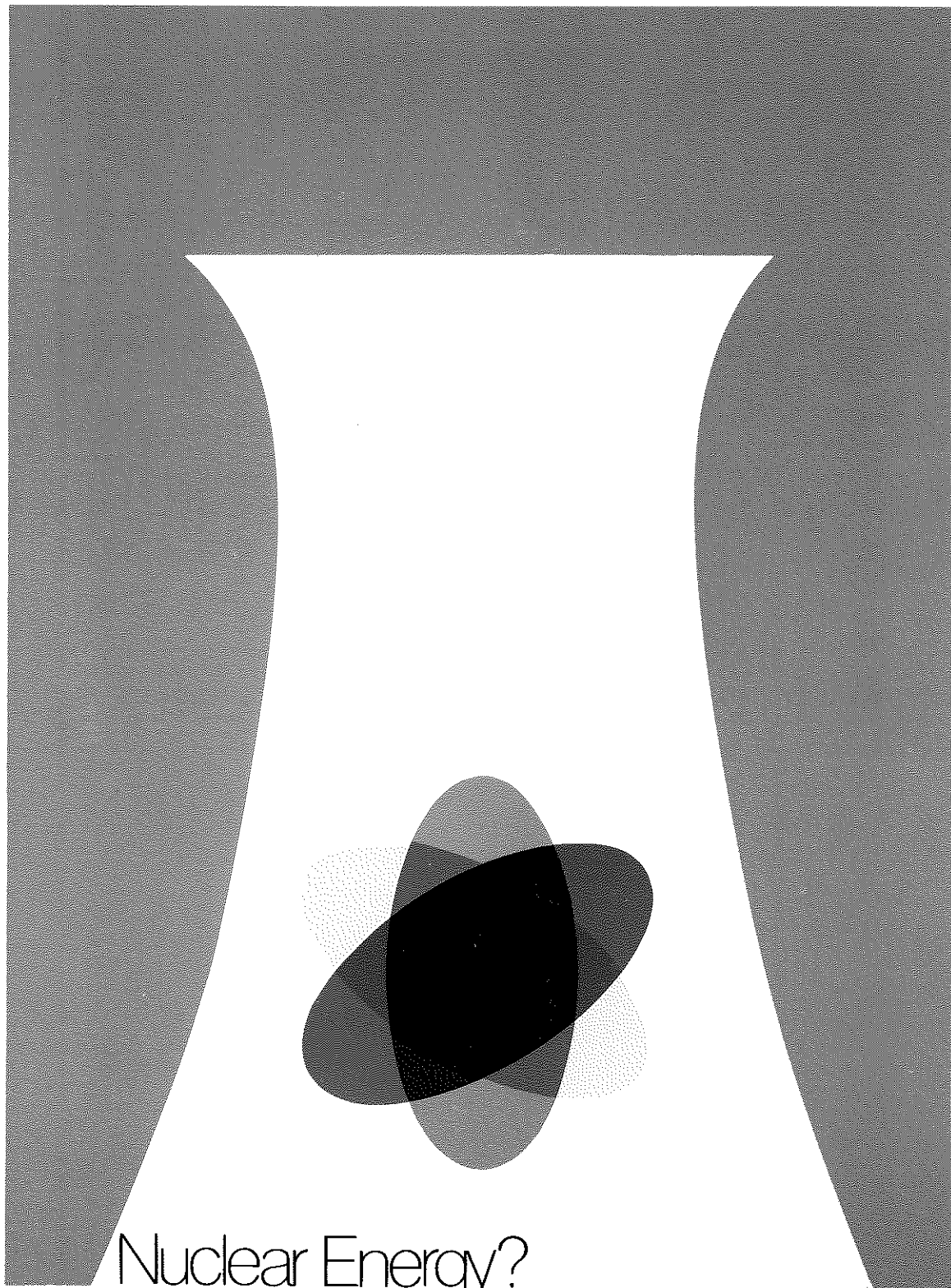


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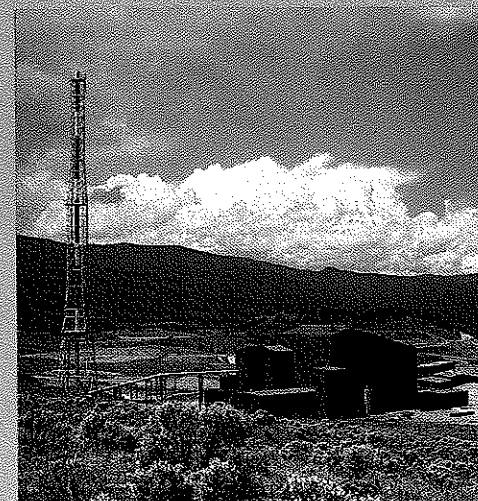
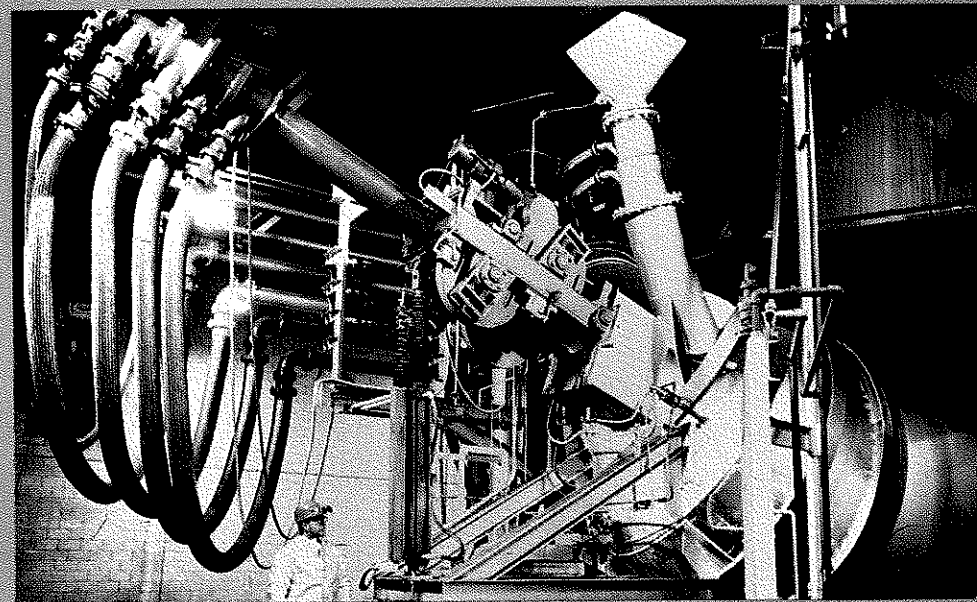
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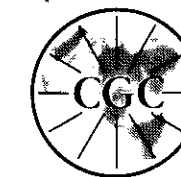
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**May 8-10—COMMENCEMENT PROGRAM**

8—Reunions for 1925, 30, 35, 40,  
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9—Commencement Banquet, Green  
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**10—COMMENCEMENT**

**June 3-5—Cont. Ed. "Maintenance Man-  
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Keystone, CO. For further information con-  
tact K. M. Barbour, CSMAA.

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**July 29-31—Cont. Ed. "Coal Industry Re-  
view", Denver, CO. For further infor-  
mation contact K. M. Barber, CSMAA.**

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## Role of Nuclear Energy in the U.S.

# Aftermath of Three Mile Island

by B. H. Cherry

The accident at Three Mile Island (TMI) had a profound and shocking impact on the people of Pennsylvania, General Public Utilities Corp. and its customers, and the entire nuclear industry. It will have a significant impact on future U.S. energy policy. The accident affects only one side of the U.S. energy equation, the supply side. The factors existing prior to the accident, which strongly supported the need for a viable nuclear industry, remain unchanged. Other events of the past year, including the Iranian revolution and subsequent disruption of oil supply and price, simply reinforce the need for a balanced energy policy in the U.S.

The basis upon which one reaches the conclusion that nuclear energy is a necessary part of a balanced supply strategy can be summarized as follows:

**1. MAINTENANCE OF REASONABLE ENERGY GROWTH.**

A large number of studies have concluded that desirable economic growth requires continued growth in energy usage. While conservation is prudent in many areas, national policy, which counts on conservation to fill the growing gap between supply and demand, risks economic dislocation and the disruption of orderly markets. Thus, a moderate growth of electricity demand is forecast. These growth rates (in the 4-5% range) might substantially increase if the cost of other energy fuels are raised, or if electrification programs, particularly in the transportation sector, begin to take hold.

**2. DECREASED DEPENDENCE ON FOREIGN SUPPLY SOURCES.**

The ability of the U.S. to develop domestic energy resources is the key to any degree of energy inde-

pendence. Nuclear energy currently provides 15% of our energy and could double this contribution in 7 or 8 years. This is important not only in an economic sense, but for national security.

**3. DIVERSITY OF SUPPLY.**

It is imprudent to concentrate a majority of our supply options, on a single resource—coal. The development and expansion of coal supply is subject to many problems. Difficulties in expanding our commitment to coal as if that were our sole resource, could severely impede our ability to meet energy demands.

**4. RELIANCE UPON PROVEN OPTIONS.**

Nuclear energy has been proven to be safe, reliable and economic. It would be highly imprudent to discard such an option in favor of major dependence on untried, untested technologies.

