal slurry pipeline. "So far they haven't succeeded," commented Sandgren cautiously. Sandgren mentioned several problems related to the pipeline, the primary one being excess capacity in the basin with demand for the coal not expected to pick up for another four to five years. Transportation capacity in the basin would increase dramatically. Since utilities in Oklahoma, Arkansas, Louisiana and Texas would "own" the pipeline, they would shift their tonnages away from rail transport. This trend could hurt the consumer, Sandgren said, because the utilities, facing difficult financial times now, would have to pass those costs on. The pipeline would cost in the neighborhood of \$3½ to 4 billion for construction only, approximately \$25 per ton of coal. "I'm sure the ETSI representative tonight will have a different opinion with respect to viability" of the pipeline, Sandgren observed.

Freight rates have increased less than the price of coal in the U.S., excluding the Powder River Basin where prices of coal have tended to stay low. Sandgren quoted a freight rate of about \$9 per ton to ship coal out of the northern Powder River Basin in Montana, an increase of about three or four times the 1969 rate. One participant, commenting on the complaint by many coal operators that shipping costs were too high, questioned the validity of

those charges and profitability of coal transport for BN. Freight rates are being upgraded, Sandgren replied, to account for mistakes made in the early 1970s. "We're making money on coal. I think with the economy the way it is, if we weren't making a few bucks on the coal we'd be in a worse fix than we are." The assumption is made that there is no competition in the basin, Sandgren stated, but fuel commodities in other states like Colorado and Texas do compete with Powder River Basin coal. "The idea that we can simply put any increases on our freight rates that we feel we should is simply not correct," Sandgren concluded.

John Maberry, Research Geologist, Branch of Coal Resources, USGS

Maberry, who traveled with the Institute during the two-day tour of Wyoming, was a valuable resource person on the Powder River Basin and development of the coal industry there. Speaking from his years of research in the basin, Maberry reviewed the geologic history and deposition of coals, and pointed out to participants outstanding features in the basin, like the red hills of clinker that dotted the rolling plains and coal silos that marked areas of development.

Studies by the USGS in the basin have helped to guide development, Maberry said. Climatic research provided coal operators with data to use in reclamation planning. Regional studies on mineral resources have served as a springboard for private sector development. Maberry pointed out that evidence from these studies supports opinion that mining actually disturbs a small percentage of land at anyone time. "Water resources are probably the most sensitive issue" in reclaiming Powder River Basin mines, commented Maberry, supporting the state's viewpoint. "I suspect that water resources are not the big issue that they were sometime ago," he added, "because people understand it better, it's not as emotional. Mines have proved not to be as big an impact upon the water resource. I think also...that this will prove to be the case with the slurry pipeline."

Maberry's other concern is with conflicting developments in the basin. As the buses drove along, he reiterated that the 200-foot deep belt of mineable coal extends from the mining district just north of Douglas to northeast of Gillette. Oil is also produced and at some point, remarked Maberry,

decisions will need to be made on which resource to exploit.

In summarizing much of what participants had seen and heard that day, Maberry stated, "It was said that 70% of the strippable coal resources of the U.S. are in the Powder River Basin, and I believe it." Of the nation's coal resources, 54% lie west of the Mississippi and another 54% are in the basin. "So this is an enormous coal resource. It's the most accessible, easiest to get at. Unfortunately, it's not all that good a coal," he added wryly. "Nonetheless, it's an energy resource that's almost unparalleled in the world."

#### AT THE WYODAK POWER PLANT

Jim Morgan, Plant Manager, Wyodak and Plant Personnel

The Wyoming tour ended, appropriately, with a tour of a coal-fired power plant, demonstrating the typical end use of that resource. Prior to and after escorting participants through Wyodak, Morgan explained the operation of the plant and deftly fielded sophisticated technical and policy questions by the participants. Wyodak, a joint project of Black Hills Power & Light and Pacific Power & Light that opened in 1978, is unique in three ways, said Morgan. The direct condensing process with air-cooled turbines allows a water consumption at Wyodak of 200 gallons per minute of which 30 gallons per minute is used in steam generation, about 7% of water usage at a conventional power plant. The second unique feature of Wyodak is the source of its water supply. Because of the unavailability of water in the area, Wyodak contracted with the city of Gillette to buy its sewage. "That's our total make-up water supply for the process," said Morgan. The sewage is treated in an expensive, complex process to a quality equivalent to distilled water. Lastly, the fuel costs at Wyodak (43¢ per million BTUs) are probably lower than those of any thermal plant in the country. Location of Wyodak at the fuel source and the efficiency of the plant is responsible for this distribution.

Responding to questions, Morgan stated that Wyodak, with an average efficiency of 34% and a heat rate of about 12,000 BTUs uses 2 million tons per year of coal. An additional five million tons per year of coal is shipped out of the adjacent mine. Costs of operating the 330 megawatt plant are \$700 per kilowatt. Though the boiler is 96% efficient, Wyodak itself uses

more electricity than conventional power plants. Participants probed for details on air emissions ("We can meet federal standards but we can't meet the state's," said Morgan dryly). Wyodak, at present, does not use scrubbers. Water constraints prevent the use of wet scrubbers for emissions and, under current air standards, the plant will not expand unless a dry scrubbing process can be developed. The remainder of the aides' discussion with Morgan focused on power transmission, power allocation, equipment make and features and rates.

#### EN ROUTE FROM WYODAK TO GILLETTE

Herb Carter and Al Miller, Campbell County Chamber of Commerce

Participants were escorted into Gillette by two members of the Chamber of Commerce one of whom (Carter) was a candidate in the fall mayoral elections. Carter and Miller provided a lively account of the current situation in Gillette as an update to reports in past years of the community's struggle to cope with socioeconomic impacts. Their discourse with the aides also served to update what had been presented to Institute participants in 1978 and elaborate on recently published articles about Gillette.

Carter remarked that the interest shown in Gillette has resulted in a great deal of assistance for the community. When asked what were the most pressing problems to be resolved, Miller replied, "Water. We didn't have enough water until this year." Residential as well as industrial growth sorely pressed Gillette's meager water supply which was also very poor in quality. The aides could not help becoming aware of another local issue--traffic congestion. During the drive to and through Gillette the buses were stopped twice at railroad crossings for a passing unit train. At the famous Gurley Street overpass participants learned that Burlington Northern had cooperated in Gillette's search for a solution to traffic flows by contributing \$750,000 toward the \$3.8 million structure.

The chores of organizing a community for energy development-related impacts are never ending. When queried as to what the future may hold for Gillette, Carter replied that the population will increase should the Hampshire Energy project become reality and that some attention is being given to what community needs will be in that event.

## AT DINNER IN GILLETTE

For this last evening in Wyoming, the aides were treated to a different program format. Instead of a featured speaker or panel of speakers, about 35 residents and representatives of industries in the Gillette area dined with the participants. Several of the guests, who were known for their experience in energy and minerals development and related issues in the Powder River Basin, were selected to act as moderators. As the moderators stimulated discussion between the aides and Gillette guests, a great deal of interaction between everyone at the function resulted in a rewarding exchange of philosophy, ideas, viewpoints, opinions and arguments. The informal structure of the event, with the guests scattered at random among the participants at the dinner tables, helped to facilitate the successful program. A list of guests attending the dinner is attached in Appendix A.

Mayor Michael Enzi, well known in Wyoming and nationally for his political savvy, kicked off the evening by elaborating on Gillette's achievements since 1977. After dinner, Mayor Enzi opened the floor to discussion on questions and issues. The following questions and responses are highlights of the exchange.

Question: Of the revenues generated by the coal severance tax levied by the state of Wyoming, how much really goes to communities that are impacted by energy development?

Answer : Mayor Enzi, "Not enough. A lot of the severance taxes that are generated come from this corner (of the state). We try to get it back here, and an excellent job is done in this regard, but of course we'd like to have more. There are always towns that we think aren't impacted, in particular by the coal, that wind up getting some of the funds, too. For instance, one of the towns that always leads an effort to get some legislation changed that would make every town in Wyoming a coal-impacted town is Jackson Hole."

Question: Would a federally imposed ceiling of 12½% on severance taxes be beneficial to the State?

Answer : Oscar Swan, "I'm not going to talk to that, except that I agree with you (Enzi) on the philosophy that there's a difference between having an impact that you didn't invite, or that is there simply because the reserves are there, and having an impact that you do invite, as Jackson does (Teton County). Gillette is a perfect example of a town that has handled its problems well but they do get some direct money from the severance tax. It goes right to the city and the state doesn't tell them how to spend it, it's theirs and if they spend it unwisely it was their own money. And it should be that way. The decision should be as close to the problem as possible."

Enzi added, "On the 12½% issue, the last severance tax that was passed by Wyoming was one that was pushed for by the municipalities, the counties and the highway department. Those are funds that do go directly to the communities and I suspect that if the ceiling

comes in those would also be the first funds that are cut as well. And that will have a very significant impact on the communities."

Question: How are severance tax revenues distributed to communities?

Answer : Enzi, "It's based on our percentage of population compared to the total population in the state."

Question: So therefore the impacted area doesn't necessarily get its fair share relative to the amount of energy it's producing.

Answer : Enzi replied, "Not out of that part of the fund. The other half of the funds are grants and loans to the Farm Loan Board (which Swan also represents) and those we pick up a higher percentage of."

Question: Along that line, what do you expect out of Washington? What sort of federal involvement or lack of it would be best for you?

Answer : Senator Katherine Geddes, "I think the state should have control of the severance tax, because like any other business, if you raise a severance tax so high that you keep production out the state will suffer."

Question: The mineral industry seems to be an up and down industry and right now the boom seems to be tapering off. Are you concerned about this in Gillette and is there anything that you think can be done about it in terms of diversification of your local economic base or do you have that potential?

Answer : Swan said, "Yes, we're concerned about it, but we were concerned about it long ago. A constitutional amendment was passed eight or ten years ago that established that trust. It's whole purpose is to, in effect, buffer the ups and downs of the industry and keep a healthy economy here."

Expanding on that, Jim Morgan responded, "A piece of federal legislation not too many years back really dealt this particular county a tremendous setback. And that was the amendments to the Clean Air Act which said that all power plants must use best available technology. That really did nothing for this county in terms of economic progress. If you want to mine western coal then let us, we can meet the standards."

Following dinner, the aides and their guests moved into a private lounge in the hotel to continue their discussions informally.

ON TOUR IN COLORADO--WEDNESDAY, AUGUST 18

Morning Briefing: Gillette - Dr. Robert Weimer, CSM  
Rifle - Dr. Weimer and Dr. Thomas Sladek, CSM Research  
Institute

Before departing from the Gillette, Wyoming airport, Dr. Weimer described the deposition of uranium, coal, and oil and gas in the Powder River Basin, a "world class energy basin." "The main message here," said Weimer, "is that in each case (coal, uranium, oil shale, etc.) the resource that we look at tends to be site specific in a certain region because of the geological conditions that form through time." Coal, oil and gas are present in the Piceance Basin but not in the same quantity because of different geological conditions. With geologic maps, he prepared the group for the overfly of the Piceance Basin in Colorado. To save time in the day's schedule, Weimer recommended that the aerial view of the Piceance Basin would take the place of a bus trip to the site of the C-b tract, which is the site of Occidental Oil Shale Company's development.

Upon arrival at the Rifle, Colorado airport, Dr. Thomas Sladek described the oil shale retorting technologies that will be used by the several oil shale companies on the Western Slope.

ON THE BUS FROM RIFLE UP PARACHUTE CREEK

Dr. Robert Weimer, CSM and Dr. Thomas Sladek, CSMRI

As the buses passed Anvil Points, Weimer traced the history of oil shale development at the site begun in 1944 by the U.S. Bureau of Mines as a result of the Synthetic Liquid Fuels Act.

Passing by the Book Cliffs, Weimer described the formations and the visible evidence of oil shale. The banded colors of purple and yellow on the lower part of the cliffs distinguish the Wasatch Formation while the grey and tan layers containing the oil shale beds in the upper half distinguish the Green River Formation.

The richest oil shale bearing layer is called the Mahogany Zone of the

Parachute Creek member, Green River Formation which is resistant to wind and water erosion and forms a hard oil shale rock "ledge." The rock which is called marlstone is an organic rich mixture of kerogen (hydrocarbon substance), calcite and clay. The hardness of the rock makes it difficult to mine and to breakdown in the retorting processes. The Mahogany Zone averages a quantity of 30 gallons of shale oil per ton of rock.

Participant DeWitt John, Department of Natural Resources, State of Colorado, explained the origin of Battlement Mesa on the east side of the town of Parachute. Originally designed by ARCO, the project was built by Exxon, the new owner of 60% of Battlement Mesa with TOSCO the minority partner. Road construction on the new by-pass and improved county road up Parachute Creek was financed by oil shale companies and the oil shale trust fund--the state share of lease bonuses.

John also explained that a railroad is planned to transport the oil from the Parachute sites to the refinery west of Grand Junction. The use of an existing refinery temporarily solves any new environmental problems that might be created by increased air pollution.

The Union shale oil upgrading hydrogenation plant in Parachute Canyon can accommodate 30,000 barrels per day and will upgrade (make the substance more liquid) the product before it is shipped to a refinery. The Union man camp, west of the hydrogenation plant, provides living quarters for construction employees and has minimized the impact on local communities.

The first module (10,000 barrels per day) will use water from the Colorado River while future expansion will depend on water in Parachute Creek which will be dammed to also provide water for the Exxon Colony operation.

Speaking from a long familiarity and experience with oil shale, Dr. Sladek comprehensively reviewed the history of the industry on Colorado's Western Slope; in particular, the various involvements of the federal government. Two aspects of the industry were highlighted by Sladek--land ownerships in the Piceance Basin and present status of the various projects there. In the early 1900s, some of the land ownership in the area was transferred from the public domain to private ownership under the General Mining Law of 1872. The land rush did not begin until 1915 to 1920, when research by the USGS indicated that two million barrels of oil could be recovered from the shale (that estimate has become as high as three trillion barrels).



Eventually, many of the smaller claims were transferred to major oil companies such as Union, now the largest single landholder with 29,000 acres.

The land rush ended abruptly with the Mineral Leasing Act of 1920, which prohibited claim staking by private parties and turned over all unclaimed lands to the federal government for leasing. With the offering of three tracts in 1968, the recent history of the industry was inaugurated. According to Sladek, that offering was handled badly by Interior. "They were very poorly advised on how to go about leasing a low value resource to an oil industry that really didn't want to have it in the first place." In 1973 came the Arab oil embargo and a new, more carefully developed leasing program with six tracts to accompany the different technologies that had been developed for different areas of the basin.

Apart from federally sponsored projects at Anvil Points and in Utah, early oil shale development on the private side began with Development Engineering, Inc. (now Paraho) in 1971, which designed the Paraho retort. That retort was a spin-off of the one used at the Bureau of Mines facility at Anvil Points. Recently, the Department of Energy decided not to renew Paraho's lease, and that lease is now being offered to other research and development companies. Paraho has proposed to the Synthetic Fuels Corporation to develop a 30,000 barrel per day site in Utah, and would also like to develop a site in Kentucky for eastern oil shales.

Responding to questions by aides, Sladek commented on the past and present status of the Colony site and the speculation concerning Exxon's and TOSCO's roles in that project. As the buses neared the union facility, Sladek pointed out and explained Union's technology, facilities and philosophy. Responding to the aides' curiosity about environmental issues in the Piceance Basin, Sladek said the land there has been overgrazed and used for many other purposes, including energy. "It is a very delicate ecosystem, which has managed to maintain some identity despite the ravages of mankind. It's an ecosystem that can be disturbed very easily. I think there are some techniques that can protect it, but unless the land is very carefully managed some real problems can emerge."

## NEAR THE UNION SITE

Near the Union bench and retort, Sladek described the history of the operation. The steel structure on the hill above the main gate is a semiworks built in the 1950s to process about 700 tons of oil shale per day. With engineering modifications, the capacity was expanded to 1,200 tons per day before it was shutdown in 1958. After the oil embargo in 1973, another construction phase was initiated and the mine, retorting complex and upgrading facility were built to produce 10,000 barrels per day of shale oil syncrude. The Union retort is being constructed on a platform next to the mine level. The plant is being built with federal assistance (purchase agreement and price supports) originally extended by the Department of Energy and now controlled by the Synthetic Fuels Corporation. With this agreement the company is assured that the product will be purchased and sold at a fair market price. According to Sladek, "They are the envy of the oil shale industry because they have nothing to lose by completing the project."

DeWitt John raised discussion on potential environmental problems associated with spent shale disposal. One plan is to spill the spent shale into the valley below the mine which could, at the commercial stage, build up the valley floor several hundred feet and create a problem with the stream flow as well as stability of the pile. A new plan would remove the spent shale at great expense to the top of the canyon.

Still another problem involves the PSD Class II air standards which could be exceeded by the upgrading facility. John believes the problem may be solved if Congress abandons the PSD Class II requirements or if a better model can be developed.

According to Sladek the air pollution problem would be compounded by multiple shale developements in the single air shed. Parachute Valley tends to trap air in an inversion. The potential impact could be partically solved if spent shale was moved to the top of the plateau. At the first module stage, Union will probably dispose of the spent shale but at a commercial stage, the company may use a technology to gasify the carbon on the retorted shale producing a gas which can be recycled to the plant as a fuel to improve the energy efficiency. TOSCO also has a patented technique to recover energy from retorted shale but will not use the technique at the Colony project

because of the increase in air emissions.