**5. TIMELY DEVELOPMENT OF UNDEPLETABLE RESOURCES.**

The total U.S. resource base of 20,000 quadrillion BTU will support projected energy needs for another 60 to 70 years assuming no supply constraints develop in the interim. It has taken almost 40 years from technical verification to bring nuclear energy to a point where it contributes 15% of our total electricity needs. We need to pursue all of our options to maintain the orderly development of undepletable alternatives and continue to pursue the nuclear option to maximize our available time for development.

**6. ABILITY TO UTILIZE HIGH TECHNOLOGY.**

The nations of the world that have the technological and economic resources available to them to utilize high technology for the production of energy have an obligation to do so. Those nations less capable of utilizing these technologies will have an ever increasing need for fossil fuel, particularly oil, in the next 10 to 20 years.

Despite these incentives, in the six years since the first Arab oil embargo, the U.S. has made little progress towards the goal of increasing energy independence. The factor which has had the most significant impact on U.S. oil imports has been the substitution of Alaskan oil for oil which had previously been imported. Even considering the Alaskan oil offset, total U.S. oil use has increased in excess of 30%. By early 1979, the commitment to nuclear plants in service in the mid 80's had been reduced by about 50% from that which had been foreseen in the early 70's. Some of these changes were due to a decrease in a perceived demand for electricity. It is my view, however, that most nuclear plant cancellations and deferrals were due to an increasing disaffection with the nuclear option by U.S. utility companies. This disaffection, which led the industry to a state of de facto moratorium in the period 1974 to 1978 (a time when other factors would have dictated expansion), was due to the environment in which the industry was operating. This environment included several problems:

**1. PERCEPTION OF FINANCIAL RISK.**

The construction and operation of nuclear plants was becoming increasingly uncertain in both

costs and schedules. Regulators increasingly looked to utility stockholders to assume the total risk of such ventures.

## 2. LACK OF POLITICAL RESOLUTION OF KEY ISSUES.

A number of issues that the government has had responsibility for, such as high level waste disposal and temporary storage for spent fuel, remained unresolved.

## 3. LACK OF CLEAR NATIONAL COMMITMENT TO THE NUCLEAR OPTION.

Despite allegations as to the need for light water reactors (LWR), no firm national commitment to an expanded role for LWR was forthcoming.

By late 1978, despite the clear need for an expanded commitment to nuclear energy, the U.S. utility industry did not deem it prudent to make such an expanded commitment. The basis for this apparent paradox was accurately captured by a quote from a senior industry executive:

"From a national policy perspective, we are convinced that

increased reliance on nuclear power is essential... but as prudent managers of our shareholder's money, unless the business can be considered on a very different basis in the future, nuclear power is not an attractive investment opportunity."

By early 1979 there was hope for changes... hope that "the politicians" would provide the environment necessary for renewed utility interest. For a while, in early 1979, it looked like this might have been the case. That slight comeback was ended by the TMI accident on March 28. It is my hope that the lessons learned from this traumatic event will provide the basis for a stronger, safer and more viable nuclear industry in the U.S.

## THE IMPACT OF THREE MILE ISLAND

The accident magnified the concerns of the public and the utility industry in two key areas:

1. The perception of plant safety and risk to the public, and

2. The perception of risk to the financial integrity of the utility investor.

Additionally and importantly, the accident provided a focal point for the previously diverse anti-nuclear interest to rally about. The accident also gave such groups a responsibility and acceptance they previously lacked. This now more homogeneous anti-nuclear community may be the single biggest obstacle in the U.S. It is clear that any expansion of nuclear energy in the U.S. will require much greater grass roots political support than ever before. In order to develop such support, the question of plant safety and risk to the public, which has been reopened by the Three Mile Island accident, is one which should demand much of our attention in the near future.

## Plant Safety and Risk to the Public

The question of plant safety and public acceptance of the operational risks of nuclear energy had been substantially resolved for a majority of the public prior to TMI. It was generally perceived that this was a technology "under control" and that even if there was an accident, health effects would be minimal. The accident impacted both conclusions. The accident was ultimately contained, as it should have been, by the plant safety systems. There is a strong view, however, that neither the operators, regulators or designers were able to understand or fully come to grips with the accident for several days.

The Kemeny Commission findings, reports from the NRC, such as the Mattson "Lessons Learned" report and the reports of the many other investigations which are being conducted will ultimately provide the foundation for a safer, more controlled technology. Improvements in many areas of plant design and operation, regulation, operator training and emergency planning will occur.

The industry would be delinquent indeed if it did not maximize the learning experience of such a traumatic event as TMI. The observation that there were

warnings of a TMI type accident as early as 1974 in the Besnau plant, and at the Davis Besse plant in 1977 is one of the more important aspects of the accident. An understanding of the substance of these two occurrences might not have "for sure" eliminated the serious consequences of the TMI accident. I would strongly urge that such knowledge would have significantly increased the probability that the consequences of the TMI incident would have been significantly diminished. The industry has lacked an effective vehicle for communicating the significance of events at one facility to the rest of the industry. A key part of a renewed nuclear industry must be an organization whose sole function is to collect, analyze and communicate the operating experience of our industry's nuclear plants. I believe that this key ingredient added to other industry initiatives in other areas will provide a strong basis for the future safe operation of U.S. nuclear power plants.

The assurance of safe operation of plants is only half the problem of the public acceptance of nuclear technology. Since there are always some risks with any technology, a significantly greater public understanding of the risks of nuclear energy is essential to the future of the industry. The ability to communicate to the public has been enhanced as a result of the accident on Three Mile Island because of the degree of the press and media coverage. The average citizen has a much better understanding of the fundamentals of nuclear energy than perhaps he did a year ago. The industry must use this increased level of understanding to its advantage with the public and must not delay in initiating such programs. The "half life" of this public understanding is likely to be short.

The role of fear of the technology and its impact on the nuclear industry was substantial. The fact that media misunderstanding and sensational journalism contributed much to that fear is important. The fact that Malcomb Browne of the NEW YORK TIMES observed that the press coverage of the TMI accident was one of the worst disasters in American journalistic history, received little notice. The impact of such sensationalism could have been substantially blunted if there had been a higher degree of awareness of the technology. Such efforts are desperately needed in the U.S. and in the world if the nuclear option is to succeed.

## Financial Integrity of the Utility Investor

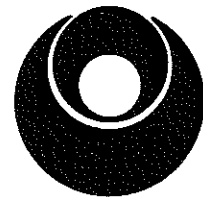
The asymmetrical nature of the risks and benefits of an investment in nuclear energy was underscored by the impact of the TMI accident on General Public

Utilities Corp. GPU nuclear plants\* prior to March 28, 1979 had produced customer benefits of close to 800 million dollars. These benefits went directly to GPU rate payers through the application of a fuel adjustment clause for the lower cost of nuclear fuel vs. coal and oil. There was little, if any recognition of such past customer benefits apparent in the initial rulings following the accident by the Pennsylvania and New Jersey Commissions. The Pennsylvania ruling was characterized in an editorial in the Harrisburg Patriot as follows:

"Responding to an unprecedented event, the PUC arrived at an unprecedented conclusion, which in effect placed the entire monetary burden of the March 28 nuclear accident on the owners of the plant..."

The monetary burden referred to is associated with the entire cost of capital on the 700 million dollar investment in the facility plus any uninsured costs associated with operations at the units. We expect the total of these costs to approach 100 million dollars for each year the unit is out of service. The impact of a temporary inability to charge customers for replacement power costs in addition to the burden of fixed charges almost resulted in the bankruptcy of the GPU companies. The editorial went on to say:

\*There were three in operation at the time of the accident; Oyster Creek—commissioned in 1967, Three Mile Island Unit 1—commissioned in 1974, and Three Mile Island Unit 2—commissioned in 1978.



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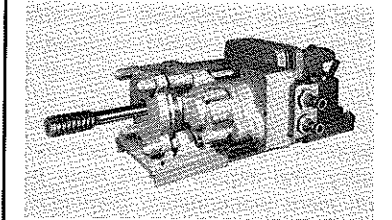
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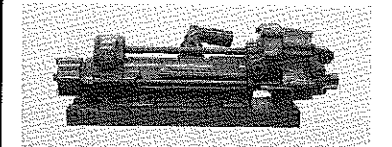
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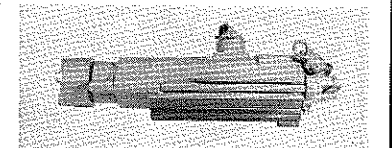
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"Every utility in the country contemplating the construction of new generating capacity must pay heed of the implications of the PUC ruling when it comes to deciding whether to build coal or some other form of generating facility."

I believe that the above quotation indicates that utilities must consider the financial risks associated with the construction and operation of nuclear power plants in a different light than ever before and clearly in a different light than other investment opportunities.

The financial impact on the company is severe. In addition, the current impact of replacement power costs on GPU customers is also substantial. Exacerbated by the NRC mandated shutdown of TMI—Unit 1, these costs are in excess of 20 million dollars per month. Had the burden been spread over the total beneficiaries of nuclear energy across the country, the impact would have been much more manageable. Development of industry supported insurance coverage for replacement power costs would be one way of spreading the burden. Without such a vehicle to spread the financial risks of major plant outages, it is my judgement that the existing commit-

ment to nuclear power will not be expanded by the utility industry.

While the impact of the cost of replacement power on a customer group can be mitigated through the development of an insurance pool, the problem associated with fixed cost coverage of a disabled plant remains. Without a basis for reducing the risk of such fixed costs, I believe it is improbable that a single utility would take on a commitment for a new nuclear plant. Diversification of such risks through regional pool ownership of nuclear facilities is suggested for reducing the impact of these costs on a single organization. Such regional consortia could be charged with the responsibility for constructing and operating new facilities. In addition to broadening the financial base of nuclear projects, these organizations could also provide much greater technical and management depth to the projects. Such an approach in an environment of renewed commitment to nuclear energy could provide a viable mechanism for expansion and progress.

#### The Need For A Clear National Policy

The successful implementation of the range of industry and regulatory

programs resulting from the TMI accident can provide the basis for an expanded commitment to nuclear energy in the U.S. Without a clear national policy backing such a renewed commitment, however, no such expansion will occur.

I am encouraged by President Carter's reaffirmation of support for nuclear energy in his speech in Kansas City in July, 1979, but I question the degree of commitment of his support in view of his clear avoidance of even the word "nuclear" in his nationally televised energy message the previous evening.

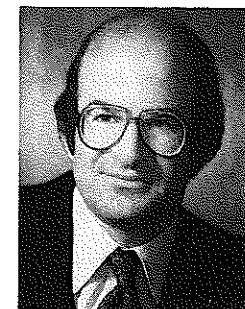
In the absence of a strong national policy on nuclear energy (either for or against) state and local governments have moved in to fill the gap. Reacting to vocal minority political pressures and near term costs impacts, the environment is negative. From New York to California, nuclear power is taking it on the chin at the state level. Unless this policy vacuum is filled, nuclear energy will be unable to be expanded on any basis in the private sector, and indeed the battle may shift from expansion and new commitments to plants under construction and in operation.

#### Summary

The need for a balanced energy supply strategy in the United States is more severe as we near the end of the 70's than ever before in our history. The impact of foreign oil dependence upon the nation's security and economy is currently intolerable. The desirability of nuclear energy as part of a national energy policy is undiminished even in the wake of the accident at Three Mile Island. The prospect for an expanded commitment to nuclear power in the current environment seems remote. Public perception of the risk of the technology and utility perception of the financial aspects of the technology must be substantially modified before commitments to new capacity will be made. Efforts of the utility industry and regulatory bodies in learning from the accident at TMI are a strong move in the right direction. A significant program aimed at the education of the public to the character and risks of the technology will also be required. A new industry organization to review and evaluate plant problems and identify and communicate their significance to the industry will help insure the future safety of nuclear energy. Commitments to new nuclear facilities may require additional insurance coverage and a modified industry structure to spread the financial risks of nuclear energy over a larger base. A series of regional nuclear generating companies is recommended. Finally, the need for a clear national policy on nuclear energy is essential to the expansion of the industry.

Despite the severe trauma the TMI accident has had upon the GPU system, we remain convinced that nuclear energy is an essential component of the nation's energy supply. I believe that the U.S. utility industry is prepared to move forward and fulfill our obligation as suppliers of the nation's electricity, but not at the undue risk of our rate payers and stockholders interests. Both the industry and the government must take aggressive action if the promise of nuclear power is to be fulfilled. The industry is prepared to do its part.

I support the Carter Administration when it says that there is a need for nuclear power to fill a gap in energy supply and demand. However, 90 words in an obscure presidential speech is not the kind of support required to move forward. Without overt support, the war which the energy problem is alleged to be equivalent of, will be lost.



Bernard H. Cherry is vice president, corporate planning, General Public Utilities Service Corp, a subsidiary of General Public Utilities Corp. He obtained a BSc. in chemistry and MSc. in nuclear engineering from the University of Illinois and has done graduate work in nuclear science and engineering, Columbia University.

The foregoing article is a condensation of a speech made by Mr. Cherry at the Fourth Annual Symposium of the Uranium Institute, London, England, in September, 1979.

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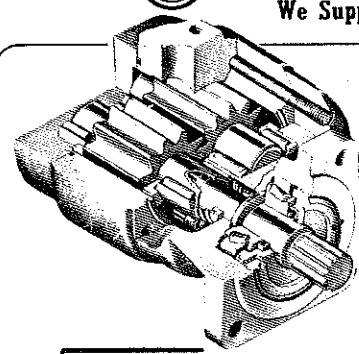
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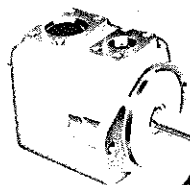
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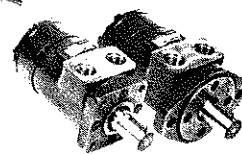
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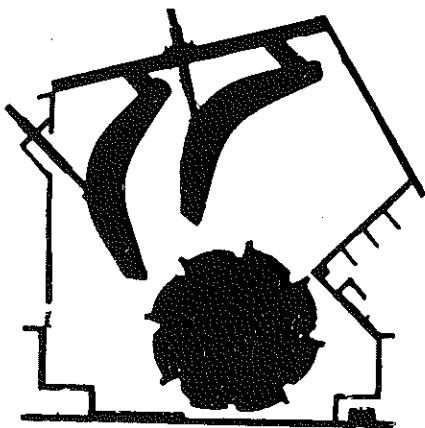
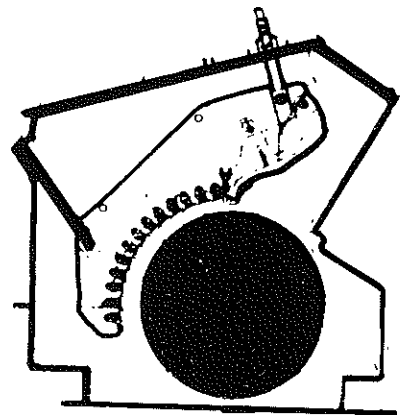
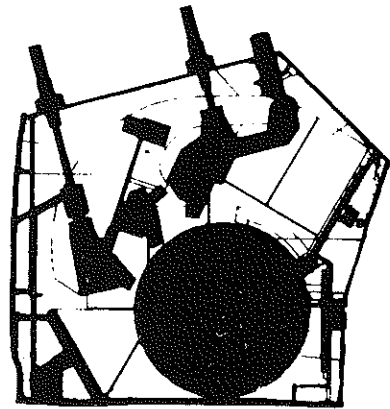
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## Nuclear Option

by Irving S. Shapiro

There was a line in a recent issue of Harper's Magazine, which said, "Split atoms, not wood." We ought to split atoms *and* wood—and dig coal, and pursue research and development projects in a number of areas. The philosophy ought to be to put lots of eggs in lots of baskets—and watch all the baskets.

One important set of baskets is labeled electric power. Almost one-third of all primary energy is used to make electricity, and the fuel used for that purpose isn't available for any other use. All of us should be concerned about any significant amount of natural gas and oil being used to generate electricity, when there are alternatives.

It's no secret that nuclear power is in trouble. There are 71 nuclear plants in operation now. Approximately 90 are on order, but there's a question about how many of them will be completed and put into operation. New orders for nuclear units have been declining for years—long before the accident at Three Mile Island—and the rate of new orders coming in is now zero.

We don't hear much anymore about all the benefits of atomic energy. We hear about the fears of a disaster. We hear about the lack of public trust in the people running the nuclear industry. We hear about the high capital costs and the delays in getting nuclear facilities built and licensed—the timetable is now up to 12 to 14 years in this country, nearly twice as that in some other nations. We hear about utilities scrapping their plans for nuclear plants, deferring construction altogether, or selecting coal-fired units. They would rather switch than fight, and, given the controversy over nuclear energy, it's hard to blame them.

Yet the facts say we ought to be going the other way. It would be *desirable* to

look to nuclear plants to produce more of our electricity within the next 10 to 15 years, at least 20 to 25 percent of the total, as compared to 13 percent now, and something in the range of 35 percent by the turn of the century. This would be prudent and safe, and the technology to make it happen already exists. Other nations are taking this route—more than 40 of them—and unless the U.S. does the same it may lose its position in nuclear technology.

### Nuclear Controversy

The controversy about nuclear power comes down to two basic questions: The question of **need**, and the question of **safety**. If the U.S. does not really need more electric power, there's no case for building generating capacity except for replacement. If there is no way to handle the nuclear safety question, in all its dimensions, then the nation has no nuclear option.

At the moment there is no shortage of electric power. There is capacity in reserve. The problem lies ahead of us, and how big it is depends on our assumptions about economic growth and power demand. We can find a lot of different numbers on this but there seems to be general agreement on a few basics: GNP in the next 10 to 20 years is likely to grow at a slower rate than in the past, and so is overall energy use. The demand for *electric* power, though, is probably going to increase more rapidly than the overall energy number, because electricity will be displacing some other forms of energy. In Du Pont we forecast an energy growth rate for the U.S. of about 1.5 percent per year, and an electricity growth rate of about 2.5 percent. These are conservative numbers, but is important to note that this still works out to be an increase in electric generating capacity of about

two-thirds between now and the end of the century. To the extent that our growth rate can be raised above the expectation, the needed generating capacity will be even greater.