John added some figures on the cost and work force in Parachute Canyon. The \$5 billion Colony project anticipates a construction workforce of 5,000 and about 4,000 permanent workers. The \$500 million Union project will employ approximately 2,000 construction workers and about 1,000 permanent workers.

AT LUNCH: COTTONWOOD PARK - BATTLEMENT MESA

Kathleen Sullivan, Colorado State Legislator

Many people believe energy development will be a "rape and run" operation while others think it will be "extremely beneficial." In this way, Sullivan described the attitudes of Western Slope residents.

Sullivan, a native of Meeker in western Colorado, talked about the inevitability of development: "You can't be no-growth and can't be pro-growth here --somewhere there has to be a median and it means we are going to have growth and development whether we like it or not, and it means we have to find a reasonable way of predicting, and at least be able to act and react to forces we can't control." The mood of local communities, according to Sullivan, has been to look at the "best way to the most rapid development of shale."

Sullivan recalled that Parachute's main street was a dirt road a few years ago and that the Battlement Mesa development replaced a fruit growing area. She foresees the need for growth to keep the Parachute area economically viable. The attitude in Rifle, Colorado is "more temperate" for it has experienced growth in agricultural and tourist interests.

The negative reaction to development has been expressed mainly by new residents, said Sullivan, those who came to Colorado to work in the oil shale industry. Exxon's pullout "shattered a lot of people's dreams and it also shattered their businesses," which had expanded with interest rates up to 25% to compete with new businesses. The situation has caused people to talk about diversification and the need to look at "alternate economies other than those based on nonrenewable resource technologies." The problem, according to Sullivan, is to find funding for economic diversification. In 1980, Parachute's population was about 400 and in 1982 it had grown to 4,000, now settling at about 3,200. Emerging state funds are scarce because of the unemployment at other mining operations in the state. In addition, the Parachute area can expect another 1,700 unemployed people by Union in January 1983.

In summary, Sullivan said, "A number of us have felt strongly that if energy development is to occur in Colorado, it must pay its own way."

Baki Yarar, Professor, Department of Metallurgy, CSM

The technology of tomorrow, according to Yarar, is in upgrading or beneficiation processes which will eliminate rubble and obtain the components to increase the capacity of above ground retorting. If the material is upgraded 100%, the capacity of above ground retorting can also be increased 100%. The principle is based on upgrading or beneficiation and can be done in several ways to obtain concentrate by exploiting the physical and chemical properties of shale, for example density differences, color differences, magnetic properties or by exploiting the surface chemistry.

Under a microscope, shale particles do not have the same color. The darker, oil-rich particles which consist of a matrix in which kerogen is embedded must be separated from the non-oil particles. Through grinding and crushing, a powder is formed and several separation processes can be used. For example, a liquid with an appropriate density can separate the sinking and floating shale particles in a density separation process which upgrades shale from 20 to 70%. The color density method exploits differences in color among the white and black shale particles. The white particles reflect light and are identified by a light beam and then separated by an air and water jet--like coal preparation. The magnetic process separates the magnetically susceptible and nonsusceptible particles. Methods which exploit the surface chemistry (that part of a mineral in contact with air) rely on the introduction of a reagent to a shale slurry which absorbs only certain particles. Another surface chemistry method relies on the introduction of oil to the slurry which adheres to shale particles, forming agglomerates and leaving the non-kerogen particles in powder form.

"The point of mineral processing of non-shale minerals has been with us and is the basis of the whole technology," said Yarar. The message for the future is, according to Yarar, "Whoever does the research of the future should be supported for the technology of tomorrow on these lines rather than the technology of yesterday which is none."

Gene Harrison, Chevron Shale Oil Company

Harrison, speaking to the "whether and when" of an oil shale industry, stated that Chevron has changed its projections of energy supply from synthetic fuels. That company had originally projected two million barrels per day by the year 2000 in 1981. Projections made in 1982 are for 750,000 barrels per day. Harrison pointed out that a general misunderstanding exists about the decline in energy demands in the U.S., what part of the decline is attributed to the state of the economy (a short term effect) and what part to conservation (a longer term, more profound effect). These figures "don't sound the death knoll" for the industry, however. Harrison thinks they are indicative of a more realistic, stable development for the industry.

Stressing the timelines that are involved in an oil shale project, Harrison said Chevron has been actively involved in shale since 1979 and "hasn't turned a shovelful of earth." Community impacts and relationships and an industrial infrastructure--everything from roads to buildings--take time to build and are important to the project's success. Economics and technologies are also critical to a successful industry. Referring to Dr. Yarar's technique of beneficiation,

Harrison emphasized that one difficulty with that process is the size to which particles must be crushed.

The big question, according to Harrison, is "are we ready to go with the shale business. Are we really truly ready, other than by brute force and awkwardness, to pound this material to pieces and have this mass heat input." The answer for Chevron is "no." They foresee a great deal more research required to prove a process they can rely on. In the meantime, Chevron is working with local communities like DeBeque on socioeconomic and environmental issues. Chevron's time frame for these early phases of development, research and infrastructure is eight years.

Harrison sees as the key to development of oil shale two basic programs of development, pure economic competition and federal support. The latter, he said, must be based on a "conscious decision" by Americans as to what our primary of energy will be, imported versus domestic. To Chevron, the right answer seems to be that oil shale should stand on "its own two feet."

Pete Rutledge, Area Oil Shale Supervisor, USGS

Rather than focusing on what has happened in the past, Rutledge talked about future outlooks and the prototype program. Tract C-a, operated by Rio Blanco (Gulf and Standard of Indiana), was originally leased to prove surface mining techniques with aboveground retorting. Then, the "sticky issue" of off-site waste disposal came up. In June 1982, Rio Blanco asked for suspension of operations until suitable arrangements for off-site disposal could be made. This procedure gave Rio Blanco a five year delay in "minimum royalties" and extended their lease for five years. "The last I hear is the prognosis does not look too good," said Rutledge about bills in Congress to provide for proper spent shale disposal.

With regard to C-b, owned by Occidental and Tenneco, Rutledge said it was originally leased to demonstrate deep, wet mining technologies, with ARCO, TOSCO, Ashland and Shell (the original lessees in Colony). When those four companies dropped out of C-b, Oxy and Tenneco entered with the idea of using modified in situ (MIS). "They went full bore right from the start with commercial facilities," said Rutledge. Their efforts on MIS were like Exxon's in terms of the size of the undertaking and its cost. A rapid escalation of costs, especially those of a surface plant to treat the low BTU gas by-product from MIS, resulted in an effort to get assistance from the Synthetic Fuels Corporation which failed. The operators are now attempting to redesign the facility and submit a revised development plan for a 10,000 to 15,000 barrel per day facility, that would start with surface mining and retorting and later include MIS, for around \$900 million. Rutledge hopes that a new development plan will be completed so that the difficulty of suspending operations at C-a can be avoided.

Rutledge also discussed the status of federal leases U-a and U-b in Utah. Land status problems there were solved this year and a joint development program approved. Construction has begun on roads, facilities and mine shafts. "Utah is also in the throes of developing an effective socioeconomic policy particularly with regard to housing," said Rutledge. At one time it was thought a man camp such as Union's would be needed, but it now appears that with the situation in Colorado the way it is, busing workers from Vernal would be more viable.

## EN ROUTE TO GRAND JUNCTION

As the buses traveled along the Colorado River from Battlement Mesa to Grand Junction, aides and staff continued to talk about Western Slope issues. The discussion leaders for that day, Dr. Weimer, Dr. Sladek and Marty Robbins, also touched upon water issues in the state and, in particular, demands upon the Colorado River system. Participants Jim Bradley, representing Utah, and DeWitt John continued to elaborate on synthetic fuels development, state attitudes and philosophies, and current trends and events in the industry. Upon reaching Grand Junction, the remainder of the afternoon was designated as free time for the aides. About half of the group and staff accompanied Weimer to the Colorado National Monument where, in addition to relaxing in the scenic beauty of the canyon, they learned more about the geological history of the region.

## AT DINNER IN GRAND JUNCTION

Jane Quimby, President, Colorado Municipal League

Quimby, who has participated in past EMFI congressional and executive aide tours, examined the attitudes of local governments towards oil shale development. "Generally speaking, I think that local governments want to see oil shale development, or other types of energy development, occur," she began. The primary concerns were preservation of quality of life and communication between local and federal officials when decisions related to development are made. Quimby stated that since local officials must deal with the consequences of development, they should have a stronger voice in Washington. "I think we have established an excellent relationship with state government and industry," she commented.

Work is being done in the state, funded by monies from mineral leasing and severance taxes, to determine how best to assist communities that are impacted by energy and minerals development. Quimby noted that Exxon has received too much criticism for the downturn that the Western Slope is currently experiencing. Colony was actually just "one piece of the puzzle," the whole of which has been affected. "We all got caught up in the excitement of what was happening," said Quimby. "We forgot the long-range perspective of if one of the companies decided to pull out or several of them at once. We weren't quite prepared for what happened. I hope we've learned from this." The real constraints on broad local support for an oil shale industry are questions about what scale and extent development should take.

When asked how communication between local and federal officials could be improved, Quimby said federal decisions should reach local officials sooner.

If local governments are better informed, they may be better able to judge when their input is appropriate or necessary. Also, some definition of roles and responsibilities is a must. With reference to negotiations between local officials and the energy companies, Quimby observed that it took some time to "sort out the players, who do you have your discussions with and use as a communicant."

"I think we at local government level have for a long time hollered we want a lot of responsibility and we want more involvement in the process. I'm not sure that we always need that. I think that only a small percentage of the people understand that the new role for all of us to have is a better working relationship between the federal government, state government and local government," Quimby summarized. "I also think that sometimes the elected officials misjudge their role or what is the clout or the influence they might have at the federal level." The perception by many local officials is that federal officials do not feel local governments are important in the decision making process.

One Institute staff member, referencing comments on the roles of federal and local governments made by local officials in Wyoming, drew upon the conflicting ideologies of western independence with what the federal government should be doing for western communities and states. In response, Quimby said that her main concern is that local officials simply be kept sufficiently informed and given "ground rules" in order to anticipate impacts of development. More dialogue is needed to establish roles and to educate local officials on who to rely on in Washington, she concluded.

Ron Cattany, Assistant Director, Colorado Department of Natural Resources

"I'm going to talk about the successes, mainly because it's too late in the day to talk about failures," Cattany opened. The Cumulative Impacts Task Force (CITF), a special state program which Cattany manages, was set up to examine the state's involvement with oil shale and other energy developments. Development in energy rich western states involves four major areas of concern: socioeconomic impacts, environmental issues, federal land leasing and the role of the federal government in terms of subsidies for energy projects. Colorado has played a very "visible and active role" in dealing with those, said Cattany. The CITF functions primarily in the area of socioeconomics and involves local, state, federal and oil shale industry officials in an effort to evaluate the cumulative impacts of various kinds of energy development (everything from oil shale to utilities) on the Western Slope. The study involves at all levels of jurisdiction, from water and sewage districts to state and county governments, issues related to development--population, demographics, labor needs and the like. Expenditures by local governments, and revenues and their sources are also part of the study. From the last two areas, fiscal balances for each community can be developed. All of the data will be used when permits for projects are generated.

In the area of environmental impacts, Cattany described the state's Joint Review Process which has increased public participation in permitting and environmental assessment activities. With respect to leasing, Cattany said that efforts have been stepped up to increase the state's and public's role

in federal decision making related to mineral leasing in the state. State and local officials and a variety of organizations, both trade and environmental, have functioned in a key advisory capacity with the Area Oil Shale Office. A similar effort has not been so successful for coal development.

Cattany ended his presentation by commenting on federal subsidies of energy development. "Colorado has very cautiously supported the Synthetic Fuels Corporation," he said. "Our feeling has been and continues to be that energy industry executives know more, at least we hope, about the economics of an energy project than the SFC does, and that a number of those decisions as to whether a project should be moved forward should be based on the decisions of companies." A liaison committee has been set up between local governments in northwest Colorado and the SFC, to enhance the awareness on the part of Coloradans of SFC funded projects, for whatever form of energy.

In response to a question about the JRP, Cattany mentioned several projects which have successfully completed the process but are currently on hold because of economic conditions. Elaborating on the JRP, DeWitt John stated that its primary function is to ensure a smooth running permit process. Under the JRP, projects which have been evaluated did not encounter any problems which were not already addressed through the JRP. John said the best evidence of the JRP's success is a broad agreement among companies that it is viable and workable.

Charles Metzger, Vice President of Marketing and Government Affairs, Paraho

Metzger remarked on his first participation with the Institute five years ago when he was Area Oil Shale Supervisor. Paraho, commented Metzger, is excited about oil shale potentials. That excitement may be dampened depending on whether Paraho survived the SFC solicitation process for funding the project in Utah. Metzger feels that many interesting opportunities exist both within and without the U.S., where projects may be proved. He also noted that the potential for projects and technologies to be proved may be greater outside of the U.S. "I think it's too bad that I even have to say that," Metzger said.

Some of the bright spots in the U.S. industry includes the way SFC is changing its negotiation process with industry. The trend is for SFC and industry to form a closer association early on in the financing of a project.

Remarking on the comments presented by Quimby and Cattany, Metzger said that the group which ultimately is most influential and important in "terms of either making a project go or not go" are county commissioners. Metzger thinks it is important for all other entities (state and federal officials and industry) to recognize this responsibility. Another important factor to successful project and industry development is industrial associations, comprised of state, local and industry officials. This, in Metzger's view, is one successful result of efforts over the years, though he does not know whether the federal government should have a role in it. The greatest problem with the federal government, according to Metzger, is the "arm's length" relationship as focused on by Quimby. The state has a better handle on the potential problems of energy, and especially oil shale, development whereas these problems



fall among the many others dealt with by the federal government and thus cannot receive the same kind of attention at that level.

From the small company perspective, Paraho's attitude towards the Exxon pullout was that their particular project would have a better chance of succeeding. Asked to comment on efforts in other countries with which Paraho is involved, Metzger said that in the case of Israel, that country's concern is with having a secure domestic energy source, so that financing there is internal. In Australia, financing for oil shale development is supplied by the Japanese with the prospect of building a reliable energy supply in that part of the world.

After Mr. Metzger concluded his remarks Dr. Tom Sladek, who moderated the program, closed the session, ending the Institute's visit to western Colorado.

ON TOUR IN UTAH -- THURSDAY, AUGUST 19

Morning Briefing: Dr. George Keller, Head, Department of Geophysics, Colorado School of Mines

At breakfast in Grand Junction, Keller explained the historical and potential development of geothermal resources both domestically and worldwide.

"In the recent past geothermal was considered an unusual, exotic or unfamiliar source of energy, and therefore not quite believable, not quite real and not quite a solution yet to the nation's energy problems," remarked Keller. "I'm afraid this is all too correct." To elaborate on this observation Keller provided some perspectives on geothermal development to date in the U.S.

Geothermal energy is as old as the earth. The heat energy stored in the earth over time is what man could put to use today. Only in the last 10 to 20 years, however, have attempts to harness this energy in the U.S. for electrical generation been effective. The efforts in these past two decades have been "high tech" in comparison to traditional uses of geothermal resources (i.e. for thermal baths). Some countries, like New Zealand and Italy, have made more progress, since their attempts to develop geothermal resources were begun a little before those in the U.S.

The first geothermal development was in 1922 at Geysers in California, about 50 to 60 miles out of San Francisco. The owner of a hunting lodge frequented by Teddy Roosevelt installed a turbine to generate electricity from the heat from fumaroles. In the mid 1960s, Union Oil Company bought out several smaller developers and began to convert Geysers into a major source of electrical power. "Today, Geysers produce electricity at the rate of 1,400 megawatts," Keller noted. Other than Geysers, little else was done in the U.S. until 1973. "Looking back on it, the real difficulty in making the U.S. energy sufficient was that we had too many solutions to the same problem," observed Keller, on the nation's attempts to develop an energy policy and program that would guarantee energy self-sufficiency. Coal, oil shale and other alternatives competed with geothermal for attention.

In 1973, the USGS put together a committee of experts on geothermal energy. The committee reported that through a crash program with extensive

federal support, all of the nation's stationary electrical needs could be met with geothermal resources within 50 years. The catch was "crash program" and the costs of implementing such a program. What did happen was the initiation of federal programs to study the resource and a more active involvement by private companies in prospecting for geothermal sites to develop. During the 1970s, about two dozen sites in the western U.S. were identified where geothermal development might occur.

One of those sites was Milford, which was the most advanced in terms of being closest to commercialization. Several problems were met there which typify the difficulties of developing geothermal resources: Lead time involved in bringing the project "on line," often years long, during which no income is derived from the development; two or three dozen wells must be drilled in order to support a profitable, commercial generating plant, which is a costly endeavor at today's drilling costs; geothermal developments must compete with other energy projects which provide a higher, quicker return on investment, such as oil and gas.

The resource at Milford is not well known yet, in terms of physical characteristics of the field and technologies required to recover and develop it. Additional difficulties at that site include marketing the resource (related to the remoteness of the site) and the need to build a 10 megawatt demonstration plant so the operation (Utah Power & Light) can sort out the technological difficulties before commercialization.

The current uncertainty of supply and the rising costs of traditional fuels require society to develop alternative energy sources. Geothermal deposits are a potential source of additional energy if technologies are available or can be developed to enable efficient extraction. Geothermal generation is growing at the approximate rate of 20% per year. However, in the U.S., the Geysers in California is still the only producing reservoir.

Following Keller's briefing, participants departed Grand Junction for Milford, Utah via chartered aircraft.

AT THE BRIEFING ON ENERGY/MINERALS DEVELOPMENTS IN MILFORD

Lee Petty, Mayor, City of Milford

Milford celebrated a centennial in 1974, and has a rich history throughout those 108 years. Indians, explorers and miners all passed through Milford's environs. The railroad has been Milford's bread and butter for many years. Also, extensive groundwater development for agricultural use has contributed to putting into production 16,000 acres of farmland.

"We've learned to live with the desert," commented Petty, "appreciate its solitude, appreciate its beauty." (Milford is on the edge of the Southwest Desert in Utah.) "We're excited about the potential of the geothermal project, we're excited about the (new) potential for mining out here. We feel that these things are going to be very positive for our future."

Participants queried Petty at the conclusion of the meeting on potential social impacts of the various projects and developments around Milford. In addition to the Phillips/UP&L geothermal site, Phelps Dodge and Getty Minerals have defined a molybdenum ore body with an eye towards developing that resource. In continuing with the Institute's emphasis on energy and minerals developments and regional perspectives, participants were provided some insight into interactions of the two types of resource development in the Milford area.

Richard Gili, Senior Project Engineer and Bob Blanc, Exploration Manager, Getty Minerals

The molybdenum discovery was made about 10 to 11 miles due west of Milford. The deposit is very deep and is associated with a porphyry (volcanic) pipe or chimney that is 20 to 30 million years old. Molybdenum mineralization was a later event to the volcanism. The top of the deposit is about 3,500 feet below the surface and the depth, to which it is presently thought to extend, is 6,000 feet. In 1974, Phelps Dodge discovered the deposit while doing exploratory drilling in the area. A joint-venture association (Pine Grove) was formed between Phelps Dodge and Getty and, since 1978, about 120,000 feet of core has been drilled to an average depth of 5,000 feet.

The techniques and challenges of mineral exploration were explained to the

participants through the presentation on the Pine Grove project. Because of the narrow definition of molybdenum mineralization, it is difficult to drill and penetrate the deposit accurately. In additional exploratory drilling, engineering work has been done to evaluate how the deposit should be mined. A shaft-site evaluation program was initiated in 1980 in order to determine how practical it would be to sink a shaft. Further efforts are being undertaken to estimate costs and design of the shaft. The geometry of the deposit influences selection of the ultimate mining method. All in all, the project will require a substantial lead time, 10 to 15 years, to development. Reserves are estimated at in excess of 120 million tons with about a 3% grade MoS; Pine Grove ranks among the top ten moly deposits worldwide.

Subsequent discussion centered on aspects of undertaking a major resource project--risks, uncertainties, timelines and costs. "Even once the discovery is made," stated Blanc, "the odds of a successful mine are incredible. It's often said that mines are made and not found." Mineral exploration near Pine Grove dates back to the 1870s. No knowledge of the moly deposit existed prior to the Phelps Dodge discovery. Geologists in the joint-venture had to convince management to continue financing exploration. In the past four years \$20 million has been spent. Now the decision must be made to go on to the next phase--sinking a shaft which would require another four years and \$50 to \$60 million. Then, at that point, the partners will decide whether or not the deposit will "make a mine." Uncertainties include ore grade and rock conditions. Property acquisition must be made and some conflicts have arisen over an adjacent area of land that is proposed for wilderness study, supported by an environmental coalition. Total estimated costs are \$600 to \$700 million for the project with start-up projected for 1991. And by that time, what will moly markets be like? Blanc pointed out that the price of moly has dropped from about \$32 per pound to approximately \$4 per pound. Market fluctuations are attributed to the general economy and high inventories to the greater exploration interest and production activity by mining companies when the price of moly was higher.

Questions were asked by participants about how decisions on the amounts of money that have been and will be spent are justified, financial structuring and potential success of the project, and how it fits into the regional economy.

Don Harban, Marketing Director, Phillips Petroleum Company, Geothermal Division

The briefing session returned to a focus on geothermal. Harban reviewed the two different types of geothermal resources: Wet (i.e. hydrothermal) resources, the most common worldwide and the type found at Roosevelt Hot Springs, the Phillips/UP&L site, and dry resources (where the steam is not associated with water), like Geysers in California. In order to produce a geothermal resource, it must be contained in a permeable formation capped by an impermeable material. Harban also made note of geothermal resources worldwide and their occurrence in the U.S. Geysers is the largest producing project in the world, supplying electricity to a large portion of San Francisco.

Phillips began exploration in 1972 using very sophisticated geological and geophysical techniques. "As an engineer I always like to give our geologists a hard time," quipped Harban. "It's kind of remarkable that most of our geothermal discoveries have been found where there's smoke in the ground." In 1976, Phillips began a drilling program north of Milford. Most of the facilities at the site are located at the initial 1976 discovery well. Since 1976, very extensive testing has been undertaken at the site.

Phillips also looked at potential problems in production. "Scaling" is not a difficulty at Roosevelt Hot Springs since that reservoir is very low in salinity. In 1980, Phillips agreed to sell the resource to UP&L. Testing by UP&L on resource conversion systems and by Phillips on resource assessment continued. The reservoir is 2,000 feet deep with temperatures in excess of 500°F. Preliminary tests indicated that the area could supply 200,000 to 400,000 kilowatts for up to 30 years.

"It's an extraordinarily nice resource from a technical point of view, it's very exciting," Harban commented. "The wells are very prolific. We've been unable, up to this point in time, to open the wells up all the way," he said with reference to the two most recently drilled production wells.

Harban fielded questions on geology, re-injection, electrical generation, physical characteristics of the hot water/steam resource of the field and potential groundwater impacts. One of the most difficult aspects of the project is confirming reserves. Phillips has not been able to produce from the field long enough to confirm its capacity beyond what is known to be sufficient for the 20 megawatt plant. Projections given at present for ultimate

electrical generation are estimates.

Dale Brown, Manager of Geothermal Projects, Utah Power & Light

The primary interest on the part of UP&L in the Milford site is diversification of electrical generating sources. The initial effort of a 20 megawatt plant, using three of four producing wells and two of three injection wells, will serve to "prove out" the resource. Total well manifold is about 2.3 billion pounds per hour, about 20% of which is steam. Using slides, Brown gave the aides a good overview of the project and UP&L's plans. Steam and fluid, produced together, are separated in a single flash process at the well sites. The steam is gathered and piped to the plant where it powers a conventional turbine. Unused geothermal fluids are piped to the injection wells. Any make up water left over from the generating process is also reinjected.

Brown stressed that since the current project is not the optimum size, economies of scale are not achieved. A plant of about 55 megawatts would be more in line with cost outlays. The 20 magawatt plant is developmental in terms of proving the resource, but its construction and operation reflect the design of an ultimate full scale power plant. A 138 kilowatt transmission line (initially to operate at 46 kilowatts) will originate in Milford and tie into the plant site. Heat balance at the plant will be 14,000 BTUs per kilowatt hour.

Lynn Rasband, Manager of Advanced Development, Utah Power & Light

Rasband discussed R&D activities at UP&L which focus on decreasing the cost and increasing the efficiency of geothermal plants. The goal here is to get more output per pound of geothermal fluid.

In addition to the design currently being used by UP&L--piping the resource from each well to a central generating plant--a design that would incorporate generating stations at each well site is also being developed. Electricity would then be gathered at a central substation for transmission. The economics of this design are appealing and UP&L is perfecting it.

Reviewing the proposed future plant design, Rasband pointed out several special design features that will make the well head generating units more

successful. Presently, flashtanks at the well sites for the 20 megawatt plant "flash" the steam to remove water which is then injected at the periphery of the field. Well head generating stations will use a rotary separator turbine (RST) which separates steam and water, repressurizes the fluid (so that the 600 horsepower reinjection pumps may not be needed) and turns a shaft, all of which will result in additional power generation. The turbine was being tested at the demo plant when the aides visited the site.

Rasband said the well head units will be tested and demonstrated after the 20 megawatt plant is built and operating. Concluding his discussion, Rasband quickly summarized UP&L's work with Biphase Energy Systems Institute, which developed the turbine. Utah Power & Light, Biphase, Phillips and the Electrical Power Research Institute are all participants in the Roosevelt Springs Project.

Dave Klipstein, Managing Director, Biphase Energy Systems Institute

The RST extracts more power for the amount of geothermal resource, said Klipstein, elaborating on the technology of the Biphase turbine. As such, the Milford geothermal site is on the forefront of R&D in this energy resource. Klipstein used graphics to demonstrate to the aides how the new turbine functions, its benefits, cost advantages and efficiency derived from using the turbine.

The knowledge of using two phase flow from geothermal resources (steam and fluids) came out of research at the Jet Propulsion Laboratories. Federal R&D funds and DOE funding have played a role at various times during the course of the turbine's development. Biphase is now a joint venture, private effort. The Milford site is the first commercial testing of the turbine. Klipstein displayed a great deal of enthusiasm and confidence about the Roosevelt Springs program, which he feels has been a highly successful effort on the part of private enterprise and public involvement to bring a new resource on line.

#### AT THE ROOSEVELT SPRINGS GEOTHERMAL SITE

The first stop was well 353, producing steam at about 700,000 pounds per hour, about half of its capacity of 1.3 million pounds per hour. The temperature was 440°F at 460 pounds pressure. As the buses pulled up to this most



recently developed Phillips well head, the group poured out to view what may have been the most impressive site during the field trip. With cameras clicking furiously, faces wet with brine and lit with excitement, the aides and CSM staff watched the roaring geyser of steam in awe. The 2,601-foot well was completed on June 14, 1982. From well 353, the group looked at the rotary separator and the control panel for the separator at the demo plant and the reinjection system.

#### AT LUNCH AT THE OPAL MINE

After the tour through the Roosevelt Springs site, the group enjoyed lunch in the brilliant Utah sunshine at an old opal mine. Aides and staff, accompanied by UP&L and Phillips representatives, scrounged among the rocks for opal, obsidian and other interesting minerals. Dr. Keller summed up the day's experience by adding a note of realism to the ambitious geothermal project. The 20 megawatt plant, while it is the most advanced design outside of established facilities in California, could not significantly contribute to the nation's electrical energy needs, said Keller. The question of whether geothermal energy is a viable, reliable replacement for electrical energy produced from fossil fuels still remains to be answered.

In addition, the size of the investment (hundreds of millions of dollars) required for the amount of power to be produced is lopsided. "The question Phillips needs to look at is will they make a profit," an urgent question, remarked Keller. He feels returns of about \$7 million per year for the prototype plant and \$70 million per year on a 200 megawatt plant, capacity of future plans and designs, are what should be expected. The larger plant would pay for itself in a shorter amount of time, a more attractive incentive for UP&L and Phillips. These difficult questions are even more profound when they are examined in the light of geothermal eventually supplying 20% to 30% of the nation's energy needs.

Another aspect of geothermal energy is that it occurs in deposits of fairly limited extent. Keller quickly mentioned other locations of geothermal deposits in the U.S., all of which share the characteristics of physical limitations. Many unsuccessful wells have been drilled in the Roosevelt Springs area. Technology is also a limiting factor. Keller noted that if the entire Roosevelt Springs area could be developed, the potential electrical generation could perhaps increase to 1,000 magawatts. The technology of producing from marginal geothermal wells does not yet exist, he added. The ability to fully develop substantial geothermal energy does exist, but it "may not be in our lifetimes," Keller said in closing.

## EN ROUTE TO CEDAR BREAKS

Clay Alderson, Park Manager and Catherine Rusnak, Interpreter, Cedar Breaks National Monument

From the opal mine, the group departed for the next stop, Cedar Breaks National Monument. In Beaver, the two National Park Service representatives joined the group to provide a background on the region of Utah visited by the Institute. The growth of the agricultural and iron mining industries was described as well as the rich Mormon and Indian cultures that left such a unique mark on the area. As the charter buses proceeded up into Cedar Breaks, Alderson and Rusnak described the geology, flora, and fauna of the national monument. Land use and development issues became increasingly common conversational topics. As participants disembarked at Cedar Breaks a spontaneous discussion on clean air, vistas, and coal development arose. The spectacular canyon served to highlight many of the week-long debates the aides had enjoyed among themselves on the pros and cons of aggressive western resource development.

After the refreshing stop at Cedar Breaks, a reprieve from the heat of the Utah desert experienced at the geothermal site, the group pushed on to the cabin where a southern Utah-style dutch oven dinner was waiting. As the buses rolled to a stop, participants clambered out to enjoy the tunes of folk and western melodies played by the Country Fiddlers, a group of young musicians from a Cedar City high school. After dinner, in that quiet, peaceful forest setting, the aides were presented with some final viewpoints on resource development in Utah.

## AT DINNER NEAR CEDAR BREAKS

Jim Clark, Iron County Commissioner

Clark has served on the local MX missile review board where several recommendations related to impacts from that defense project reached Washington policy makers. The prospect of the proposed defense project served to heighten the concerns of citizens in that region of Utah where, before, no great need or concern for impact awareness had been felt. This transition has created a situation in which communities and counties are just beginning to evaluate the

effects of the many potential developments in that part of Utah on its residents. With respect to energy projects, social and economic costs are of foremost concern, elaborated Clark. With only 17,000 people in Iron County, of which 70% is federally owned, the tax base is very narrow. Drawing comparisons to Gillette and other Wyoming municipalities Clark focused on the adverse impacts that communities like Cedar City, Parowan and Milford want to avoid. He stressed, as Jane Quimby did in Grand Junction, the need for local, state and federal officials to communicate closely and drew attention to federal legislation proposed by the MX study board that would provide for impact assistance to areas like Iron County, where so much of the local economic activity is derived from land that is federal property.

Mentioning the Sagebrush Rebellion, Clark said that "we could all be good neighbors." Westerners are most concerned with merely having a say about what goes on in their states and local environs. Growth, though welcomed, should be planned. Though the MX did not come to pass, housing, water availability, electricity would all be in too short of a supply with accelerated growth related to energy developments. Clark feels that an impact mitigation program similar to that proposed for the MX would contribute towards these needs.

Buzz Hunt, Utah Department of Natural Resources

In comparing Utah to Wyoming and Colorado, Hunt said that while current production statistics are lower, a great diversity of energy and minerals resources exist. Hunt's data showed 23.6 billion tons of coal reserves in place, 225 million barrels of oil, 1.3 trillion cubic feet of natural gas, 26 billion barrels of oil in tar sands (90% of that resource known to be in the U.S.), and 321 billion barrels of oil in oil shale. Utah ranks fifth in the U.S. in solar potential and has nine known geothermal prospects. In addition, copper, molybdenum, silver, gold and iron are just a few of the many nonfuel minerals produced and existing in Utah.

The mining sector is the largest, non-government, private sector in Utah, contributing about one third of the economic activity (\$2 billion) annually. Approximately 10% of employment in Utah is related to energy and minerals activity and about 60% of property tax assessment. About \$70 million in rents and royalties are generated annually.

Energy resource production has increased dramatically over the past decade, particularly in coal, oil and natural gas. Hunt said that Utah's contribution to the nation's objectives of decreasing reliance on foreign supplies is an important one. Utah's net exports of energy has increased at an average annual rate of 21%. In terms of future trends, Hunt expects coal production to double simply because of installed capacity at coal-fired power plants. Oil production should remain stable while natural gas increases. Exploration along the Overthrust Belt down into Iron County is expected to remain at a high level. Synthetic fuels projects--nine tar sands and three coal gasification projects--are in the planning phase.

This data shows the importance of extractive industries and energy development to Utah, in terms of revenues, employment and economic growth, especially in rural areas where much of it occurs. "That presents special problems,"

said Hunt, as communities and areas that have not experienced accelerated growth are suddenly faced by that prospect.

"We're in what I think is kind of a delicate stage in our process of developing energy resources, and I think our experience over the last 12 to 18 months points out that our economy is extremely vulnerable to economic recessions at the national level. It has an impact on demand for energy resources," concluded Hunt. "There is considerable feeling in Utah and many western states that our economies are also becoming increasingly susceptible to what we perceive as being perhaps an erratic federal policy towards energy development," he added. "To my tally, the Synthetic Fuels Corporation has funded minus one projects, and this has been two full years after the legislation was passed. And presumably we were all in favor of passing this legislation to meet a national goal in 1992 of producing 500,000 barrels per day of synthetic fuels." Some of the enthusiasm, excitement and challenge of energy development in Utah and elsewhere has been lost, Hunt commented, and that emphasizes the need for consistency in federal policy.

Jim Bradley, Utah Energy Office

Participant Jim Bradley put on his other hat for the Institute, that of a state official welcoming visitors to Utah. Bradley summarized briefly the issues addressed to that point during the week and that first day in Utah, emphasizing that those kinds of sensitive issues will always be addressed, and would continue to be addressed by the aides as the week's activities concluded. He then introduced the final speaker of the evening as the group prepared to end a very special day in Utah, an unusual one for the Institute with its many different events and experiences, and return to Salt Lake City for the night.