Those numbers, incidently, take into account a serious conservation effort. Fewer B.T.U.'s; more work out of the B.T.U.'s available. Co-generation, retrofit homes and offices and industrial plants. All of that can be done, and is being done; but the curve is bound to flatten out. Conservation by itself will not be enough.

What about new or expanded sources? As a practical matter, the options for the near future for electric power come down to coal and nuclear energy. Solar energy and some of the other unconventional technologies, whatever their value in other applications, are **not** going to give us significant growth in electricity generation in the rest of this century.

The big push in Washington now is to get the natural gas and oil out from under the boilers, and the substitute coal. Ten percent of our oil and 16 percent of the natural gas are now used to generate electricity. Those materials are simply too precious to use in that way, so there is a strong case for substituting coal.

As a singular solution to the energy problem, though, coal is too simple an answer. There are side effects that can't be dismissed lightly: The problems of mining and transportation, and most important, the environmental and health loads. For some of the coal-use technologies large quantities of water are required, and may not be available. Handling the sulfur dioxide emissions and the oxides of nitrogen will not be easy or inexpensive. Beyond that, there are polyaromatic hydrocarbons and the concerns about the buildup of carbon

dioxide in the atmosphere. Combustion of any fossil fuel produces CO<sub>2</sub>, and any energy policy emphasizing coal alone would increase that concern.

### What Harm Done?

Physicians have a code that starts with one fundamental: Do no harm. The same kind of logic ought to extend to the environmental and health side of our energy policy. We cannot eliminate all risks, but we ought to be especially cautious about steps that could cause large-scale and irremediable insults to the environment. No one knows whether the so-called "greenhouse effect" will increase the earth's average temperature, or whether, if that happens, the results will be all bad. In the case of electric power, it would be better **not** to switch but to fight—to keep nuclear power along with coal as part of the energy package, and expand the proportion nuclear power contributes to the total.

Nuclear plants do not emit CO<sub>2</sub>. They save oil and gas. Their costs per kilowatt hour are at least competitive, and over the next 10 to 20 years probably will be lower than power from coal. The fuel they use, uranium, is available in quantity and the reserves are adequate to take the nation past the year 2000—even without using breeder reactors or reprocessing plants to recover some of the energy value of used fuel.

**There is still the rule to follow, though: Do no harm.**

That brings us back to the safety question: Is nuclear power safe? Can it be? The answer is "Yes." Nuclear reactors **have been and can continue to be** operated safely. The wastes generated can be disposed of safely.

The obvious political fact of life is that most people in this country are far from convinced that nuclear power is as safe as they would like it to be. They aren't confident that they are being told the

truth, and they are not confident that the people in charge of nuclear plants know what they are doing. The public has been given assurances, but they have also seen news stories about shut-downs of nuclear plants and leaks of radioactive materials, and then there was Three Mile Island—worst accident of the commercial nuclear energy program in the United States.

The public is not against the increased production of energy—people vote for that in the polls—but the support for nuclear power has been declining over the years.

### What is the fear?

- Is it that a nuclear plant could fail and go off like a bomb? Two-thirds of the population think the answer is "Yes," although the physicists have said again and again that it simply cannot happen.

- Is it that there could be a meltdown and massive release of radiation costing thousands of lives? Many people believe there is a serious chance of that, though the probability of that happening is extremely small.

- They also believe that smaller leaks cause health hazards and do genetic damage, that there is no good way to store nuclear wastes, and that other nations—or terrorists—may get their hands on nuclear materials and turn them into bombs.

Set those fears against some facts that are easy to check. The U.S. has compiled a record of more than 500 reactor-years of commercial nuclear power generation. The safety record has been extraordinarily good. I know of no new technology of a major scale that has evolved with a safety record approaching that of the commercial nuclear power industry.

The accident at Three Mile Island killed no one, and, according to the

Kemeny Commission report on that accident, the effects of the radiation release on the public surrounding the plant will be negligible. It is estimated that the most radiation any citizen might have received was about 70 millirems; that is far less than the average individual receives per year from natural sources, and less than the amount medical science regards as tolerable. It is about the amount that people receive annually from dental and medical X-rays. The chances that we will later see an increase in the incidence of cancer because of that accident are so small as to be statistically meaningless.

If there had been a meltdown in the reactor at Three Mile Island, the Kemeny report said, it is highly probable that the radiation still would have been contained in the building and would not have been released to the outside.

Du Pont can bring some firsthand testimony to the safety question. Du Pont probably has as much experience in running reactors and handling nuclear wastes as anyone in the world. Our company built the Hanford, Washington, facility during World War II, and the Savannah River atomic plant in South Carolina. We continue to run Savannah River today.

Savannah River is a big operation by anybody's standards. The plant site covers 315 square miles, and includes 65 miles of railroad track. Five nuclear reactors were built there. Three are operating now. The reactors have not been used to produce electricity. They are designed to make nuclear materials for defense, rather than to produce heat to generate steam to run turbine generators, but they are comparable in scale to those found in a major power plant.

Along with the reactors there are fuel reprocessing units and storage facilities. Employment totals about 8,000.

Savannah River has been running a

long time—120 reactor-years; 26 years on the calendar. No member of the operating staff has suffered an injury from radiation. No member of the public in the surrounding area has been injured, or exposed to a radiation level that is more than a few percentage points of the natural background radiation. We know that is true because radiation levels have been monitored at many locations from the first day of operations. From a health standpoint, the most hazardous part of the plant is not the nuclear reactors but the coal-fired power station used to generate the electricity to run the facility.

The Savannah River location stores and controls one of the major accumulations of nuclear wastes for this nation. There are now some 20 million gallons of radioactive wastes in storage in underground, double-walled steel and concrete tanks. These are the wastes created by the reprocessing of uranium fuel. The handling of nuclear wastes is a matter of serious concern, but it should be noted that there are some good answers available. Long range, the wastes can and should be converted into another form of much smaller volume, and disposed of in a permanent way.

We now know how to encapsulate nuclear wastes into glass. If you did so a piece of glass the size of 1 quart in volume could hold all of the wastes generated by 1,000 people in one year.

The glass could be put in containers deep underground, removed from all human contact. The risks of the public thereafter would be vanishingly small. There are no technical barriers to stop us from vitrifying liquid wastes into what amounts to this permanent disposal form.

DuPont operates the facility for the Federal Government, at cost plus a fee of one dollar. It's a defense installation and a research center, not a commercial venture. Perhaps we should be publicizing the safety message from Savannah River, because it shows that more of the answers are available on nuclear energy than the public realizes.

The outstanding safety record at Savannah River is traceable to two major reasons. One is an abiding philosophy that all accidents are preventable. It's the safety philosophy we have used in managing chemical manufacturing oper-

ations, many of which also involve hazardous materials. Everybody in the organization is responsible for safety. Managers are evaluated first on the safety performance of their groups, and second on everything else.

The second part of the explanation is a system of management and technical support designed to spotlight safety problems and resolve them before they cause trouble. At Savannah River, for example, the operating crew is backed up by a technical service group of more than 50 people whose only job is to keep surveillance over the process, identify problems and shortcomings, and set up better operating procedures.


**What about nuclear proliferation?**  
When uranium is reprocessed, plutonium is produced, and a handful of plutonium can make a bomb. The building of light-water reactors—the kind producing electric power today—does not add to the hazards to world peace. The nuclear horse is long since out of the barn, and if other countries want to make plutonium for weapons they are not likely to start with a reactor of this kind. There are more efficient routes. Commercial power generation in the U.S., using light-water reactors, does not measurably affect the nuclear arms question.

**The safety question in all of its dimensions is not one of absolutes, but of keeping risks acceptably small.** By any comparative standard, nuclear power is surely one of the safest bets we could make. It may prove to be less hazardous than the use of coal-fired plants, and to the extent that nuclear energy reduces consumption of oil and natural gas, that improves our security position by limiting dependence on foreign sources.

What's the formula for an energy program? Is there a particular balance of different sources that is best?

A short time ago the results of a four-year study were released by the National Academy of Sciences. It deals with energy for the time period of 1985 to the year 2010. Significantly, it offers options but no detailed menu. It looks to a balance of coal and nuclear fission as the practical way to produce large quantities of electricity in the intermediate term, but it avoids the fixed-formula approach.

We do not have to choose nuclear over solar, or solar over syngas, or coal over nuclear, but should push forward wherever there are attractive technical openings, and wherever the environmental problems can be kept



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within bounds.

That may mean R&D funding or incentives for less conventional technologies to get them to the stage of large-scale demonstration units. That shouldn't bother us. We can afford it—or to put it the other way around, we cannot afford *not* to do it. Long range, a strategy of diversity will probably prove to be the one with the lowest overall cost, when we find the best technologies to fill different energy needs in different geographic areas.

#### Diversity Necessary

I argue in favor of an aggressive synfuels program and for continuing research on the environmental problems of fossil fuel, including the CO<sub>2</sub> question. I also urge increased investment in solar conversion devices, plus some longer range studies on projects such as biomass and fusion-reactor research. In addition, there should be continued development of oil and gas supplies—and let's not forget that conservation still has a lot to offer.

Nuclear power will stay in this picture only if the public supports it. To make that happen we need better communications on the part of industry and the government's nuclear agencies. We

need some compromises on the part of the supporters of nuclear power; and we need some changes in the way the nation goes about its nuclear program.