Gary Tomsic, Director, Office of Community and Economic Development

This Department is responsible for activities on a state level that promote stable economic growth statewide. It is also concerned with quality of life. "To many minds," Tomsic remarked, "trying to pursue both of those objectives is indeed not only a dichotomy but a paradox." The state is trying to balance the scales of "private and public profitability" of energy development. It is felt strongly that some corporate responsibility should exist. Through legislation and state policies, this attitude has been reinforced although no legal requirements have been set up to guarantee socioeconomic impact mitigation.

Cooperation between communities and industry is encouraged and seems to be successful. If it should prove not to be in the future, then alternative policies would be put in place. There is an increasing feeling on the part of industry that being attentive to community needs throughout resource development is "the cost of doing business" and can be included in their planning. This may be the best indicator that the approach currently taken by the state towards socioeconomic impacts of development may be the right one for Utah, Tomsic commented in closing.

ON TOUR IN UTAH -- FRIDAY, AUGUST 20

Morning Briefing: Dr. Sam Romberger, CSM Department of Geology

Romberger prepared the group for the "metals portion" of the field trip which involved Bingham Canyon and the historic Park City mining district. Later in the day on Friday the focus would turn back briefly to the oil and gas and synthetic fuels industries with a visit to the Chevron Refinery and Shale Semiworks.

"The metals industry is in a significantly depressed state," Romberger opened, briefly touching on the fact that this current situation would probably encompass, to a large degree, the topic of discussions during the wrap-up session. In the copper industry, 13,000 jobs have been lost with 900 employees laid off at Kennecott as of July 1. Mine closings have increased in the West. Production in the industry has dropped to 50% of capacity, although the Bingham Canyon Mine has maintained a high level of activity.

Aides would visit the Bingham pit first, the largest copper mine in the world and largest open pit mine in the world. About 110,000 tons of ore from 350,000 tons of rock is extracted per day. Since 1865 when the mine opened, about 21 billion pounds of copper and 300 million ounces of precious metals have been produced. Minerals like molybdenum, paladium, selenium, zinc and others are also extracted in the process. Briefly addressing geological aspects, Romberger said that the deposit was a classical porphyry copper type of deposit, very large and disseminated, with hydrothermal and low grade mineralization.

Over the history of the mine, copper production has averaged 18 pounds of copper for every ton of rock. Because of this, a high degree of concentration is required and a large amount of waste material results. Romberger mentioned that at a new gold mine operated by Getty, just south of Bingham, ore grade is about a tenth of an ounce of gold per ton of rock.

Moving on to the Chevron Refinery, Romberger mentioned that the shale R&D retort will process only about 320 barrels of shale oil per day. The Park City mining district, the last stop on the day's agenda, has been in operation off and on since the 1860s; no mines are presently operating there. Romberger addressed briefly the geology of the district, mineral occurrences, historical

and present day activity. An interesting aspect of the district is the influence of newer recreational developments there on the older mining industry, a case of one industry crowding out another.

Wally Jensen, General Manager, Utah Copper Division, Kennecott

Moving from the general to specific, Kennecott's eloquent spokesman for the Copper Division continued the morning briefing by focusing on Bingham Canyon and what the tour there would encompass. Jensen drew the aides' attention to slides which illustrated various aspects of operations and economics as he concisely reviewed operating details, statistics and the current status of Bingham Canyon.

The basic operating functions of drilling, blasting, loading and hauling apply both to waste and ore, said Jensen, with 3.5 tons of waste per ton of ore removed. Some of the waste is leached to gain additional copper. Ore grade is presently .575% copper. Mining, leaching and ore haulage comprise 50.8% of Bingham's operating costs. Crushing, grinding and flotation concentrate the copper to yield about 22,000 tons per day (25% copper). Other minerals are also recovered, molybdenum in a separate process and sold as sulfides. Concentrating accounts for about 24.4% of production costs. Copper anodes are produced by smelting and contain about 99.6% copper as well as gold and silver values. Smelting comprises about 18.8% of costs. Anodes are transported to the refinery where cathodes of about 99.98% copper ore are produced for market. Minerals like platinum, paladium, selenium and others are recovered in by-products circuits. In summary, Jensen emphasized that the 11.5 pounds of copper contained in a ton of ore yields after processing 9.8 pounds of copper in the cathode. At Bingham, the world's first as well as largest copper mine, waste is deployed on dumps which surround the mine, where some of the leaching occurs. Ore is shipped by rail out of the mine to processing. Jensen reviewed in more detail certain phases of each process in smelting and refining operations.

Focusing on specific features of Bingham, Jensen noted that the smelter, commissioned in 1977, cost \$300 million for modernization to meet ambient air quality standards. Pointing to the slide of a chart showing excursions above the 0.14 ppm sulfur dioxide standard, Jensen noted that emissions

volumes are seasonal.

Jensen then opened the floor to questions, deftly responding to a wide variety of inquiries by the aides. In response to one question, Jensen clarified that the operating costs quoted do not include capital, and no exploration costs are incurred. Bingham produces about 8% of the national consumption of copper. As the pit is extended to greater depths, ore grade decreases. Ore grade headings will increase slightly to 0.6% copper through the end of the century, the extent of the open pit. Mine planning is continually adjusted to incorporate lower ore grades. Pit dimensions are presently 1½ miles deep by 2½ miles wide. Economics indicate that the pit will extend to a depth of about 1,000 more feet (at a rate of about 35 feet per year). A relatively stable ore grade is maintained for processing.

Asked whether Kennecott has changed production schedules to cope with poor market and economic conditions in the industry, Jensen replied no. "In doing that we're attempting to keep our unit costs down, because our fixed costs are such a high percentage of our unit costs," he explained. "A shut-down becomes almost unthinkable if one can do better." Of course, he elaborated, an operator cannot keep producing into a market which does not consume. "That is a significant problem at this time," Jensen wryly commented. Kennecott stockpiles copper instead of cutting production.

In comparing Bingham to foreign competitors, Jensen said ore grades in Utah were generally lower and technology as good or better, though much of the equipment (particularly the concentrators) is outdated. Jensen added that while two of the three concentrators were outdated, the mine and smelter were some of the most modern in the world. The question of whether or not to modernize Bingham is "a difficult decision for the corporate executives at this point in time," he said. Some deposits in Zambia have ore grades of 3% or 4% with lower stripping ratios, Jensen added. Copper prices today are essentially what they were in 1977, corrected for inflation. Commenting on the status of Bingham and the industry, Jensen said, "The business is in worse shape today than it was during the Depression." From 1946 to 1973 Kennecott "enjoyed a growth market of approximately a 3.5% compounded growth rate per year," Jensen added. In 1973, the cyclical copper industry began to change, swinging upward briefly and crashing after 1980. "We made money in 1932 at 7¢ per pound. We're selling at 66¢ per pound now and we're losing money on it."

The major copper markets in the U.S. are construction and transportation (a combined 50% per year), both suffering from the recession.

The complex issue of foreign competition was then brought up. According to Jensen, only a small percentage of copper used now in the U.S. is from foreign suppliers. Foreign producers, more concerned with foreign exchange than profits, will produce into a market with that goal and suffer the consequences. "We believe our costs of production are significantly lower than in Zambia and Zaire," stated Jensen, but Kennecott cannot compete with Chili, where a Kennecott pit is operated by the Chilean government. Under the classical definition of ore, no copper ore deposits exist in the world today because of poor economics and price. Price is the major factor affecting the industry. Probing questions by the aides along these lines focused on whether improved recoveries would help Kennecott, how that would be achieved, what are effects of substitution, what do operating costs in today's economy entail (in labor, fuel, repairs and maintenance), and whether research and development are being conducted in the industry.

Broaching political issues, the aides asked Jensen for his views on the move in Congress, supported by other producers, to stockpile copper. "I'm not in favor," replied Jensen. "It might help you in a down period, it hangs over your head in a good period. We'll roll our own. We'll either make it or we won't make it." To Jensen, stockpiles reward the inefficient producer. Stockpiles for security reasons are a different matter. A general economic recovery is what copper needs for improvement, said Jensen, and even with that copper may or may not survive.

Environmental issues were also addressed, with Jensen stating that air pollution is extremely expensive to cope with and water will likely be more of a problem of long-ranging national concern than air ever was. Kennecott spent \$10 to \$11 million this year on water pollution controls to satisfy NPDES standards, "and my reward for meeting the standard was to get a new standard anywhere from 10 to 100 times as strict." Jensen said that Kennecott has always supported national ambient air standards and supports in general U.S. environmental laws, but questions how they should best be applied.



### EN ROUTE TO BINGHAM MINE

Del Madsen, Government Relations and Ken Hochstetler, Director of Communications and Public Affairs, Kennecott

On the way to Bingham, aides were given an opportunity to ask additional questions related to Jensen's presentation and other issues. Madsen and Hochstetler also provided some insights into the history of Bingham Canyon and the surrounding area, the peculiarities of that part of Utah and development there, and relationship of Kennecott to the local and state economy and policy postures.

### AT BINGHAM CANYON

During a short session at the mine administration office, an aerial layout of Bingham's facility was presented to orient the group before departing for the mine. Responding to questions on reclamation, a Kennecott official noted that while experimental reseeding has been undertaken, with the life of the mine being what it is not a great deal of reclamation design has been attempted. No plans have been made for recontouring waste dumps. The group was reminded that Bingham is a National Historic Site and, as such, would probably remain as it is. The route from the office took the group past the precipitation facilities, which were not included in the tour. Driving up to the mine overlook, the aides became increasingly impressed with the immense size of the open pit. At the overlook one of the participants was heard to comment that he "never thought an open pit mine could be attractive." From the huge pit the group was escorted to the maintenance shop, concentrators, smelter and refinery. The tour proved to be extremely educational and enlightening as an illustration of the process of producing copper.

### AT LUNCH AT THE COPPER CLUB

After touring Bingham Canyon's facilities, the group met with several Kennecott officials for lunch so that individual discussions could be continued. Once all final questions and comments were completed, the participants departed

for Chevron's industrial plant north of Salt Lake City.

AT THE CHEVRON REFINERY AND SEMIWORKS

Jay Christenson, Public Affairs Manager and Mike Hannon, Refinery Manager, Chevron U.S.A.

Christenson introduced the Chevron personnel who would be leading the afternoon session and gave a brief outline of the program. Taking the lead from there, Hannon mentioned that Chevron had nine domestic refineries. The Salt Lake refinery is unique in that it is coupled to oilfields just to the east of Salt Lake City (Rangely in western Colorado and fields in the Overthrust) and is situated such that an immediate marketing area exists for the refinery's products. In addition, a pipeline carries refined oil to Spokane, Washington with depots along the way. The primary products from this refinery are gasoline and diesel fuel. Another unique aspect of the refinery is its cracking capacity, so that heavier materials can be converted to lighter products.

Hannon then briefly explained what the group would see as the buses drove through the refinery. The tour was conducted by Bill Bruner, formerly manager of the refinery, and Hannon. As they pointed out the various features of the complex facility, Bruner and Hannon answered questions by the aides on processes, water sources, safety and environmental hazards, pollution controls, sources of the crude supplies to the refinery, how refined products leave the refinery, grades of crudes that enter the refinery, refining capacities, and many other aspects of the installation. The tour through the refinery and subsequent summary briefing served as a finishing touch to Monday's introduction to the petroleum industry. By week's end, the aides had experienced a nearly complete picture of the industry, from exploration and production to refining, marketing and transportation.

As the buses returned to the administration building, Hannon and Bruner pointed out the tall, skeletal structure of the semiworks retort adjacent to the refinery. The aides learned that the shale, which will be brought in by rail from Chevron's mine in western Colorado, will be crushed to about one quarter inch for processing in the retort. Construction of the facility is

slated for completion by September or October, 1983. Other features of the site, such as shale ore bins, conveyor belts, crushers, were indicated to the participants. Because of the proprietary nature of the R&D retort, the group was not able to tour the facility.

Mike Hannon, Refinery Manager

As the aides enjoyed refreshments following the refinery tour, Hannon opened the floor to questions and discussion on the refining operations. Elaborating on the process, Hannon explained that many light products are refined at once. At the end of the process, gasoline and other final products are "blended" from the lighter fractions that are refined. Leaded gasoline is constantly decreasing in volume, and is currently less than 50% of the gasoline produced at the refinery. This is in response to clean air regulations that limit the type of fuel automobiles can use. The high elevations in the refinery's marketing area have resulted in increased demand for higher octane unleaded fuel. Processes for producing unleaded fuel are more intricate, energy consuming and costly, in that more barrels of crude must be refined. Addressing the costs of gasoline, which vary from area to area, Christenson said competition among companies is the major factor. Also, gasoline does vary from refinery to refinery, Hannon remarked, so that there is a difference between "K-Mart versus Chevron" gasoline.

Commenting on the current situation in the industry, Hannon said that refineries can only cut production to a point before losses are so great that they are forced to close. No matter how much a refinery produces, the energy costs will still be high, and those costs increase with decreased production. Also, when equipment is used below its capacity, it becomes less efficient.

Rebecca Mack, Public Affairs, Chevron Shale Oil Company

Mack discussed how shale will be transported from Chevron's property north of DeBeque, Colorado to Salt Lake City. Chevron is the largest private land holder in Colorado with the 45,000 acres in the Piceance Basin. The company will mine 350 tons of rock per day for the semiworks retort. Moving on to the history of the oil shale industry, Mack mentioned the original discovery

of the "rock that burns" by early homesteaders and the present circumstances. In spite of an announced delay on Chevron's proposed Western Slope facility, legal and environmental requirements will be initiated for the \$6 billion, 100,000 barrel per day facility. Current plans are to run the semiworks for 18 months to two years to prove its technology before making a firm commitment on the larger facility.

Commenting on recent events, Mack said the primary concerns of local citizens were with socioeconomic impacts rather than environmental ones. She noted that with the downturn came a realization that "bust" as well as "boom" must be dealt with.

Bill Bruner, Shale Project Manager, Chevron Research Company

Bruner passed around to the participants several samples from earlier testing of shale retorting by Chevron. In Chevron's search for a process, they found that "there is no proven commercial shale process in existence today," stated Bruner. Chevron has looked at retorting processes off and on since about 1950. "Everyone in their career gets to see shale at least once," he quipped. In developing a process Chevron is looking for several features: the ability of the process to handle all mined shale (Bruner noted that Union Oil's process cannot handle fines), to handle a wide range of shales (rather than having to high grade or low grade), provide a high efficiency and liquid yield (Chevron believes their process can make 100% of Fischer assay or better), refine to high quality gasoline products, provide a high shale throughput (which would involve processes similar to fluidized technologies used in the refinery), to operate on a large scale, and ensure minimal disposal problems with spent shale. These items are the basis for the semi-works, Bruner summarized.

From outlining the goals of the project, Bruner went on to its specifics. It will cost about \$35 per barrel for transportation, he noted. After the shale is crushed it is combusted and hot shale is returned to the process. Some site specific environmental controls in Utah had to be met for the facility, which will probably cost \$80 million in fixed costs and about \$15 million in pollution abatement. Once metals are removed, the shale oil is ready for traditional hydrocarbon treatment in a refinery. Spent shale will be stockpiled

at the semiworks and studied for disposal techniques and long range consequences.

The semiworks plant was located in Salt Lake for the expediency of siting on property already occupied by a Chevron industrial facility and where the infrastructure required was already in place. It was felt this would speed up the process of developing the property in Colorado when all final decisions are made and the technology is ready for commercial applications. The size of the semiworks plant was related to PSD stipulations (Salt Lake City is in a nonattainment area) as well as other considerations of economics, technology and time frames. The project is a joint venture, entirely privately funded, between Chevron Shale and Conoco, with Chevron Research hired to design, build and test the retort. The retort was scaled with commercial sized equipment so that the step up in scale for the Colorado development could be more easily accomplished.

Dan Johnson, Senior Governmental Affairs Official, Chevron Shale

The critical element to a successful oil shale industry in Colorado is dealing with the influx of people related to growth, and how that would impact local communities, Johnson said. Some steps have been taken towards mitigating socioeconomic impacts in Colorado. For example, the Colorado General Assembly (state legislature) has made extensive adjustments to give more power to local governments. Increased leverage has been put into the Special Use Permit so that the permitting process will be more stringent. The Oil Shale Trust fund which receives monies from the federal tracts is made available to communities for use in critical planning activities and other needs. Efforts are being made to adjust the mineral leasing formula so that more money will be returned to the state from federal royalties.

In summary, Johnson emphasized that progress has been made towards increasing funding and building relationships between industry, citizens and state and local officials.

### EN ROUTE TO PARK CITY

Dr. Sam Romberger, CSM and Leon Hansen, LA Associates

To enlighten the participants as they traveled from Salt Lake City to Park City, Romberger and Hansen talked about geology, mining history, and potential new water projects in the Wasatch Mountains and answered questions from the aides on Park City's evolution as a recreational center. Some discussion ensued on how state officials and local citizens have handled the many varied types of developments taking place there. The recurring topic of a depressed minerals industry, in particular precious metals, was addressed in the light of recent closings of silver mines in the area.

### AT DINNER IN PARK CITY

Dinner was an informal, outdoor affair. Several guests, including Kennecott and Chevron officials as well as representatives from the state government were present to mingle with and meet the participants. After the dinner, the aides broke up into their respective discussion groups, which had been assigned earlier in the week, to begin preparation for Saturday's wrap-up session on the week's activities.

### III. OBSERVATIONS OF PARTICIPANTS ON SATURDAY, AUGUST 21

An evaluation session on the week's activities was held in Park City, Utah. For about an hour, each group met to continue discussions begun the previous evening. Issues were prioritized and possible solutions addressed. All of the groups then convened to exchange reports and ideas. Marty Robbins supervised the session and presentations by each group leader, and Jim Mietus of OMB chaired the discussion period following the group reports.

Group A: Mark Trautwein, Staff Consultant, House Interior Subcommittee on Energy and the Environment, U.S. House of Representatives

Three general issues were addressed:

1. The pace of development. Pace was defined as the "issue which drives all other issues." The sense of frustration that local and state officials had expressed at "getting at the pace of development," being able to plan for the right cycle, was a consequence of this issue. Related to pace is the scale of energy and minerals developments. Impacts are generated in proportion to scale and the size of western operations makes the associated impacts more difficult to deal with.
2. The failure on the part of local and state officials to ask the right questions in order to plan for the correct time frames and impacts. In the group's view, the present slowdown may provide some "breathing space" in order to re-evaluate and assess what issues and problems really need to be dealt with and when, as well as what may be on the horizon.
3. What is the proper federal role in the marketplace? The group concluded that in R&D and synfuels the government perhaps should be more actively involved. With respect to strategic and industrial minerals and energy fuels like uranium, that question is an overriding one that merits careful consideration.

#### Additional Comments

In discussing these points, Group A concluded that with all the various forms of activity taking place in the West and cycles of boom and bust, some

"sorting out" is needed in order to determine responsibilities and roles for the different entities involved--government, industry and citizenry.

Group B: John Blodgett, Environment and Natural Resources Policy Division, Congressional Research Service, the Library of Congress

This group examined issues of development in light of how group members looked at them while actually visiting western operations. Also, interpretations of issues and resolutions were evaluated in light of group members' preconceptions which may have changed during the course of the week. Group B reported that:

1. A great deal of inconsistency seems to exist among Westerners over what the federal government should or should not be doing with respect to energy and minerals developments and socioeconomic impacts. Ideological inconsistencies are also present, with some Westerners feeling strongly about non-intervention while still seeking federal assistance. The group felt that what they had observed during the week had confirmed their preconceptions on the West, western issues and trends of development.
2. These initial observations led to intense discussion within the group on what the proper federal role should be. This discussion "covered the whole spectrum" of possibilities and the group encountered difficulties when attempting to justify any of the scenarios of federal involvement. Group B also found that the problem of identifying a federal role tended to overshadow other issues they were attempting to address and resolve.
3. Underlying all of these concerns and issues is the current state of the economy, which again is derived from federal policies.
4. In attempting to arrive at solutions, the group looked at whether the federal government should take a more active role in forecasting for energy and minerals developments, or become involved in efforts by local, state and industry officials. No consensus was reached on solutions because of strongly differing views within the group on "how much" government should be involved in development.
5. In conclusion, it was noted that while most of that group's prior



conceptions were not changed, and in some cases were reinforced, the members saw a great deal that was unexpected. It was observed, for example, that while water has been recognized as a premier concern of western citizens and developers, it is of more concern at some times than others due to the cyclical nature of resource industries. The scale and financing requirements of western energy/minerals projects were also revealing to the participants in Group B.

#### Additional Comments

It was noted by Audrey Buyrn of OTA that the short term, acute crisis may be getting confused with long term shifts. This was explained in the light of commodities such as uranium, about which expectations of recovery may be too high.

Group C: Mary Proctor, Project Director, Energy Group, Office of Technology Assessment

Several observations on "surprises" encountered during the week were made by this group:

1. The limited surface disturbance of coal mining in Wyoming and, in general, the limited disturbances by energy and minerals operations at all sites visited.
2. The extent to which companies took reclamation for granted and were successful with it.
3. The aggressiveness and competence of local officials.
4. The regional variations of oil shale deposits, resulting in uneven quality of the resource, and the fact that one project may succeed when another, nearby project may not. Related observations dealt with the site-specific nature of oil shale technologies and related impacts on long term capital cost requirements for projects.

The group was able to reach a consensus that the following issues were critical to western development:

1. Federal role in R&D. One view held that there should be no federal involvement at all, while another held that there might be a role in

spite of the inherent problems which arise. A third view was that there could be a limited role when there is a long-term payout by a company before the technology is "ready" to meet national needs.

2. Federal subsidy of unproven resource technologies. Private industry is better equipped to handle risks and hedge. Conversely, it may be appropriate to have government intervention in order to secure energy supplies and stabilize development.
3. Federal subsidy of proven technologies. No federal intervention should exist, except perhaps where uranium and strategic minerals are concerned.
4. Land leasing. Federal leasing has a major impact in those states where a large proportion of surface and subsurface estates are federally owned. The pace of leasing and whether leasing should be used to generate revenues for the federal government was also discussed by Group C. With regard to the latter, it was agreed that "leasing of mineral rights and leasing of lands was not the place to make a buck." This type of activity could lead to intervention with markets for commodities. The coordination of federal and state policies was another related issue addressed by the group. It was felt that federal policies should not supersede a state's, and that control of leasing within a state could aid in controlling socioeconomic repercussions of development.
5. Air and water issues. Where there are interstate impacts, standards must be set by the federal government in accordance with national consensus. How those guidelines should be set was the point of major disagreement.
6. Socioeconomic impacts. The state should be the monitoring, planning and controlling entity in this area.

#### General Discussion

Robbins, in opening the floor to discussion, quickly summarized some of the goals the Institute attempted to meet when planning the field trip. He related those goals and the observations made during the group reports to highlight and emphasize some of the issues addressed. Location of development, scale, federal land ownership and thus federal role, project life cycles and

western culture were all considered in the 1982 program planning. Mietus then took the floor to moderate the ensuing discussions.

One interesting aspect that was noted and led into other issues was that of the differences in the way operations used to be conducted years ago versus today. This point was elaborated by a comparison of Bingham Canyon to Black Thunder, and it was felt that this may account for some of the problems faced by industry as a whole. Another point which was raised had to do with who pays for the external costs of development. The aides again focused on the visible reclamation successes they had seen and concurred that technologies do exist that make reclamation in the West feasible. It was noted that reclamation is site specific, and that it is a difficult and sometimes costly undertaking.

From that topic, the subject of federal regulation arose. Some discussion followed on the affect of regulation on markets for commodities, for example western and midwestern coal. The general attitude was that regulation did indeed have an effect on private enterprise, in some cases more obvious than others.

The aides were unanimous on the issue of responsibility for socioeconomic impacts. How states might better handle this responsibility was brought up. DeWitt John emphasized that while it is the state's responsibility, the federal government should not "walk away" from the issues and needs. Many of the aides felt that since local citizens and businesses do benefit and profit from development they should accept the consequences and learn to deal with them. Some of the participants were of the opinion that local citizens should also be more concerned with the issues of development and involved in the planning effort.

#### IV. SUBSEQUENT EVALUATIONS

##### A. Participant Evaluation

Participant Evaluation of the 1982 field program is documented in two ways: first impression letters and completed evaluation forms. The following letter excerpts are included to illustrate the array of participant observations and reactions to the program.

##### EXCERPTS FROM LETTERS

Most of the following excerpts concern program content. A few comments at the end of the section are directed at the perceived goals of the program and the format.

My "first impressions" of the Institute was that the field trip provided all participants a great opportunity to exchange ideas and information amongst themselves as well as with local public officials and private citizens. I thought the administrative details of arranging transportation, lodging, and food for 40 people for six days were handled extremely well.

The week-long field trip was well planned and excellently carried out (you even provided for perfect weather). The site selections and competent field representatives provided the ingredients for a highly successful trip. Although the schedule was full, CSM staff had time for a one-on-one discussion with the participants. Also, the many professional acquaintances established during the trip will be helpful in my work.

The trip gave me an opportunity to see things I had heard about and analyzed ever since 1973 when I worked on the Project Independence report at the old Federal Energy Administration -- oil drilling rigs, western strip mines, oil shale sites and geothermal wells. I knew roughly how many quads they could contribute to the U.S. energy balance but not what they actually looked like.

Presented here are some general impressions, "surprises" and observations about Western energy which I gained through the CSM experience. First, the West is BIG!! One intellectually knows this, of course, but that knowledge can be internalized only after spending six days flying over it and riding through it. The long bus trips in the Powder River Basin were especially effective in this regard. Shortening the trip and/or making it more geographically compact, in my opinion, would greatly reduce the opportunity for one to gain a true understanding of these immense open spaces.

As you must have heard by now from my colleagues, the 1982 Energy

and Minerals Field Institute was a technical, logistical, and social tour de force. I marvel at the ambitious nature of the task you set out for yourself and I marvel again at the unqualified success of your efforts.

I have worked on energy issues exclusively for eight years and never in all that time have I had an opportunity which even approaches the learning experience of the Field Institute.

The strong point of this program is the visits to the sites and the opportunity to see their operations: the size, scale, equipment, personnel, logistics, support, and management involved in the various projects. There is simply no good substitute for seeing these things personally, and this visit affords new perspective to the work I do in Washington. Your staff did a wonderful job in getting us through so many sites, making key personnel available for our questions, and choosing sites which would be representative of the area. The program moves efficiently and effortlessly--a tribute to the experience and expertise you've developed in managing such visits.

From a personal perspective, my participation in the Institute was both valuable and insightful. The Institute provided me with my first substantial perspective on western energy development. As an individual frequently charged with advising Members on the ramifications of certain public policy questions affecting resource management and development, the Institute has provided me with a rare and welcome opportunity to observe on a first hand basis the diversity, breadth, and extent of the energy resources existent in the nation and the degree of technical competence and engineering skill exhibited by the energy development community.

The field trip was enjoyable, useful and productive--altogether a unique educational experience.

The trip was unique, from my perspective, for at least three main reasons: The places we visited. I have visited drilling rigs and mines before. But I have never experienced the "total immersion" which the trip entailed, with back-to-back shale facilities, growing towns and peaceful parks. I suppose, in theory, I might have assembled some of the information which I gathered on the trip here in Washington myself--but, in practice, I would never find the time to do so. And even if I did, I would not have appreciated the vast distances involved, the awesome size of Bingham Canyon and the wild beauty of Cedar Breaks and other areas which inspire passions among partisans in policy discussions here in Washington.

I did come home with several other distinct impressions that I would like to comment on. First, no matter where we went, I was always struck by the physical scale of operations. There is no way to comprehend the size hole 75 years of copper mining can produce without actually seeing it. In comparison, on-site experience alone can convey how really small and seemingly benign a 400 megawatt geothermal installation is. The feeling of wide open spaces hosting a range of oil and coal activity in

the Powder River Basin can only be appreciated by driving through the region.

If the field Institute did not provide this sort of trip, then I (and probably most others along) would never have the opportunity to see the number and diversity of projects that we did. One way or another, a person might get to Gillette and, perhaps, to one of the coal mines, or to Kennecott's mine--although the "hands on" tour would be unlikely--but there is no way I could have seen the diversity of activities and been introduced to so many persons engaged in them without the Institute. Touring the various facilities revealed to me a number of surprises, for example, the success of reclamation in eastern Wyoming, the size of several of the projects (and the financial investments entailed), and the adaptability of the local communities--with the concurrent problem of sometimes adapting to what community leaders hoped for rather than what happened. Because of my professional orientation, I was particularly struck by how little formal environmental requirements appeared to have posed problems for these projects.

#### RECOMMENDATIONS:

In South India, sculptors traditionally leave a small flaw in a statue, so it will not come to life and dance away. Perhaps you should leave a few flaws in the Institute, so future participants can find ways to make it even better!

My chief criticism of the trip is that it could have taken greater advantage of the participants' abilities to identify issues and link their trip experiences with their own prior knowledge. There are several ways this could have been done. We might have begun on Sunday in small groups with each person talking about his or her background, expertise and interest in the trip, followed by an attempt to outline the likely key issues. Or we could have held a preliminary version of the Saturday discussion on Tuesday night. I also think that dinner and the evening hours should have been left free of briefings for free discussion among the participants and with individual guests. This free conversation is important for catching up on what others picked up during the days, for making sense of what has been seen and for coming to trust each other enough to discuss things frankly.

It seems to me that one major problem with this trip was the failure to more fully involve the participants as resources and in discussions. Mostly the attempt at information transfer was from a single briefer/resource person to the group. Little information came from various participants to other members of the group even though many times much information and good insights regarding issues could have been provided via that route. In order to achieve this, in my opinion, the group has to be prepared in advance. I believe assignments could be made to participants two to three months in advance of the trip to provide both technical briefings and to lead issues discussion groups. Assignments would be made in such a way so as to assure mixing of the participants, the lack of which was another of the trip's shortcomings. For this pre-trip assignment

program to work, communication among participants would be necessary. Naturally, early selection of the participants and formation of a roster with telephone numbers would also be necessary. I have included an example of an assignment duty roster to help explain what I have in mind. The groups should also have responsibility for selection of a few key documents-both factual, technical pieces as well as issue pieces. These would be sent to you for inclusion in the overall briefing book, which would then be provided to each of the participants about two weeks in advance of the trip.

## PARTICIPANT QUESTIONNAIRE RESULTS

Twenty-eight completed questionnaires were returned. Responses are given in percentages according to the rating of the total responses to each item. "Excellent" includes "outstanding," "good" includes "very good" and "fine" and "okay" includes "adequate."

### AN EDITORIAL COMMENT:

A number of participants commented about the information overload and the need for better information management on the part of the Institute. The Institute will not attempt to reduce or manage information for two reasons: 1. The Institute operates as a facilitator for information dissemination and withholds judgment about the quality of the information, and 2. "Overload" is an individual perception: What is overload to one is often inadequate to another.

The Institute staff believes participants should make a commitment before joining the program to work at information management as a personal challenge. Each participant will, therefore, actively seek the information most pertinent to his/her work.

#### Item # 1 Opportunities to interact with other participants:

Excellent	Good	Okay	Other
43%	36%	21%	

Most participant responses fell in the good-excellent range. Positive evaluations referred to these opportunities as the "strong point of the program" and "a major benefit of the Institute." Others commented that the changing rooming list each day helped participants to know one another. In spite of enthusiastic agreement by a majority of participants, a small number lamented the "limited" time for interaction.

#### Item # 2 Opportunities to interact with local people, state and industry representatives:

Excellent	Good	Okay	Other
29%	46%	21%	4%

Evaluations were primarily positive, exemplified by the following comments: "the problem was to take advantage of them (the opportunities)," "one of the strongest points of the trip." Some participants evaluated interactions with local representatives more positively than those with industry and state representatives. Events during the week were rated in terms of opportunities to socialize and the Gillette dinner event was judged to be the most effective social event with the Grand Junction dinner the least effective.



Item # 3 Accommodations/food:

Excellent	Good	Okay	Other
39%	39%	18%	4%

Most evaluations seemed to reflect individual choices about food. It was clear that breakfast eaters liked breakfast while nonbreakfast eaters preferred dinner. It was also clear that participants preferred a more varied dinner menu with less beef and fewer carbonated drinks. In general, accommodations received a high rating. Responses revealed a great array of individual health peculiarities and eating requirements which we cannot handle adequately in the field.

Item # 4 Bus Transportation:

Excellent	Good	Okay	Other
14%	50%	25%	11%

Bus transportation did not receive rave evaluations but then most participants acknowledged that a field trip requires bus transportation. Several participants viewed the bus trips as an opportunity to socialize and, therefore, an essential ingredient of the program.

Item # 5 Air Transportation:

Excellent	Good	Okay	Other
21%	46%	29%	4%

Most participants felt the charter air transportation was good and met the needs of a large traveling group. Several participants thought it inconvenient to leave Washington from National Airport and return to Dulles Airport. The arrangement was unavoidable since the only Saturday afternoon flight from Salt Lake City to Washington, D.C. terminated at Dulles.

Item # 6 Site and facility selection:

Excellent	Good	Okay	Other
46%	50%	4%	

In general, site and facility selection received favorable ratings with representative comments such as, "the selection appeared to give a good crosscut of energy and mining technologies and problems," "well-paced schedule," and "exceptional." The oil shale day generated the only difference of opinion: Some participants felt the day was a waste of time while others wanted more time to discuss the future of oil shale. Still others missed an underground mine tour.

Item # 7 Technical and issue preparation before and after site visits (e.g. staff and industry briefings):

Excellent	Good	Okay	Other
36%	39%	21%	4%

A majority of evaluations are positive with a few complaints and suggestions (see the editorial comment at beginning of the section).

Item # 8 Evening sessions in terms of relevance to Institute and information dissemination (e.g. dinners in Douglas and Gillette, Wyoming and Cedar Breaks, Utah):

Excellent	Good	Okay	Other
11%	61%	21%	7%

The concentration of "good" evaluations includes many favorable comments about the Gillette and Cedar Breaks dinner. Participants liked the informality of both events which encouraged discussion with local guests. Other comments include the following: "Evening sessions were extremely valuable," "Evenings are for relaxing," "probably the most useful as far as depth of understanding," and "interesting, but marginally useful to me. Most participants admitted diminishing powers of concentration by dinner."