*There has been an excess of zeal on both sides of the nuclear controversy.* The people against it—including some who are going to be opposed no matter what the facts are—have used doomsday rhetoric to block power plant construction and licensing; but there have also been mistakes made on the other side. For example, we were once promised that the nuclear age was going to bring us electricity so cheap it wouldn't pay to meter it. That rings a little hollow to the people paying the light bill today. More recently, advocates of nuclear power have left the impression that the future should be nuclear-powered almost to the exclusion of other sources, and that of course turns away some of their potential friends.

The antinuclear groups have been more effective than the advocates of nuclear power in reaching the public media, and in claiming the high moral ground in appealing for the public's support.

At this point, with public support and opposition more or less evenly divided, it would pay the advocates of nuclear

power to expand their communications. It's important to be candid, though, and not overpromise. Let's stick very strictly to the facts, lay off the rhetoric, and address the concerns of the opponents on their merits.

#### Nuclear Needs Friends

Nuclear power needs more friends in government, as well as with the public. That means something called coalition-building—which is the modern label for good old political give-and-take. This kind of talk often offends technical people. They want to go with the logic, and be fully rational in a technological or economic sense; but unless the pro-nuclear camp operates in a spirit of compromise, there may not be much left for it to defend in years to come.

On the question of plant location, let's recognize that many of the people opposed to having a nuclear plant next door are willing to see plants built a few miles farther away. Why push a rock up a hill? Why not work from a policy of putting new power plants in more remote locations, even if that implies higher transmission costs for power?

On the question of breeder reactors, we should settle for a continuation of R&D, but without a major push for commercial units in the near future. Granted, other countries are building breeder reactors; but we cannot claim that it is essential for the U.S. to go this route at this time. We're not running out of uranium. Maybe it would be politic for the U.S. to presently stick to light-water reactors for commercial plants.

The safety issue is the most important of all. To get nuclear energy back on the track there will have to be substantive changes pointed toward better management of nuclear facilities, with safety the paramount goal. Nuclear operations must be approached with a combination of top-notch engineering, excellent technical service, and a lot of attention to the human factor. That's the approach that characterizes the safest organizations in the high-technology industries, and the one that prevails in the utilities that run nuclear facilities without serious incidents. This means taking a new look at the training of the people doing the work, at the way the management structure is set up and,

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above all, at the level of the commitment to safe operation.

Regulations can help, but they cannot do the whole job on safety. As the Kemeny Commission said in the Three Mile Island report, we have to get away from the notion that because a practice meets regulations, it is therefore completely safe.

A major finding of that study was that the accident was caused not by one large failure, but by a series of small failures in succession, partly due to human error, partly to equipment problems—all preventable failures.

To prevent such a sequence of events in the future, nuclear plants must improve the inspection and oversight procedures, and make broader use of technical support staffs. This has not yet been done in any great depth at most locations. The Institute of Nuclear Power Operations has recently been established to upgrade criteria for power plant staff and management.

The Kemeny Commission called for a reorganization of the Nuclear Regulatory Commission. At present the NRC is headed by a five-man group. Congress and the White House want to keep the structure that way but there is clearly an

administrative problem: *The system doesn't work.* Either through reorganization or in some other way, the lines of responsibility and accountability have to be more clearly drawn, with special emphasis on the government's licensing and inspection functions.

The present licensing process tells you how diffuse the present management structure is. It's not just slow; it's also a two-step process. You get one permit to construct a nuclear power plant, and have to apply for another before you put the plant into operation. In this day of high interest rates, who wants to commit more than \$1 billion on that basis? It's like asking a man to buy a very expensive car without promising that he will be allowed to drive it when he gets it home. What is needed is a one-step licensing procedure, with rigid inspections to ensure that the construction job and the training programs for employees meet the standards in every way.

None of these changes, none of the technologies that are required, none of the funding requirements—none of the steps we ought to take to ensure the safe production of adequate electric power for the future—is beyond our

resources or skills.

We are looking at a need. It is real. We're looking at options. They are promising, though some contain questions we can't answer yet. The option considered here, nuclear power, is one with more answers than most. We have the technology and the experience to expand capacity efficiently and safely and gain a great many kilowatts.

*Irving S. Shapiro is Chairman of E. I. duPont de Nemours & Company, of Wilmington, Delaware. The article, "We Need More Nuclear Power," was derived from a speech Mr. Shapiro gave to the National Petroleum Refiners Association, New Orleans, Louisiana on March 24, 1980.*

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# Mt. Taylor Project—Overview

by Richard J. Barendsen

The Mt. Taylor Project is one of the larger projects undertaken by the Gulf Oil Corporation. It is located in the Grant uranium belt about 60 air miles west, northwest of Albuquerque near the 200 year old Spanish village of San Mateo. It is at the extreme southeast end of the Ambrosia Lake mining district. The name of the project derives from the 11,389 foot extinct volcano in the vicinity. The elevation of the mine shaft collar is 7,300 feet. The mine is being developed by a subsidiary of the Gulf Oil Corporation, Gulf Mineral Resources Co., with headquarters in Denver.

We first obtained an interest in the Mt. Taylor area in 1971 with the purchase of a significant known uranium reserve. Consolidation of our position has given us total ownership over a trend somewhat more than 6 miles in length, comprised of claims and surface and mineral leases from private individuals and the Santa Fe Railroad. Extensive drilling since 1971 has added proven reserves throughout the trend.

Field construction began in

September of 1974 and shaft sinking was initiated in 1975. Now, 5 years later, we are at the point of beginning the large scale underground development that will lead to commercial production rates.

We believe the reserves present in the Mt. Taylor project area comprise the largest in the U.S. accessible from one location, with reserves estimated in excess of 128 million pounds. Based on the 1979 DOE estimate of remaining low-cost U.S. reserves of 580 million pounds, Mt. Taylor represents some 22 percent and should prove to be a stable and dependable source of uranium for between 20 and 25 years. The uranium contained in this exceptionally high grade set of ore bodies, when used for power generation, will be equivalent to the energy of about 4 billion barrels of crude oil. The deposit is contained in the Westwater Canyon member of the Morrison sandstones which, at this location, are buried between 3,100 feet and 4,000 feet below the surface. The average grade of the deposit would be

somewhat above 5 pounds per ton, and in the location of the shafts, the source of production in the early years, the grade will run very substantially above 5 pounds per ton, a very high grade indeed for production in the U.S. today. According to the DOE, the average for the entire nation for the year 1979 was slightly over 2 pounds per ton.

There are two concrete-lined shafts 400 feet apart and 3,300 feet deep. These shafts were sunk using conventional sinking methods. The main shaft is 24 feet in diameter and will be used for hoisting the ore as well as the exhausting of ventilation air. It was started in January, 1976, and bottomed in early 1979. The service shaft is a 14 foot shaft which was designed for the movement of men and materials as well as the intake of ventilation air. Sinking was started in July, 1975, and it also was completed in 1979. The pumping stations have a primary design capacity of 7,000 gallons per minute with a secondary system capable of an additional 6,000 GPM. These are now pumping from 4000 to 6000 GPM from the bottom of the mine.

To more effectively deal with the difficulties associated with water, heat and radon, we are planning to go to a multilevel development scheme. The ore level is at about 3,100 feet, the haulage level at approximately 3,200 feet and the drainage exhaust level at approximately 3,300 feet. Long-holes will be drilled upward from the haulage level to provide advance drainage of the ore bodies and allow definition of the same prior to mining.

The captive mill will be located approximately 3 miles north of the shafts. The process will be acid leach with the initial capacity expected to be approximately 2,000 TPD or about 4-5 million pounds U<sub>3</sub>O<sub>8</sub> per year. Tailings are planned to be disposed of at a site about 4-5 miles further north of the mill. They will be moved to that location by slurry pipeline. The mill will have a 20 to 25 year life and will operate 7 days a week with 3 shifts per day. A coarser fraction

of the tailings will be separated at the mill and be returned to the mill to be used as backfill. The remaining approximately 50 percent will be disposed of using a new below-grade trench burial scheme.

During the past summer, we successfully completed a pilot mining program intended to verify the quality of the deposit, the ground conditions and the basic approach to be used in mining. Following corporate Board approval in December, we have embarked on the major mine development program accessing the ore. The detailed design of the mill was started in the second half of 1978 following the original submission of our application for a Radiological Materials License from the state of New Mexico in May of 1978. Site preparation and construction of the mill and tailings disposal area should begin as soon as this license is obtained, which is now expected mid-year 1980. The target for initial operation of the mill is currently mid-year 1982.

Expenditures on the project through year-end 1979 were approximately \$160 million for the development of the mine. Additional money was spent on acquisition of mineral leases and surface rights. We expect that the mine will start

producing commercial volumes during 1981. Current plans are that production will reach about 5 million pounds per year as the underground development is expanded and as more mining areas are opened up by the mid-1980's.

Our ultimate production goal, should the world market be able to absorb it, is to de-bottleneck the mill and expand the mine to reach a production rate of above 4,000 tons per day yielding between 7 and 8 million pounds U<sub>3</sub>O<sub>8</sub> per year.

We estimate that the capital required for initial mine development and fixed plant over the next several years to reach the 5 million pound per year level of production will amount to between \$150 and \$200 million and the cost of the mill and tailings program will be between \$50 and \$100 million more. The resources are also large, so that the initial capital costs per pound will still be not much over \$4.