Item # 9 Coverage of issues:

Excellent	Good	Okay	Other
14%	29%	36%	21%

The concentration of mid-range responses indicates a mediocre rating of issue coverage. Several participants lamented they did not have time during the week to read the briefing notebook which included an overview of issues. Technical issues were covered "well" said most participants, but recommended better political issue coverage and less emphasis on socioeconomic issues. Most responses indicated a sense of frustration about the issues: What they were, the importance of each and the need for more background information on each issue. Another group of participants praised the range of issues presented: One representative view--"You hit a broad range of issues and hit them well! I wonder how much the DC folks could absorb, especially people who had not been West before."

Item # 10 Balance of perspective on issues:

Excellent	Good	Okay	Other
4%	46%	29%	21%

Responses included the following comments: "Well-balanced, non-judgmental," "mostly pro-development," "every shade of opinion," "well distributed among industry, government, and local citizens," "all sides seemed equally ignored," and "no particular slant" on issues was observed." The few comments in the "other" category offered opinions without an evaluation.

Item # 11 What, for you, were the most significant aspects of the Institute:  
(Responses listed reflect the most frequently mentioned "significant aspects.")

- Opportunity to see resource development sites and facilities and observe particular problems associated with development: for example, water, federal lands, community problems, capital investment requirements, etc.
- Opportunity to meet congressional and executive staff people and discuss policy issues with Washington peers.
- Introduction to individuals involved in western energy and mineral development, such as company representatives and local/state officials.
- Discussion of the roles of the local, state and federal government in energy and mineral development and an appreciation of the "internal conflicts and inconsistencies among those involved in development."
- Gaining an understanding of the technology and technical problems involved in development and the size of the operations.

Item # 12 Smaller group (less than 40):

Smaller	Same Size
19%	81%

Some participants spoke of the advantages of a smaller group, such as a group that could travel on one bus. A majority of participants thought the group size should not be altered for many reasons, but one reason predominated: "The broad range of interests and backgrounds was one of the strengths of the Institute."

Item # 13 Small area concentration (e.g., cover same types of facilities in smaller geographic area by bus):

Yes	No	No Preference
11%	89%	

Most participants disapproved, almost vehemently, of a smaller target area. The vastness and diversity of the West would not be appreciated with a smaller area. The regional diversity is a key strength of the program. The few smaller-area recommendations bore the comment that a smaller area should not affect the quality of sites.

Item # 14 Participants pay roundtrip fare from Washington to Denver:

Yes	No	No Preference
36%	39%	25%

A surprising number of participants thought that their agency or committee should pay the fare and reasoned that the offices would choose their representatives more carefully if they had to pay. A few participants noted that they could not have attended without paid transportation.

Item # 15 Number of days in the field: (e.g. 4, 5, 6, etc.)

Less than 6	6 field days (includes wrap-up)	Other
18%	79%	4%

Most participants described the field trip as "just right" in duration. The few who recommended a shorter field trip would shorten it by only one day. Only one participant wanted the same field trip but in 4 days.

Item # 16 Should staff formally identify issues connected with site visits?

Yes	No	No Preference
86%	7%	7%

Most participants felt the staff should identify the issues but differed in "how": some said, "explicitly," and others "indirectly." A few participants thought they were capable of identifying issues without staff help. Issue selections and the choice of sites and facilities to demonstrate issues creates the theme of a field program. The staff considers issue briefings to be crucial to the success of a program and, therefore, seeks new ways to introduce and explain issues during a field program.

Item # 17 Should staff continue to give technical briefings?

Yes	No	No Preference
100%		

Every participant thought the staff should continue to give technical briefings but added the following suggestions: "as long as they are brief," "add water, air, reclamation," "some material covered too many times." Participants should also be utilized as resource persons as well as local resource persons and company representatives.

Item # 18 Should staff be involved in discussions or as discussion leaders?

Yes	No	No Preference
79%	21%	

Most participants saw the staff as facilitators and catalysts rather than discussion leaders. Yet four participants thought the staff members should serve as leaders to help focus discussions. Several responses recommended that participants should be involved

as discussion leaders which we interpret to mean "during the week," since the final summary sessions to a field program are always led by participants.

Finally, several requested discussions throughout the week similar to the Saturday wrap-up session.

## B. Staff Evaluation

Several weeks after the field program, staff members wrote independent evaluations of the program. The elapsed time allowed staff members to engage in reflection about the positive and negative aspects of the program, particularly about the field days each one planned.

Some general thoughts about the Institute and program should be noted. Unlike prior years, all staff members were new to the program and approached the planning with a "fresh look" in the selection of sites and issues. In addition, the inclusion of nonfuel minerals provided a challenge for the integration of a new set of issues and new site selection. This integration was particularly difficult at a time when both the energy and mineral industries are working in an unfavorable economic environment. The real challenge for the staff was to select issues and sites which would demonstrate the pervasive effects of economic problems in the target area. While results of economic problems are visible, the staff had to also select issues and sites that would demonstrate problems that contributed to the mineral industry economic malaise, such as mining and processing technologies, and state and federal policy issues. In addition a geothermal site was included to illustrate the activity of, at least, one company in the development of an alternative energy site.

This year's field program was more diverse than prior years and more comprehensive in addressing issues which contribute to the economic well-being of states heavily dependent on resource development. In general, the staff is satisfied with the program and the themes which characterized the field days but also notes activities which fell short of expected value to the whole program.

## SUNDAY

The opening dinner at CSM was more congenial than prior years. One reason may be that the participants had briefings from past participants prior to the trip. Expectations were, therefore, uniform and few individuals questioned the goals or purpose of the field program. Staff members presented an overview of the week and discussed the field notebook contents which each participant was given at registration.

## MONDAY

No field trip has ever escaped logistical problems and the first of the week was encountered at the Casper, Wyoming airport. Buses were late which caused an hour delay. The tours of Conoco's enhanced recovery sites and Rocky Mountain Energy's uranium mines (solution and surface) were excellent. Company representatives at the sites were well-organized and provided descriptive materials of their operations. While the stop at Exeter's drill rig was the last field visit of the long and exhausting day, it also may have been the most dramatic as participants experienced the dynamics of a working rig.

Resource persons from Wyoming represented a high level of state government, regional federal agency offices and local government. These individuals were credible spokespeople for the array of issues covered during the day. It should be noted that the Institute has gained recognition in the intermountain area which has had a positive effect on the program in terms of the stature of individuals who will spend time with participants in the field. The presence of Dave Love, USGS; Walt Ackerman, governor's office; Oscar Swan, Commissioner of Public Lands; Gary Glass, Wyoming Geological Survey and John Maberry, USGS enhanced the discussion of resource recovery and state/federal policy issues.

The dinner at Douglas, Wyoming was well attended by state leaders but may have fallen short of providing an overview of critical issues because of its timing at the end of a long field day. Long bus trips between sites seem to have spent the energy of the group so that the discussion following dinner was less than lively. The Institute staff is aware that a percentage of participants will be unresponsive at different times of the day because of personal interest in certain sites and issues as well as differences in individual tolerance for information acquisition.

In retrospect, the staff believes the evening speakers should have had time during the day to address the entire group about issues relevant to site visits.

## TUESDAY

The Powder River Basin area was selected for the field trip because of the economic uncertainties of coal production. Black Thunder mine was chosen as an example of a rich coal resource with market and transportation problems common to coal mines in the West. The staff concurred that company representatives at Wyodak gave an excellent description of operations of the unique air cooled power plant. The discussion that followed the plant tour was lively and informative.

The tour and lunch at Wright City gave participants a chance to view and discuss the impact of a slowed energy market on ARCO's town development. Socioeconomic impacts were also the topic of discussion at the Gillette dinner where key leaders focused on infrastructure expense, the slowed energy market and the future of Gillette which is based on energy development. The staff agrees that Wright City and the Gillette dinner may have emphasized socioeconomic issues, but these issues also describe the economic health of the area which depends on oil/gas and coal development.

## WEDNESDAY

The staff experienced difficulty in planning an oil shale day that would illustrate both the technical problems of oil shale recovery in light of the present national policy and the effects of the shutdown of several companies on the Western Slope economy. Market and federal policy decisions contributed to the reluctance of an oil shale company to allow a tour of its property.

Instead of visiting a facility, the staff planned a tour of the Parachute, Colorado area--the site of Exxon's and Union's properties. An introduction to the problems accompanying shale development was accomplished at a lunch program to which leaders in the area were invited to speak. Aspects of development were discussed by a Chevron representative, the USGS area Oil Shale supervisor, a state representative and two professors who addressed technology problems. The staff agrees that the informal setting provided an excellent opportunity for the participants to gain an understanding of the problems of oil shale development. The lunch meeting was also viewed by the participants as a unique opportunity to interact with those involved in oil shale development.



The same development issues were discussed at a Grand Junction dinner which, according to some staff members, appeared to duplicate the lunch discussion.

The midweek free afternoon was planned with an optional visit to Colorado National Monument. To the surprise of staff members, one-half of the group elected to take the tour with Dr. Weimer who led a geology field trip of the Monument area. The staff was surprised at the attendance because past program evaluations had stressed the need for a half-day break from planned activities.

#### THURSDAY

A charter plane problem developed which delayed departure from Grand Junction. This unforeseen event caused some adjustments in the day's schedule but otherwise did not alter the planned events.

The reception at Milford High School was outstanding as company representatives worked with local leaders to stage a briefing of mineral and geothermal development in the area. Unplanned parts of the day, which enhanced the quality of the day, included briefings from high level Getty and Phillips representatives who came from West Coast offices to address the group.

Getty representatives explained a planned molybdenum mine and the problems of development in light of the current oversupply of the mineral. Dr. George Keller's briefing of geothermal development was complemented by company representatives who gave detailed descriptions of the technology, power plant operation and use of geothermal energy.

An unexpected highlight of the day was the lunch site at an abandoned opal mine where participants collected samples. Although the site was chosen for its beauty, the staff did not anticipate the group's enthusiastic interest in opal mining. Dr. Weimer explained the geology and large quantities of samples were gathered by the participants.

Check in at the Salt Lake City hotel was poorly planned and the slow registration procedure aggravated the exhausted participants. In this case, the hotel management did not follow instructions but the staff agreed that check in plans must be doublechecked on the day of arrival.

## FRIDAY

All staff members agree that the day at Kennecott was the high point of the week. Company executives gave a breakfast briefing on the state of the copper industry and responded to a deluge of questions which had to be terminated to keep to the daily schedule. Participants were divided into small groups to tour the mine, smelter and refinery. At least two company representatives accompanied each group providing ample opportunity for discussion at each stop.

Lunch at the Copper Club gave the group another opportunity to talk with company representatives who shared perspectives with participants. The tours of Kennecott facilities exceeded the expectations of the staff in terms of how the company understood the audience.

A late afternoon tour of the Chevron refinery and semiworks was well organized but hurried because we arrived late and caused several prepared briefings by company representatives to be shortened. The staff regretted the alterations in the planned visit.

The business scheduled for dinner at Park City was essential in that participants were to begin their group discussions for the Saturday summary report. The outdoor barbecue setting at Park City was not conducive to a group discussion which, in turn, affected the depth and extent of the preliminary discussions. This was the first year group discussions began before Saturday which was necessary because of the early Washington flight departure on Saturday.

## SATURDAY

Because of a tight schedule, group discussions began early, the quality of which was disadvantaged by the exhausted participants. In general, the plenary session fell short of staff expectations. In part, the problem lay in what was perceived by the staff as an uneven understanding of issues among participants. At least one-third of the group had mineral experience and understood energy and mineral development issues. Another one-third of the group rigidly adhered to a partisan view of the issues while another one-third creatively addressed the issues and speculated about solutions for identified

problems. CSM faculty members who have accompanied prior trips commented that the participants were, in general, more uninformed about energy and mineral issues than those in past years. This situation creates a critical need for Institute programs to acquaint Washington policy makers and regulators with on site experience. The program probably fulfilled a greater information need this year than any other year since the beginning of Institute programs in 1978.

#### GENERAL COMMENTS

The staff agree about the need for the following program refinements: more time must be allowed each day to compensate for logistical problems; one recreational event should be scheduled to allow participants to know one another informally; overflies of development areas are unsatisfactory; briefings should be scheduled at breakfast and before the group begins the day's activities and participants must have time each day to discuss the day's events.

While objectives of the Saturday wrap-up session were contained in the briefing notebook and were discussed at the beginning of the week, the preparation was thought by both participants and staff to be inadequate. The staff recommends a daily summary session which would help prepare participants for the Saturday wrap-up session.

**APPENDICES**

COLORADO SCHOOL OF MINES  
ENERGY AND MINERALS FIELD INSTITUTE  
Congressional and Executive Aide Program  
August 15-21, 1982  
ON TOUR IN WYOMING

Monday, August 16

- 5:30 A.M. - Breakfast at CSM
- 6:00 - Bus to Stapleton Airport
- 6:30 - DAILY BRIEFING  
Dr. Robert Weimer, CSM
- 7:00 - Flight to Casper, Wyoming
- 9:00 - Bus to Glenrock  
ENERGY/MINERALS DEVELOPMENT IN POWDER RIVER BASIN REGION, WYOMING  
Bus A: Dr. Dave Love, U. S. Geological Survey  
Bus B: Dr. Robert Weimer, CSM  
TERTIARY OIL RECOVERY AT THE BIG MUDDY FIELD  
Bus A: Jim Sidwell, Supervising Reservoir Engineer,  
Conoco, Inc.  
Bus B: Glenn Schaaf, Project Engineer, Conoco, Inc.
- 10:00 - Tour Big Muddy Project
- 11:30 - Tour South Glenrock Oil Field  
Skip Curry, Consulting Geologist, Casper
- 12:00 P.M. - Bus to Bear Creek Uranium Mine, pick-up sack lunches in Glenrock  
ISL MINING OF URANIUM - CONCEPTS, STATUS, DILEMMAS  
Bus A: John Yellich, Project Manager - Uranium, and  
Rick Iwanicki, Environmental Coordinator for Uranium,  
Rocky Mountain Energy Company  
Bus B: Break  
Bus A: Break  
Bus B: Speakers

- 1:30 - Tour Bear Creek (15 minute wrap-up on ISL and briefing on Bear Creek to precede tour)  
William Bauman, Resident Manager, Bear Creek  
E. Y. Scott, Mill Superintendent, Bear Creek  
Jerry Blossom, Environmental Specialist, Bear Creek  
Gary Chase, Radiation Safety Officer, Bear Creek  
Dan Anderson, Environmental Specialist - Reclamation, Bear Creek  
Bill Sims, Mine Engineer, Bear Creek
- 4:00 - Bus to Exeter #7 drill rig site  
STATUS OF PETROLEUM INDUSTRY IN WYOMING  
Bus A: Skip Curry, Consulting Geologist  
Bus B: Rick Robitaille, Executive Director, Petroleum Association of Wyoming
- 
- 4:30 - Tour drill rig site
- 5:30 - Bus to Douglas, continuation of dialogue on Wyoming's petroleum industry  
Bus A: Rick Robitaille  
Bus B: Skip Curry
- 6:00 - Arrive at Holiday Inn
- 6:30 - Cash Bar
- 7:30 - Dinner  
- INFORMAL SUMMARY SESSION  
Dr. Dave Love, USGS  
Gary Glass, WGS

COLORADO SCHOOL OF MINES

ENERGY AND MINERALS FIELD INSTITUTE

Congressional and Executive Aide Program

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Tuesday, August 17

- 6:30 p.m. - Breakfast at Holiday Inn, Douglas  
DAILY BRIEFING (Powder River Basin)  
Gary Glass, State Geologist, Wyoming Geological Survey
- 7:30 - Bus to Black Thunder Mine  
COAL LEASING AND LAND MANAGEMENT ISSUES IN THE POWDER RIVER BASIN  
Bus A: Walter Eckerman, Administrator, Wyoming Department of Environmental Quality Land Quality Division  
Bus B: Oscar Swan, Commissioner of Public Lands, State of Wyoming
- 8:00 Bus A: Oscar Swan  
Bus B: Walter Eckerman
- 8:30 - Tour Black Thunder Coal Mine  
M.K. Fielder, Plant Operations Superintendent, Thunder Basin Coal Co.  
George R. Larson, Environmental Supervisor, Thunder Basin  
Larry D. Baeder, Associate Environmental Coordinator, Thunder Basin  
Jerry M. Nettleton, Mining Engineer, Thunder Basin  
David E. Sinkbeil, Senior Mining Engineer, Thunder Basin  
Charles B. Smith, General Manager, Thunder Basin
- 11:30 - Bus to Wright City and lunch  
UPDATE ON A COMPANY TOWN - WRIGHT CITY  
Walt Wierzbicki, Supervisor-Wyoming Projects, ARCO Coal Co., Community Development
- 1:30 - Bus to Wyodak Power Plant  
Bus A: TRANSPORTATION ISSUES IN THE POWDER RIVER BASIN  
Dan Basford, Director of Coal and Taconite Movements, Burlington Northern Railroad  
Bus B: ENVIRONMENTAL AND ENERGY ISSUES IN THE POWDER RIVER BASIN  
John Maberry, Research Geologist, Branch of Coal Resources, USGS
- 2:00 Bus A: John Maberry  
Bus B: Dan Basford

- 2:30 - Tour Wyodak  
Jim Morgan, Plant Manager, Wyodak  
Dave Sharp, Plant Engineer and Maintenance Staff Supervisor  
Glenn Fosher, Engineer A
- 4:30 - Depart Wyodak for Gillette; drive-through tour of community  
GILLETTE REVISITED - THE GILLETTE SYNDROME ???  
Bus A: Joye Bujol, Executive Vice President, Campbell County  
Chamber of Commerce  
  
Bus B: Al Miller, Chairman-Public Relations Committee,  
Campbell County Chamber of Commerce
- 5:30 - Bus to lodging (Holiday Inn)
- 7:00 - Cash bar
- 7:45 - Dinner and evening program with local guests  
\*\* All participants will receive table seating assignments  
during check-in at the facility. Be sure to follow them!  
WELCOME AND OPENING REMARKS  
Michael Enzi, Mayor, City of Gillette
- 8:00-8:45 TABLE GROUP DISCUSSIONS WITH LOCAL GUESTS AND MODERATORS -  
THE POWDER RIVER ENERGY BASIN AND NATIONAL ENERGY POLICY
- 8:45-9:30 OPEN DISCUSSION AMONG TABLE GROUPS  
Leaders - Michael Enzi, Michelle Michot Foss
- 9:30 SUMMARY AND CLOSING REMARKS  
Michael Enzi  
Skip Spensley, Director, Consortium on Energy Impacts



GILLETTE DINNER INVITATION LIST

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Gillette, WY 82716

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Birleffi & Birleffi  
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Cheyenne, WY 82001

Herb Carter  
Powder River Office Supply  
310 S. Gillette Avenue  
Gillette, WY 82716

Joe Dunbar  
Dunbar Well Service  
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Gillette, WY 82716

Marilyn Dunbar  
Gillette Veterinary Clinic  
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President, City Council  
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Diana Enzi  
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Mayor Michael Enzi  
City Offices  
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Bill Flaherty  
Campbell County Engineer  
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Gerald Fuller  
Citizens for Responsible  
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Caballo Rojo Mines  
Mobil Coal Producing, Inc.  
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Gillette, WY 82716

Bill Geis  
Chairman of School Board  
PO Box 995  
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Representative Tom Getter  
Getter Trucking  
PO Box 279  
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Assistant Superintendent  
Burlington Northern  
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Rockpile Museum  
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Chief of Police  
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Spike Hlabky  
Sheriff  
500 S. Gillette Avenue  
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Rusty Holler  
WKE Highway  
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Jes Jessen  
Rural Route  
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COLORADO SCHOOL OF MINES  
ENERGY AND MINERALS FIELD INSTITUTE  
Congressional and Executive Aide Program  
August 15-21, 1982

Wednesday, August 18

- 6:30 A.M. - Breakfast in Gillette
- 7:00 - Daily briefing at Breakfast - Bob Weimer
- 7:45 - Bus to Gillette Airport
- 8:00 - Flight to Rifle, CO  
Over-fly Oil Shale Country - C-a and C-b sites; Colony and Union Sites
- 9:30 - Bus to C-b Site; Bus Discussion:  
Land Ownership in Area, Ranchers, Water and Wilderness Issues
- 10:30 - Briefing at C-b Site; Discussion:  
Geology of Area, Technology of Oil Shale and Surface-Underground Mining Techniques
- 11:00 - Bus to Rifle; Bus Discussion:  
Transportation Issues, Environmental Concerns, Development Infrastructure of Area
- 11:45 - Bus to Parachute; Bus Discussion:  
History of Area, Water Issues  
Conflicting Resource Development:  
Agriculture, energy, recreation and industrial
- 12:15 P.M. - Bus to Union and Colony Sites up Parachute Creek; Bus Discussion:  
Processes of Existing Oil Shale Operations, Geology of Area, Economics of Oil Shale
- 12:45 - Luncheon at Cottonwood Park, Parachute  
Presentation on Beneficiation of Oil Shale  
Questions and Answers from Oil Shale Development
- 1:45 - Bus to Grand Junction; Stop at Tight Sands - time permitting
- 3:00 - Free time at Ramada Inn
- 6:30 - Cash Bar at Ramada Inn
- 7:30 - Dinner at Ramada Inn
- 8:30 - Discussion on Oil Shale moderated by Dr. Tom Sladek

\* Discussion leaders for the day are: Dr. Robert Weimer, CSM, Dr. Tom Sladek, CSMRI, Mr. Martin Robbins, CSM Foundation, Dr. Baki Yarar, CSM (Metallurgical Engineering)

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COLORADO SCHOOL OF MINES

ENERGY AND MINERALS FIELD INSTITUTE

Congressional and Executive Aide Program

August 15-21, 1982

ON TOUR IN UTAH

Thursday, August 19

- 6:00 a.m. - Breakfast, Ramada Inn, Grand Junction  
DAILY BRIEFING (Geothermal energy issues)  
Dr. George Keller, Head, Department of Geophysics, CSM
- 7:00 - Flight to Cedar City, Utah
- 8:30 - Bus to Milford
- 10:00 - Briefing in Milford  
STATUS OF ENERGY/MINERALS DEVELOPMENTS IN MILFORD  
Lee Petty, Mayor, City of Milford  
Richard Gili, Senior Project Engineer, Getty Minerals  
Bob Blanc, Exploration Manager, Getty Minerals
- PHILLIPS/UP&L GEOTHERMAL SITE  
Lynn Rasband, Manager of Advanced Development, UP&L  
Dale Brown, Manager of Geothermal Projects, UP&L  
Don Harban, Marketing Director, Phillips Petroleum Co.,  
Geothermal Division  
David Klipstein, Managing Director of Biphase Energy  
Systems Institute
- 11:00 - Bus to geothermal site  
Bus A: David Reese, Manager-Geothermal Branch, Phillips  
Lynn Rasband
- Bus B: Dale Brown  
David Klipstein  
Don Harban
- 11:20 - Tour facilities with Phillips/UP&L discussion leaders
- 12:45 p.m. - Lunch at site  
GEOTHERMAL RESOURCES: AN OVERVIEW  
Dr. George Keller, CSM
- 1:45 - Bus to Cedar Breaks National Monument
- 3:45 - HISTORICAL CEDAR CITY, PAROWAN, AND CEDAR BREAKS  
Bus A: Clay Alderson, Park Manager, Cedar Breaks
- Bus B: Catherine Rusnak, Interpreter
- \* Stop at Cedar Breaks Overlook

- 6:00 - Dinner and evening program at SUSC cabin (entertainment - Country Fiddlers)  
ENERGY/MINERALS DEVELOPMENTS, LAND MANAGEMENT, AND ENVIRONMENTAL ISSUES IN UTAH  
Harry Grafe, Superintendent, Zion National Park  
Jim Clark, Iron County Commissioner  
Gary Tomsic, Deputy Director, Utah Department of Community and Economic Development  
Temple Reynolds, Director, Department of Natural Resources, State of Utah  
Lorin Nielson, Deputy Director, Department of Natural Resources
- 8:15 - Bus to Cedar City Airport
- 9:00 - Flight to Salt Lake City and lodging (Airport Hilton Inn)



CEDAR BREAKS GUEST LIST

Energy and Minerals Field Institute  
August 15-21, 1982

Betty Lou Bacon  
Recorder  
P.O. Box 22  
Milford, Utah 84751

Robert Blair  
Senior Technical Advisor  
Getty Oil Corp.  
Getty Tower  
Los Angeles, CA. 90036

Don Bridge  
Foreman  
P.O. Box 275  
Milford, Utah 84751

Rollo Brunson  
District Ranger  
Dixie National Forest  
82 North 100 East  
Cedar City, Utah 84720

Mike Demteric  
Governmental Affairs  
Getty Oil Corp.  
Los Angeles, CA. 90036

Ed Fournier  
Forest Supervisor  
Dixie National Forest  
82 North 100 East  
Cedar City, Utah 84720

Kent Giles  
Associate District Manager  
Bureau of Land Management  
1579 North Main  
Cedar City, Utah 84720

Margaret Grimshaw  
Historian  
P.O. Box 151  
Milford, Utah 84751

Garth Jones  
Manager  
Cedar City Chamber of Commerce  
P.O. Box 220  
Cedar City, Utah 84720

Leo Kanell  
Attorney  
P.O. Box 613  
Milford, Utah 84720

Wendy Pectol  
Treasurer  
P.O. Box 985  
Milford, Utah 84720

ON TOUR IN UTAH

COLORADO SCHOOL OF MINES

ENERGY AND MINERALS FIELD INSTITUTE

Congressional and Executive Aide Program

August 15-21, 1982

Friday, August 20

- 6:45 a.m. - Breakfast, Airport Hilton Inn, Salt Lake City  
- DAILY BRIEFING (Introductory briefing on Bingham Canyon)  
Dr. Sam Romberger, Assistant Dean of Graduate Studies and  
Associate Professor of Geology, CSM  
  
W.H. Jensen, General Manager, Kennecott Minerals, Utah  
Copper Division
- 8:00 - Bus to Bingham Canyon Mine  
BRIEFING AT MINE ADMINISTRATION OFFICE  
T.R. Carlson, Manager of Mining and Ore Haulage, Kennecott  
Minerals  
  
R.R. Dimock, Director-Modernization Project, Kennecott  
Minerals
- 8:45 - Tour Bingham Canyon Mine, Smelter and Refinery  
R.D. Jeppson, Manager of Concentrating, Kennecott Minerals  
R.J. Anderson, Manager of Smelting, Kennecott Minerals  
R.T. Kirkham, Manager of Refining, Kennecott Minerals
- 12:15 p.m. - Bus to Copper Club and lunch
- 1:45 - Bus to Chevron Refinery and Shale Semi-Works
- 2:30 - Tour refinery and semi-works  
Mike Hannon, Refinery Manager, Chevron USA  
Bill Bruner, Shale Project Manager, Chevron Shale Oil Co.  
Rebecca Mack, Public Affairs, Chevron Shale Oil Co.
- 4:15 - Bus to Park City and Keetley  
PERSPECTIVE ON BASE AND PRECIOUS METALS/HISTORY OF PARK CITY  
MINING DISTRICT  
Bus A: Dr. Sam Romberger, CSM  
  
Bus B: Leon Hansen, LA Associates
- 6:00 - Arrive at Park City Racquet Club
- 6:30 - Cash bar
- 7:00 - Dinner; assignments for plenary session Saturday morning

COLORADO SCHOOL OF MINES  
ENERGY AND MINERALS FIELD INSTITUTE  
Congressional and Executive Aide Program  
August 15-21, 1982

Saturday, August 21

7:00 a.m. - Breakfast, Park City Racquet Club

- Evaluation Session

DISCUSSION LEADERS

Group A - Mr. Martin Robbins, CSM  
Vice President, Development  
Executive Director, CSM Foundation, Inc.

Hanneke Humphrey, CSM Graduate Student  
Department of Mineral Economics  
Graduate Research Assistant, EMFI

Group B - Michelle Michot Foss, CSM Graduate Student  
Department of Mineral Economics  
Graduate Research Assistant, EMFI

Jeffrey S. Ovian, CSM Student  
Mining Engineering Department  
Professional Staff, EMFI

Group C - Janice C. Hepworth, Director  
Energy and Minerals Field Institute

Michael Wilson, CSM Graduate Student  
Department of Mineral Economics  
Graduate Research Assistant, EMFI

10:30 - Bus to Salt Lake City International Airport

12:20 p.m. - Depart Salt Lake City Airport

United Airlines Flight #200

Ciao! See y'all...

## PREPARATION FOR THE WRAPUP SESSION, August 21, 1982

A wrapup session is the last event of the field program. Preparation for the wrapup will take place according to the following schedule:

August 17 - Participants will be assigned to one of three groups. Each group will have two staff facilitators.

Group A - Martin Robbins, CSM  
Vice President for Development and  
Director, Colorado School of Mines Foundation, Inc.

Hanneke Humphrey, CSM Graduate Student,  
Department of Mineral Economics  
Graduate Research Assistant, EMFI

Group B - Michelle Michot Foss, CSM Graduate Student,  
Department of Mineral Economics  
Graduate Research Assistant, EMFI

Jeffrey S. Ovian, CSM Student  
Mining Department  
Professional Staff

Group C - Janice C. Hepworth, Director  
Energy and Minerals Field Institute

Michael Wilson, CSM Graduate Student  
Department of Mineral Economics  
Graduate Research Assistant, EMFI

Groups will meet informally during the week to discuss daily field events.

August 20 - Groups will meet during the evening to choose a spokesman and rapporteur and to plan a formal report for the plenary session.

August 21 - Plenary Session 8-10:00 AM

### QUESTIONS/IDEAS TO GUIDE OBSERVATION DURING THE WEEK:

1. What, in your opinion, were the most important issues discussed or observed during the week?
2. Prioritize the issues and give reasons for the order.
3. Identify major problem areas in the development of energy and minerals.

**CSM**  
Colorado School of Mines  
Golden, Colorado 80401  
303-279-0300

Appendix B

Energy and Minerals Field Institute

March 15, 1982

Mr. Michael D. Hathaway  
Staff Director  
Committee on Energy and Natural Resources  
United States Senate  
Dirksen Senate Office Building  
Washington, D.C. 20510

Dear Mr. Hathaway:

Colorado School of Mines will conduct a Fifth Summer Field Institute on Western Energy Opportunities, Problems and Policy Issues during August 15-22, 1982, for approximately 40 congressional and executive aides. A preliminary plan for the event is enclosed.

The purpose of this letter is to ask you to nominate two individuals and two alternates to participate in the 1982 Energy and Minerals Field Institute. Nominees should be of sufficient stature and permanence on the committee or subcommittee so that the Institute experience will have value in terms of enhancing the quality of future decisions and legislation.

Please send nominations by mail or call extension 2900 at the telephone number above by April 23. When nominations are complete, the Institute will issue invitations. For your information, a 1981 list of participants is enclosed as well as a tabloid of last year's event.

We look forward to receiving your nominations.

Sincerely,

Janice C. Hepworth, PhD  
Director

JCH:sjk  
Enclosures  
cc: E. David Doan



ENERGY AND MINERALS FIELD INSTITUTE

COLORADO SCHOOL OF MINES

Appendix C

CONGRESSIONAL AND EXECUTIVE AIDE GROUP

August 15, 1982 to August 21, 1982

Participant List

Allen, Mr. Frederick  
Chief, Energy Development Branch  
Office of Policy and Resource Management  
U.S. EPA  
401 M Street, SW, PM-221  
Washington, D.C. 20460  
(202) 382-5487

Anderson, Mr. Robert M.  
Chief, Division of Geology and  
Minerals Assessment  
Bureau of Land Management, 550  
1800 C Street, NW  
Washington, D.C. 20240  
(202) 343-3207

Beecy, Mr. Dave  
Director  
Planning and Environment Division  
Fossil Energy  
U.S. Dept. of Energy  
FE-13, Room C-176  
Washington, D.C. 20545  
(301) 353-2782

Blair, Mr. Louis  
Professional Staff  
Committee on Commerce, Science  
and Transportation  
U.S. Senate  
Washington, D.C. 20510  
(202) 224-8172

Blodgett, Mr. John  
Specialist, Head, Environmental Protection  
Section  
Environment & Natural Resources Policy Div.  
The Library of Congress  
Washington, D.C. 20540  
(202) 287-7231

Boland, Mr. Michael  
Associate Minority Counsel  
Committee on Energy and Commerce  
U.S. House of Representatives  
2125 Rayburn House Office Building  
Washington, D.C. 20515  
(202) 225-3641

Bradley, Mr. James  
Director  
Utah Energy Office  
3266 State Office Building  
Salt Lake City, UT 84114  
(801) 533-5424

Bryant, Mr. Paul  
Audit Manager  
General Accounting Office  
Washington, D.C. 20548  
(202) 254-6937

Buyrn, Dr. Audrey B.  
Materials Program Manager  
Office of Technology Assessment  
U.S. Congress  
Washington, D.C. 20510  
(202) 226-2210

Christy, Mr. Jim  
Associate Minority Counsel  
Committee on Energy and Commerce  
U.S. House of Representatives  
H2-564, Annex 2  
Washington, D.C. 20515  
(202) 225-3400

Civiak, Mr. Robert  
Analyst in Energy Technology  
Science Policy Research Division  
Congressional Research Service  
The Library of Congress  
Washington, D.C. 20540  
(202) 287-7055

Dare, Mr. Wilbert L.  
Special Assistant to the Assistant  
Secretary for Energy and Minerals  
6649 Main Interior Building  
Department of the Interior  
Washington, D.C. 20240  
(202) 343-4367

Congressional and Executive Aide Group

Page 2

Feibus, Mr. Howard  
Director  
Division of Coal Utilization Systems  
Office of Fossil Energy  
U.S. Department of Energy, FE-27  
Washington, D.C. 20545  
(301) 353-4348