We have not yet committed any of the production to market but we are currently engaged in discussions which will lead to such commitments.

Richard J. Barendsen is Manager, Planning and Budgeting, Uranium Division, Gulf Mineral Resources Co., Denver.

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*'This estimate of \$200-300 million total additional capital does not include expenditures for on-going mine development and equipment replacement or for later expansion to the more than 4,000 TPD production rate.*

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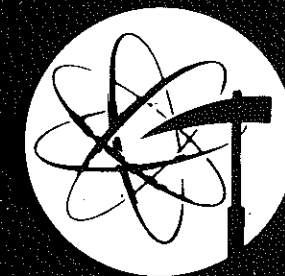
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An overview of the Mt. Taylor project, picturing the complexities of the operation and its size.

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# Mt. Taylor Project—Mine

by John A. Heron

The major uncertainties concerning the mining programs for Mt. Taylor have been confronted and resolved during the station construction and pilot mining work and development in the Westwater Sands.

The rock strength is better than anticipated and observations at the mine provide ample evidence that steel set support is unnecessary except in unusual geologic situations and main station areas. Higher rock strengths allow more flexibility in mining methods and reduce mining development, and drift maintenance costs. Rock strengths were measured to be in the range of 2,730 PSI in barren rock near shafts to 8,030 PSI for ore from test stope.

Engineering and operational solutions have been developed for the problems in pumping of water, drainage of ore blocks, ventilation refrigeration of work areas and movement of ore, men and materials.

The full continuity of the ore bodies will only be known as closely-spaced long-holing is completed from the drifts under the ore zone. Presently, over 2,800 feet of drift has been driven in ore with very good ore continuity, and we have every hope that other ore bodies will exhibit similar characteristics.

The primary access to the ore trend has been established with the completion of the production and service shafts and the pumping facilities. A pilot mining program producing over 100,000 contained pounds of U<sub>3</sub>O<sub>8</sub> was completed July 15 of last year. The program was structured to establish reliable mining productivity figures, associated production and development rates, ore continuity, and drainage rates.

The mining plan involves three basic stages of operation:

<b>Primary Development</b> (Began 1975)	Access to the ore horizon (Shaft sinking & stations)
<b>Secondary Development</b>	Drainage & access to the ore bodies (drifts & raises)
<b>Mining Operations</b>	Ore extraction and backfill

## PRIMARY DEVELOPMENT

The production and service shafts will eventually be augmented by two additional large diameter ventilation shafts providing intake air to maintain a mine environment which allows a rapid production buildup and high volume mining.

## SECONDARY DEVELOPMENT

The secondary development will generally consist of a set of four parallel drifts driven along the trend, underneath the ore bodies. From these drifts, long-hole drilling upwards into the ore zone will give detailed information on the area to be mined and begin drainage of the ore. Then raises and inclined ramps will be driven upwards to begin actual extraction of ore. Stope preparation work will consist of driving drifts to the extremities of an ore block and establishment of extraction facets (longwall or slots).

## MINE OPERATIONS

At present traditional room and pillar mining is being used. We are developing a system for use with fill whereby mining extraction then proceeds by taking a series of slices along the longwall faces and filling the void with cemented sand. A new cut is then made alongside the fill. This cycle is repeated in a retreating pattern until the entire block of ore is removed, milled and replaced by the sand fraction of the original ore. Portions of this system are used in the mining pilot program with conventional drill blast mining equipment. (This system also lends itself to use of mechanical continuous miners which are now undergoing tests underground.)

Ore is then moved by load haul dumps to ore passes, dropped to haulage trains for movement to the slusher trench at the central production shaft and hoisted in 12-ton skips to the surface.

The environment underground at the mine is hot and humid, the water and rock temperatures in the Westwater Sands reaches 128°F and is flow governed by pore porosity. In order to create conditions to mine effectively at this depth and in these conditions, refrigeration and cooling of the work places becomes extremely important. During initial excavation of shaft stations and the areas surrounding the shafts cooling was accomplished with large volumes of air supplemented by 900 tons of refrigeration underground and 800 tons on surface. Presently 3000 tons of mechanical cooling and 1500 tons of evaporative cooling is under construction. This will provide refrigeration in order to maintain a productive environment in the stopes and will be

supplemented by the additional two shafts and some additional refrigeration to be constructed later in the mine life.

Drainage of stope areas is also a key component of the mine system. Prior to mining most stopes they will be drained by longholing some 6 months prior to mining. This drainage will reduce the water inflow and thus heat transfer into the stopes and provide a solid road base for the mobile equipment

## OPPORTUNITIES

The Mt. Taylor ore body has tremendous potential for being mined mechanically. The support systems for each individual stope are quite extensive and the centralization of a number of small conventional stopes into more productive, larger mechanically mined stope panels is attractive because of a common support base. Contrary to a number of mines in the Grants area, the continuity and large size of the higher grade ore bodies, the mine life, and the strength of the rock all tend to support the conversion to larger more mechanized mining systems. The mechanized mining systems for Mt. Taylor are being aggressively pursued, equipment is presently on site undergoing testing, and programs are being developed for continuous mining.

## MILL OPERATIONS

Milling the Westwater Sandstone ores in the Grants district is a well established process at several operations. Mt. Taylor ores are quite similar but slightly more refractory. Laboratory and pilot testing have confirmed that recovery of over 96% of the uranium values can be accomplished in a conventional two stage acid leach, followed by CCD thickening, and solvent extraction process using extended leach times with higher temperatures and additional oxidant (sodium chlorate).

*John A. Heron attended Colorado School of Mines. He is currently Operations Advisor, Uranium Division of Gulf Mineral Resources Co. of Denver.*

*The two foregoing articles were presented at the Uranium Resources Technology Seminar III, directed by Dr. Jerome Morse, CSM and CERL. The complete proceedings of the Seminar will be available through the Publications Department, CSM, Golden.*

—mm—

## alumni update



'35 Roy Hall, E.M., brought in a vintage TIME magazine as an item of interest for the Alumni Office. The cover, showing Herbert Hoover, is of particular interest to the graduates of the class of '35, for Mr. Hoover was the featured speaker at that Commencement and was given an honorary degree by CSM at that time.

'38 Stewart B. Harris, Met. E., recently retired from Bethlehem Steel Corporation's Sparrows Point, Md. plant. Harris has been with Bethlehem since his graduation from Mines, and was honored for his 41 years of service with the company. He was appointed assistant superintendent of the primary mills in 1961 and superintendent in 1967, which post he held upon retirement.

'50 Jasper (Jack) Warren, P.E., and his partner, Allan King, were recently featured in the U.S. News and World Report. In an article on petroleum wildcatters and entrepreneurs, they were described as being typical of the successful oilmen currently operating. Involved in nine companies, the two are best known for their interests in Goldking Production Company and Goldrus Drilling.

'51 Paul A. Hodges, E.M., has established his own consulting business in Tucson. With

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more than 28 years in world-wide experience, he has worked with a number of major companies, the most recent being Anamax, where he spent 5 years before going into consulting practice.



Mitterer

'52 Adolph V. Mitterer, E.M., has been promoted to vice president-technical services at Rocky Mountain Energy, according to James C. Wilson, president of the Denver-based Union Pacific subsidiary. He will head a newly-formed function responsible for providing technical support services to all of the company's operations.

'53 Andrew Patten, P.R.E., and his company, Patten and Company, manufacturer's reps, were recently given an outstanding sales achievement award from Chempump Division, Crane Company, based upon exceeding the sales quota established by the firm. Patten and Company is based in Arvada, CO.

'54 Donald O. Rausch, E.M. and DSc. Min. '59, has been elected to the post of executive vice president of Western Nuclear Inc., Lakewood, CO. Rausch has been with the firm since 1979. Western is a wholly-owned subsidiary of Phelps Dodge Corp., which explores for, mines and mills uranium.

'57 CF& I has announced that James W. Copeland, E.M., has been named superintendent of the steel company's Maxwell Coal Mines, at Weston, CO. Copeland was formerly in Wyoming as superintendent of the Sunrise mine, also a CF& I property. Robert R. Beckman, E.M. and MSc. Min., is now supervisory mining engineer, Denver technical support center, MSHA.

'59 Lary G. Cahill, Met. E., is the newly appointed assistant to the senior vice

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Thompson

president of ASARCO, K.D. Loughridge. Cahill will attend the Alfred P. Sloan Fellows Program in executive development at MIT prior to assuming his duties in New York City. Cahill has been with ASARCO since 1960.

'61 Mountain States Research and Development, Inc. has announced that David L. Thompson, Met.E. has accepted the position of senior process engineer with the firm. Prior to accepting this, Thompson was manager of the technical development center, UOP, in Tucson.

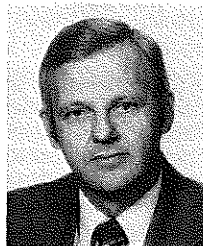
'62 Richard G. Hoagland, Met. E., is now a professor at Vanderbilt University. Prior to this, he was associated with the Battelle Memorial Institute. Project engineer for the Rio Blanco Oil Shale Project's Lurgi-Ruhrgas surface oil shale retort is C. W. Downing, P.R.E. He has been with Rio Blanco since 1974, after several years with Gulf Oil Corp. The Lurgi project includes a three phase program to design, construct and operate a 4,400 tpd surface retort on Tract C-a in Rio Blanco County, CO.

'63 Stephen L. Harvey, Met.E., is now staff metallurgist with the Kaiser Aluminum and Chemical Corp., at the Trentwood Works, Spokane, WA. Keith L. Linck P.R.E., MSc. Math and PhD CPR '74, formerly with Ashland Oil, is now a consultant in the maintenance engineering division of Conoco Oil Co., in Ponca City, OK.

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'64 Nuclear Dynamics of Phoenix, AZ, has moved its management team around—**Kelsey L. Boltz, Geol. E.**, formerly president and c.e.o., has been named chairman of the board. Herbert W. Reynolds has been elected to succeed Boltz, one of the founders of the company, as president. **Stephen D. Chesebro', P.E.**, was elected vice president of Tenneco at the company's March meeting. He has been serving as director of planning and development for the past 11 months and will continue to be in charge of corporate long-range planning. Chesebro' has been with Tenneco since his graduation from Mines.

'65 **Gary Gantner, E.M.**, is the new vice president of S. A. Scott and Company Engineering, located in Lakewood, CO. He was vice president of Entercon prior to this.



Cummins

'66 **William E. Cummins, MSc. Met.**, is now plant manager of the Haydn, AZ smelting and refining installation of ASARCO. He has been assistant plant manager of the unit since 1979, and before that was at the ASARCO plant in El Paso. He has been with the New York-based company since 1966. **Ronald P. Sage, MSc. Geol.**, is currently with the Ontario Geological Survey, Toronto, Canada. His previous employment was at the University of Minnesota, in the institution's department of Mineralogy and Petrology.

'67 The corporate reorganization of the Natomas Company, recently completed, has resulted in **Robert D. Carson, E.M.** being elected as president of Natomas Coal Company, which is designated as a subsidiary of Natomas Energy Company. **Robert W. Jensen, E.M.** is now vice president of energy for the 1st National Bank in Dallas, Texas. Mitchell Energy Corporation of Denver has announced the appointment of **Donald W. Howard, Geop.E.** as the senior district geophysicist for the firm. The company is a subsidiary of Mitchell Energy and Development Corporation.

'68 **Clifford Kangas, Jr., BSc. Met.**, formerly with the Dravo Corp., is now production engineer with the Industrial Minerals and Chemical Corp. **Ronald P. Walden, P.E.**, was incorrectly listed in the March issue as having a BSc. degree in petroleum engineering, when he in fact has the professional degree. He is still associated with Texoma Productions, where he is drilling superintendent.

'69 **Jesse M. Martinez, Geop. E.**, has recently been transferred from Union Oil-California's field office in East Kalimantan, Indonesia, to Bangkok, Thailand, where he will also be employed in the company's field office operations. Rocky Mountain Energy Company, Denver, has announced the appointment of **William R. Casey, Jr., E.M.** as project manager of the company's Copper Mountain uranium project in Wyoming. Casey was promoted from the post of principal mining engineer for the same project. **Linden E. Snyder, Geol. E. and MSc. Eng. Geol.** '78, who was formerly project engineer with Geotech, has joined the US Bureau of Mines as a mining engineer in the Denver branch.

'70 **Orlo E. Childs, Honorary** and former president, CSM, is now associated with the Arizona State Geological Survey. Childs is emeritus director of the Mining and Mineral Resource Research Institute University of Arizona. **Robert K. Nichols, Met.E.**, is metallurgy engineering manager for the Oncor Corp., Houston, TX.

'71 **James B. Page, BSc. Min.**, changed jobs in February 1980. Formerly with Atlantic Richfield, he is now senior mining engineer for American Mine Services, based in Golden. **James R. Black, BSc. Phy.** is field engineer for ASARCO, in Taft, TX.

'72 **Robert A. King, BSc. CPR**, is now production engineer with the Monsanto Company in Casper, Wyoming. He was formerly in Texas.

'73 **George F. Sanders, Jr., BSc. Geol. and MSc. Geol.** '75, is now a geologist for the Anschutz Minerals Corp. in Asuncion, Paraguay. **Jose F. T. Agapito, PhD.**, who was with Colony Development Associates, has formed his own company, Agapito and Associates, in Grand Junction, CO.

**—mm—**

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'74 **Craig S. Alexander, BSc. Geol.**, is head of the geology section of Colorado Interstate Gas Company, Colorado Springs, CO. **Kent F. Perry, BSc. Pet.**, is now manager of drilling and production for MGM Development Company, Michigan. Recently promoted from exploration technician to geophysicist by ARCO is **William K. Dalton, BSc. Geop. Freddy J. D'Elia, MSc. Min. Econ.** is now evaluation head for statistics and proposals in the exploration coordination department of Petroleos de Venezuela, based in London, England.

'75 **Jonathon R. Lang, BSc. Min.**, is supervisory mining engineer for Exxon Minerals Co., U.S.A. in Texas. **James G. Neuner, BSc. Min.**, is currently mine evaluation engineer for Rocky Mountain Energy in Lakewood, CO. **Mike E. Brazie, BSc. Geol. and MSc. Geol. E.** '79 is a geological engineer with F. M. Fox & Associates, Inc. in Wheatridge, CO.

'76 **Lt. Thomas V. DeMars, Jr., BSc. Phy.**, recently participated in operation "Gulf Dart 1980" while being based at Tyndall Air Force Base, Panama City, Fla. **James Donald Walton BSc. Min.**, is a mining engineer for Rocky Mountain Energy, accepting the position in March.

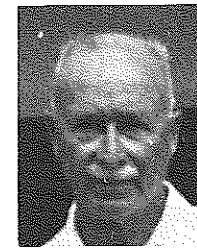
'78 **James Richard Aylor, BSc. CPR**, was recently promoted to district engineer for Dowell Div. of Dow Chemicals in Hominy, OK. **Joseph Kuchinski, BSc. Phy.**, has recently left Combustion Engineering for a new position as shift technical advisor at Yankee Atomic Electric Co.'s Yankee-Rowe Nuclear Power Plant in Rowe, Mass.

'79 **James Jay Culberson, BSc. Geol.**, is now with Computing Associates International; he worked for the Duval Corp. before accepting this position. Amoco Production Company recently announced that **David J. Cesario, BSc. CPR**, had joined its engineering staff in Oklahoma City. Another new Amoco employee is **Dennis A. Pieters, BSc. Geol.**, who will be based in the Casper, Wyoming District office of Amoco.

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## in memoriam



IRVING A. CHAPMAN

Irving A. Chapman E.M. 1913, died recently in Connecticut, where he had made his home for many years. He was 90 at the time of his death.

Born in Brooklyn, New York, Chapman also attended schools there, until coming West to enter CSM in 1909. Following graduation, he entered the U.S. Naval Academy, and served as captain of a submarine during WW I. He was based in Panama for much of this time.

At the close of the war, he joined the Anaconda Company and always recalled with great pleasure his days as an underground mining engineer at Butte, MT.

Chapman returned to the East in the late 1920's, and entered the brokerage business, as an engineer advisor. He again served his country during the second World War, when he advised the firm of Pratt and Whitney on various aspects of high altitude aircraft engine performance.

His wife, the former Lucile Gildersleeve and his son Henry Staunton Chapman, preceded him in death. His son was killed on two Jima in 1945. He is survived by two daughters, Mrs. David T. Guernsey and Mrs. Fletcher D. Richards, Jr.; 10 grandchildren and 2 great-grandchildren. The family has requested that memorials be made in his name to the Colorado School of Mines Foundation.

### NORBERT W. HYLAND

Norbert W. Hyland E.M. 1922, died January 31, 1980, in Denver. Hyland had retired and been living in Denver for several years preceding his death.

A native of Colorado, Hyland was born in Denver, and attended school in that city, graduating from North High in 1919. Following his graduation from Mines, he moved to Kansas, entering the construction industry.

During his years at Mines, Hyland was a football player, and a member of Sigma Alpha Epsilon. He served as a lieutenant colonel during WW II, in the U.S. Army Engineers.

He is survived by his wife, the former Marie M. Davidson, and several nieces and nephews.

### FREDERICK F. FRICK

Frederick F. Frick Met. E. 1908, died February 29, 1980 in Torrance, California, after a brief illness. Mr. Frick was born in

1882 in Illinois, and reared in Indiana. He entered Mines in 1904.

Frick's first job after leaving Mines was with the Anaconda Company, and he ultimately became one of the firm's outstanding metallurgists. He pioneered several techniques and developments and was known as an authority on the leaching of copper ores. Other developments with which he was associated were electrolytic zinc production, coal dust firing, ferro manganese recovery, sponge iron and uranium processing.

In 1949, Mr. Frick was the recipient of the Colorado School of Mines Medalist award, in recognition of his many contributions to the industry. While at Mines, he was elected a member of Tau Beta Phi and joined Delta Tau Delta.

Seven of his forty years with Anaconda were spent in Chile, where he supervised the opening of the large copper producing mill at Chuquicamata.

Mr. Frick is survived by his daughter, Mrs. Clyde Longworth of Almanor, CA, a niece, Betty Ross, two grandchildren, Larry and Linda and other nieces and nephews.