Fidler, Ms. Shelly  
Assistant to the Chairman for Policy  
Subcommittee on Fossil and  
Synthetic Fuels  
Committee on Energy and Commerce  
U.S. House of Representatives  
Washington, D.C. 20515  
(202) 226-2500

Fitzgerald, Mr. Bruce  
Policy Analyst  
Office of Management and Budget  
726 Jackson Place, NW, Rm 8234  
Washington, D.C. 20503  
(202) 395-3040

Fleishman, Ms. Sandy  
Editor  
Environmental & Energy Study  
Conference  
515 House Annex 2  
Washington, D.C. 20515  
(202) 226-3300

Goodier, Mr. John  
Chief, Mineral Development Division  
of the Wyoming Department of  
Economic Planning & Development  
Barrett Building  
Cheyenne, WY 82002  
(307) 777-7361

Graham, Mr. David  
Acting Director  
Energy Processes Division  
U.S. Environmental Protection  
Agency  
Washington, D.C. 20460  
(202) 382-2600

Harvey, Mr. William  
Minority Facilities Specialist  
Committee on Science & Technology  
U.S. House of Representatives  
Rayburn House Office Bldg., Ste 2321  
Washington, D.C. 20515  
(202) 225-6371

Heitowit, Dr. Ezra D.  
Deputy Staff Director  
Subcommittee on Energy Development  
and Applications  
Committee on Science & Technology  
U.S. House of Representatives  
Rayburn House Office Bldg., Rm B-374  
Washington, D.C. 20515  
(202) 225-4494

Hoffman, Dr. Dale  
Resource Geologist  
Mineral Development Division of the  
Wyoming Department of Economic  
Planning and Development  
Barrett Building  
Cheyenne, WY 82002  
(307) 777-7361

Johanson, Mr. Gus  
Group Director, Energy & Minerals Div.  
U.S. General Accounting Office  
441 G Street, NW, Rm 4478  
Washington, D.C. 20548  
(202) 275-6461

John, Mr. DeWitt  
Assistant to the Director  
Colorado Department of Natural  
Resources  
1313 Sherman Street, Rm 718  
Denver, CO 80203  
(303) 866-3311

Kerrigan, Mr. Mark  
Budget Examiner  
Office of Management & Budget  
726 Jackson Place, Rm 8002  
Washington, D.C. 20503  
(202) 395-4956

Congressional and Executive Aide Group  
Page 3

Kish, Mr. Dan  
Consultant  
Subcommittee, Public & National Parks  
Committee on Interior & Insular Affairs  
U.S. House of Representatives  
1324 Longworth House Office Building  
Washington, D.C. 20515  
(202) 225-5614

Leonard, Mr. Brad  
Chief, Interior Branch  
Natural Resources Division  
Office of Management & Budget  
New Executive Office Building, Rm 8208  
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Mahrenholz, Mr. Gary  
Analyst  
Natural Resource & Commerce Division  
Congressional Budget Office  
U.S. Congress  
Washington, D.C. 20515  
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Mietus, Mr. Jim  
Policy Analyst  
Office of Management & Budget  
726 Jackson Place, Rm 8013  
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Nielson, Ms. Melissa  
Ass't. to the Director for  
Congressional & Legislative Activities  
U.S. Department of the Interior  
Washington, D.C. 20240  
(202) 343-2165

Offield, Mr. Terry W.  
Chief, Office of Energy Resources  
U.S. Geological Survey  
National Center, Mail Stop 915  
12201 Sunrise Valley Drive  
Reston, VA 22092  
(703) 860-6431

Proctor, Ms. Mary E.  
Project Director  
Energy Group  
Office of Technology Assessment  
U.S. Congress  
Washington, D.C. 20510  
(202) 226-2262

Rubin, Mr. Ken  
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U.S. Congressional Budget Office  
House Office Annex 2, Rm 495  
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Segal, Ms. Bette  
Congressional Liaison  
Energy and Minerals  
U.S. Department of the Interior  
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Seibel, Mr. Richard J.  
Senior Staff Engineer  
Bureau of Mines  
U.S. Department of the Interior  
Washington, D.C. 20240  
(202) 634-1245

Sliter, Mr. Tom  
Professional Staff  
Budget Committee  
U.S. Senate  
Washington, D.C. 20510  
(202) 224-0642

Smith, Mr. Ned L.  
Supervisory Management Analyst  
Energy and Minerals Division  
U.S. General Accounting Office  
Columbia Plaza Audit Site  
2401 E Street, NW, Rm W-644  
Washington, D.C. 20240  
(202) 254-6937



Stolpman, Mr. Paul M.  
Director, Office of Policy Analysis in  
the Office of Air, Noise and Radiation  
U.S. EPA  
401 M Street, Rm 2838, ANR 444  
Washington, D.C. 20460  
(202) 426-2482

Yago, Jr., Mr. John W.  
Minority Staff Director, Senate  
Committee on Environment & Public  
Works  
4210 Dirksen Senate Office Building  
Washington, D.C. 20510  
(202) 224-7842

Stuntz, Ms. Linda  
Associate Minority Council  
Fossil & Synthetic Fuels Subcommittee  
Energy & Commerce Committee  
House Annex 2, Rm 564  
2nd & D Streets, SW  
Washington, D.C. 20515  
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Trautwein, Mr. Mark  
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House Interior Subcommittee on  
Energy and the Environment  
1327 Longworth House Office Building  
Washington, D.C. 20515  
(202) 225-8331

Trumbule, Mr. Robert  
Specialist in Energy Policy  
Congressional Research Service  
The Library of Congress  
Washington, D.C. 20540  
(202) 287-7230

Warner, Mr. Chris  
Associate Minority Council  
House Energy and Commerce Committee  
2322 Rayburn House Office Building  
Washington, D.C. 20510  
(202) 225-3641

Wood, Dr. Richard E.  
Director, Energy & Technology Division  
Idaho Operations  
U.S. Department of Energy  
550 Second Street  
Idaho Falls, ID 83401  
(208) 526-1432

Colorado School of Mines  
Golden, Colorado 80401  
303/279-0300

Appendix D

Energy and Minerals Field Institute

May 4, 1982

The Colorado School of Mines will conduct the Fifth Summer Field Institute on Western Energy Opportunities, Problems, and Policy Issues during the week of August 15-21, 1982. Approximately 40 selected Congressional and Executive Aides of the federal government are invited to participate in the Institute. We are pleased to invite you to be one of this group. The entire cost of your participation, including round trip transportation, will be paid by the Institute which is funded by various federal and state agencies and private foundations.

The purpose of the Institute is to promote better understanding of the complex regional and national issues surrounding energy development. For your information, a Preliminary Plan of the 1982 event is enclosed as well as a tabloid of last year's event.

We appreciate your response by June 1, 1982. In the event you are unable to accept our invitation, an alternate will be invited to ensure a group of 40. If you have questions, please call me at (303) 273-3900. Detailed information about the Institute field program will be sent to participants in early July.

We look forward to your participation in the 1982 Field Institute.

Sincerely,

Janice C. Hepworth, PhD  
Director

JCH:sjk

Enclosures



**CSM**  
Colorado School of Mines  
Golden, Colorado 80401  
303/273-3900

Energy and Minerals Field Institute

June 16, 1982

TO:

We are pleased you will participate in the Colorado School of Mines Energy and Minerals Field Institute August 15-21, 1982. The purpose of this letter is to provide you with travel and accommodation information. Additional information will be mailed to you by the first of August, including a detailed program (a field program itinerary), and a list of participants.

All lodging and meal expenses will be borne by the Institute. Roundtrip air transportation between Washington, D.C. and Denver has been prepaid for each participant. United Airlines has reserved a block of seats for Institute participants and we have a ticket in your name. Your ticket will be sent to you in a July mailing. When you arrive at CSM, we will collect your ticket carbon which is required by our business office.

For your convenience, the following flight to Denver has been arranged for you:

<u>FLIGHT</u>	<u>DEPART DULLES</u>	<u>ARRIVE DENVER</u>
August 15 -- United Airlines #399	11:10 A.M.	12:55 P.M.

A Grey Line bus will be waiting at the baggage pick-up area for this flight. The 25 mile drive to Golden from Denver's Stapleton International Airport takes approximately one-half hour.

You will return to Washington on the following flight (please note you will leave from Salt Lake City and arrive at National):

<u>FLIGHT</u>	<u>DEPART SALT LAKE CITY</u>	<u>ARRIVE NATIONAL</u>
August 21 -- United Airlines #200	12:20 P.M.	7:37 P.M.



June 16, 1982

Rooms have been reserved for Institute participants at the new CSM solar dormitory (see (3) on the enclosed map of the Campus.) All room accommodations at CSM and throughout the field trip are for double occupancy. The dorm is a short walk from the Ben Parker Student Center where an informal reception and buffet dinner is scheduled for 6:00 P.M. Sunday, August 15.

Attire will be informal throughout the week. Long-sleeved shirts, long pants, and a hat are recommended for the field trip. A sweater is also advisable, as well as comfortable walking shoes.

Air transportation for the field trip will be provided by a chartered CV 580 plane from Aspen Airways. The nature of our itinerary and Aspen Airways expertise in field trip charters governed selection of the aircraft. Because of high airport elevation and expected hot weather, please limit your luggage to field trip essentials.

Brief backgrounds of participants and speakers will be printed and distributed at the start of the Institute. For this reason, a resume form is enclosed which should be completed and returned as soon as possible.

If you have any questions concerning travel or accommodations arrangements, please call the ENERGY AND MINERALS FIELD INSTITUTE at (303) 273-3900.

We look forward to meeting you on August 15.

Sincerely,

  
Janice C. Hepworth, PhD  
Director

JCH:sjk

Enclosures

COLORADO SCHOOL OF MINES ENERGY FIELD INSTITUTE

Participant Resume Form

NAME: \_\_\_\_\_

BUSINESS ADDRESS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Telephone: (area)        -        - \_\_\_\_\_

HOME ADDRESS: (This information will not be distributed.)

\_\_\_\_\_

\_\_\_\_\_

Telephone: (area)        -        - \_\_\_\_\_

CURRENT POSITION AND TITLE: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

DESCRIPTION (200 words or less) OF EDUCATION, EXPERIENCE, and PROFESSIONAL ACTIVITIES:

(Please see attached sample. This will be distributed to the participants  
in the form you write it.)

**CSM**  
Colorado School of Mines  
Golden, Colorado 80401  
303/273-3900

Energy and Minerals Field Institute

July 23, 1982

To: Energy and Minerals Field Institute Participants

Enclosed is your Washington-Denver; Salt Lake City-Washington United Airlines ticket.

This second mailing details the Energy and Minerals Field Institute program and schedule. The enclosed program for the week outlines major events and tour stops. At the start of each day in the field, you will receive a detailed program for that day.

The Institute participant list is enclosed. To expedite check-ins, we will arbitrarily pair names on the list to reflect hotel room assignments for the week.

Please remember to dress informally during the Institute. For the field trip, we recommend long pants, long sleeved shirts, and a good sun hat. Walking shoes (not sandals) must be worn at mine sites. A sweater will be necessary in the evening, and a bathing suit is optional as some hotels have swimming pools. Please remember to pack lightly for the field.

On August 15, a bus or limousine (labeled "Energy Institute") will be at Stapleton Airport at the baggage pickup area (lower level at Stapleton) to meet the following flight:

United Flight #399 Y, arriving Denver 12:55 P.M.

If you have any other airline arrangements which coincide with our pickup time, please find us in the pickup area.

If you have not already done so, please return your resume form which was included in the first mailing.

We look forward to meeting you on August 15; meanwhile, do not hesitate to call the Energy and Minerals Field Institute office, 273-3900.

Sincerely,

Janice C. Hepworth, PhD  
Director

JCH:sjk

Enclosure



RESOURCE PERSONS IN THE FIELD

WYOMING

Appendix E

Alan Basford  
 Director of Coal & Taconite Movements  
 Burlington-Northern Railroad  
 76 E. 5th Street  
 St. Paul, MN 55101  
 612-258-2480

W. F. Bauman  
 Resident Manager  
 Bear Creek Uranium  
 P. O. Box 2654  
 Casper, WY 82602  
 (307) 358-2514

Boye Bujol  
 Executive Vice President  
 Campbell County Chamber of Commerce  
 Box 1006  
 Gillette, WY 82716  
 (307) 682-3673

William H. Curry (Skip)  
 Consulting Geologist  
 P. O. Box 3001  
 Casper, WY 82602  
 (307) 234-6205

Walter Ackermann  
 Administrator, Wyo. Dept. of  
 Environmental Quality-Land  
 Quality Division  
 801 West 19th  
 Cheyenne, WY 82002  
 (307) 777-7756

Mayor Michael Enzi  
 City Offices - Gillette  
 801 S. Gillette  
 Gillette, WY 82716  
 (307) 686-5203

Gary Glass  
 State Geologist  
 Wyoming Geological Survey  
 P. O. Box 3008  
 Laramie, WY 82071  
 (307) 742-2054

De M. Hamner  
 Resident  
 Carter Mining Company  
 P. O. Box 3007  
 Gillette, WY 82716  
 (307) 682-8881

George Irvin  
 Rig Superintendent  
 Exeter Drilling Co.  
 P. O. Box 3153  
 Gillette, WY 82716  
 (307) 682-0248

Dave Love  
 U. S. Geological Survey  
 Box 3007, Univ. Station  
 Laramie, WY 82071  
 (307) 745-4495

John Maberry  
 Research Geologist, Branch of  
 Coal Resources  
 U. S. Geological Survey  
 956 U.S.G.S. National Center  
 Reston, VA 22092  
 (703) 860-7461

Kent Moore  
 Sales Manager  
 Exeter Drilling Co.  
 P. O. Box 17349  
 Denver, CO 80217  
 (303) 861-0181

Jim Morgan  
 Plant Manager, Wyodak  
 Pacific Power and Light  
 Railroad 81, Box B91  
 Gillette, WY 82716  
 (307) 686-1248

J. M. Nettleton  
 Mining Engineer  
 Thunder Basin Coal Company  
 P. O. Box 406  
 Wright, WY 82732  
 (307) 939-1300

Rick Robitaille  
 Executive Director  
 Petroleum Association of Wyoming  
 330 South Center, Ste. 115  
 Casper, WY 82601  
 (307) 234-5333

James V. Sidwell  
 Supervising Reservoir Engineer  
 Big Muddy Project  
 Conoco Inc.  
 907 Rancho Road  
 Casper, WY 82601  
 (307) 234-7311

RESOURCE PERSONS IN THE FIELD (Con't.)

WYOMING

Skip Spensley  
Director - Consortium on  
Energy Impacts  
P. O. Box 3000  
Boulder, CO 80307  
(303) 494-6894

Oscar Swan  
Commissioner of Public Lands  
2424 Pioneer  
Cheyenne, WY 82002  
(307) 777-7331

Walt Wierzbicki  
Supervisor, Wyoming Projects  
ARCO Coal Company  
P. O. Box 547  
Wright, WY 82732  
(307) 464-0049



COLORADO RESOURCE PEOPLE

OIL SHALE IMPACT

Jane Quimby  
President, Colorado Municipal League  
Former Mayor, City of Grand Junction  
Planning Commission member, City of  
Grand Junction  
484 North Sherwood Drive  
Grand Junction, Colorado 81501  
(303) 242-3509

Bill McDermott  
Executive Vice President  
Occidental Oil Shale (Cathedral Bluffs)  
P. O. Box 2687  
Grand Junction, Colorado 81502  
(303) 244-3000

Gene Harrison  
Senior Staff Engineer/ Community  
Facilities  
Chevron Shale Oil Co.  
711 Arrowest Ct.  
Grand Junction, Colorado 81501  
(303) 242-3442

Floyd McDaniel  
Mayor, Town of Parachute  
P. O. Box 188  
Parachute, Colorado 81064  
(303) 285-7786

Red McGehee  
Public Affairs Coordinator  
Colony Oil Shale Project  
Public Affairs  
P. O. Box 308  
Grand Junction, Colorado 81502  
(303) 244-3900

Ray Baldwin  
Garfield County Impact Coordinator  
2014 Blake Ave.  
Glenwood Springs, Colorado 81601  
(303) 945-8212

Nancy Poloske  
Public Relations Representative  
Oil Shale Operations  
Union Oil Company of California  
2777 Crossroads Boulevard, Suite 100  
Grand Junction, Colorado 81501  
(303) 243-0112

Blake Chambliss  
Architect; partner, Mobius Planning  
Consultants  
P. O. Box 2104  
Grand Junction, Colorado 81502  
(303) 243-1956

Jim Evans  
Director  
Associated Governments of Northwest Colorado  
P. O. Box 351  
Rifle, Colorado 81650  
(303) 625-1723

Charles Pence  
President, Battlement Mesa Inc.  
P. O. Box 308  
Grand Junction, Colorado 81502  
(303) 244-3900

Gary Bates  
Coordinator, Colony Mine  
Superintendent  
P. O. Box 308  
Grand Junction, Colorado 81502  
(303) 244-3900

Laurel Kubin  
Chairman, Eastern Advisory Group  
of Rio Blanco County  
(also County Extension Agent)  
P. O. Box 270  
Meeker, Colorado 81641  
(303) 878-4093

Wood Smith, Mayor  
Box 48  
DeBeque, Colorado 81360  
(303) 283-5475 (De Beque Town Hall)

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