### GEORGE D. VOLK

George D. Volk P.E. 1935, died February 20, 1980 of a heart attack at his home in Denver. Mr. Volk was 70 at the time of his death.

An athletic star while at Mines, Volk was particularly well-known for his prowess in football, boxing and wrestling.

Following graduation, Volk worked for the Brown-Willard Oil Co., then entered the U.S. Army Corps of Engineers at the outset of WW II. He served in both the European and Asiatic Theaters and was discharged with the rank of captain.

He was associated with his late brother, Russell Volk, in the Plains Exploration Company, later merged as part of the Cardinal Exploration in Denver. He had been an independent petroleum consultant for many years.

He is survived by his wife, Dr. Hannah M. Wormington, a noted anthropologist and author.

Contributions in his memory may be made to the CSM Scholarship Fund, in care of the CSM Alumni Association.

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DONALD MORRISON DAVIS

Donald Morrison Davis Geol. E. 1925, died on January 5, 1980 in Eastland, Texas. Mr. Davis retired in 1967 from his position

as vice-president of exploration for the Union Oil Co. Except for three and one half years spent in the executive office of the Pure Oil Co. at Chicago, he had always worked in Houston.

A native of Washington D.C., he attended Central High School before entering Mines in 1921. He married Lillian Harvey in 1926 and moved to Houston as a geologist for Pure Oil. He was particularly adept in geophysics and applied these talents to exploration geology, which resulted in many oil and gas discoveries for his firm.

He was a member of Sigma Gamma Epsilon and Mu Epsilon Tau fraternities and a number of professional societies, including A.A.P.G. His wife Lillian; daughter Mrs. H. J.

# Expertise in geological and mining engineering

- Geological investigations
- Planning and supervision of exploration
- Planning and supervision of programs to obtain pilot plant ore
- In-house computer programs for ore reserve determination
- Geostatistical evaluation
- Area surveys and reconnaissance of mineral potential and resources
- Rock mechanics and slope stability
- Property examination and evaluation
- Open-pit mine design with in-house computer programs
- Shaft and underground mine design
- Open-pit and underground equipment selection with computer optimization
- Design, procurement, and construction management of open-pit and underground facilities

- James V. Thompson.....'40
- David L. Watson.....'60
- Richard J. Pitney.....'60
- Douglas G. McIntosh.....'66
- Larry G. Hayes.....'52
- Curtis J. Templain.....'53
- John J. Chulick.....'68

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Bulgerin; five grandchildren; one great-grandchild; two brothers, L. R. Davis of McLean, VA; and Dr. S. B. Davis of Greenwich, KY, survive him.

Editor's Note: Many thanks to M. C. Kiess '25, who sent us the information. He was Mr. Davis's college roommate, lifelong friend and colleague.



MARK U. WATROUS

Mark Ulysses Watrous E.M. 1914 and Medalist 1954 died in Denver January 28. He was 88 at the time of his death, which followed several weeks of hospitalization for pneumonia.

Watrous, retired from the State of Colorado Highway Department in 1963, after having been one of the most productive and controversial chief engineers of the department's history. He became chief highway engineer in 1946, and thereafter pushed constantly for more funds to upgrade the state's highway system. He is widely credited with the conception and construction of both Interstate Highway 25 and the Denver-Boulder turnpike.

A native of New York, Watrous moved with his family to Monte Vista, Colorado as a small child. The family lived briefly in Alaska, also, but returned to Colorado just after the turn of the century.

After graduation from CSM, Watrous worked as a mining engineer in various Western states, then served during WWI in a special Army mapping and surveying detachment.

Following his service, he returned to Monte Vista and operated his own engineering firm for a time, until entering the employ of the U.S. Forest Service for four years. He then became a construction engineer, until his appointment by Gov. John Vivian in 1946.

While instituting many reforms in specification writing, funding, and control of the department, Watrous often found himself under fire. He was uncompromising in his beliefs, however, and usually implemented his project despite opposition.

He became a Medalist of Colorado School of Mines in 1954, in recognition of his service to the State and to his profession.

His first wife died many years ago, and he married Dorothy M. Bowen in 1961. In addition to his widow, he is survived by a daughter, Carol Wood, four grandchildren and five great-grandchildren.

—mm—

## Recap of Colorado School of Mines Alumni Assn. Board of Director's Meetings February & March 1980

Membership is slightly ahead of last year with 2256 members, 210 junior members and 197 life members. The membership committee is co-chaired by Stew Squires '74 and Gary Nydegger '74. The financial statement for the first five months of operations shows the expenditures to be on budget target for the year.

Marshall Crouch, Alumni Assoc. President, made the following committee appointments for the year:

1. Budget & Finance—Dick Daniele, chairman.
2. Membership—Stew Squires and Gary Nydegger, co-chairmen.
3. Nominating—Three immediate past presidents.
4. Teller—Walt Dumke, chairman.
5. Long Range Planning—Dick Angerer, chairman
6. Foundation & Fund Raising—Tom Smagala, chairman
7. Continuing Education—Bob Reeder, chairman.
8. Honorary Membership—Dave Cole, chairman.
9. Local Section—John Lindemann, chairman
10. Loan & Scholarship—John Wright, chairman

Ad Hoc Committees:

- Alumni House—Bob Brace, chairman
- Special Survey—Gary Nydegger, chairman
- Foundation Board—Jim Link, chairman
- Tax Status—Marshall Crouch, chairman

It is intended that committees will take an increasing role in the operational direction of the Alumni Association. Two important committees will be the Long Range Planning, which will help formulate long term goals and objectives for the Association. The Local Section Committee is currently preparing a report on the current status of local sections and how the Alumni Association can provide greater support to currently active sections and also to reestablish dormant sections.

It is of utmost importance that the officers and the board of directors of the Alumni Association receive input from the membership. This will allow the Association to provide services required by the membership and truly represent the graduates of the Colorado School of Mines.

Robert Reeder  
Secretary

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MARK U. WATROUS

Mark Ulysses Watrous E.M. 1914 and Medalist 1954 died in Denver January 28. He was 88 at the time of his death, which followed several weeks of hospitalization for pneumonia.

Watrous, retired from the State of Colorado Highway Department in 1963, after having been one of the most productive and controversial chief engineers of the department's history. He became chief highway engineer in 1946, and thereafter pushed constantly for more funds to upgrade the state's highway system. He is widely credited with the conception and construction of both Interstate Highway 25 and the Denver-Boulder turnpike.

A native of New York, Watrous moved with his family to Monte Vista, Colorado as a small child. The family lived briefly in Alaska, also, but returned to Colorado just after the turn of the century.

After graduation from CSM, Watrous worked as a mining engineer in various Western states, then served during WWI in a special Army mapping and surveying detachment.

Following his service, he returned to Monte Vista and operated his own engineering firm for a time, until entering the employ of the U.S. Forest Service for four years. He then became a construction engineer, until his appointment by Gov. John Vivian in 1946.

While instituting many reforms in specification writing, funding, and control of the department, Watrous often found himself under fire. He was uncompromising in his beliefs, however, and usually implemented his project despite opposition.

He became a Medalist of Colorado School of Mines in 1954, in recognition of his service to the State and to his profession.

His first wife died many years ago, and he married Dorothy M. Bowen in 1961. In addition to his widow, he is survived by a daughter, Carol Wood, four grandchildren and five great-grandchildren.

—mm—

## Recap of Colorado School of Mines Alumni Assn. Board of Director's Meetings February & March 1980

Membership is slightly ahead of last year with 2256 members, 210 junior members and 197 life members. The membership committee is co-chaired by Stew Squires '74 and Gary Nydegger '74. The financial statement for the first five months of operations shows the expenditures to be on budget target for the year.

Marshall Crouch, Alumni Assoc. President, made the following committee appointments for the year:

1. Budget & Finance—Dick Daniele, chairman.
2. Membership—Stew Squires and Gary Nydegger, co-chairmen.
3. Nominating—Three immediate past presidents.
4. Teller—Walt Dumke, chairman.
5. Long Range Planning—Dick Angerer, chairman
6. Foundation & Fund Raising—Tom Smagala, chairman
7. Continuing Education—Bob Reeder, chairman.
8. Honorary Membership—Dave Cole, chairman.
9. Local Section—John Lindemann, chairman
10. Loan & Scholarship—John Wright, chairman

Ad Hoc Committees:

- Alumni House—Bob Brace, chairman
- Special Survey—Gary Nydegger, chairman
- Foundation Board—Jim Link, chairman
- Tax Status—Marshall Crouch, chairman

It is intended that committees will take an increasing role in the operational direction of the Alumni Association. Two important committees will be the Long Range Planning, which will help formulate long term goals and objectives for the Association. The Local Section Committee is currently preparing a report on the current status of local sections and how the Alumni Association can provide greater support to currently active sections and also to reestablish dormant sections.

It is of utmost importance that the officers and the board of directors of the Alumni Association receive input from the membership. This will allow the Association to provide services required by the membership and truly represent the graduates of the Colorado School of Mines.

Robert Reeder  
Secretary

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# CSM and AIME

The 109th AIME Annual Meeting, held in Las Vegas, Nevada, February 24-28, featured programs of the Society of Mining Engineers of AIME, the Metallurgical Society of AIME and the Iron and Steel Society of AIME. Within these broad frameworks were programs by the Society of Economic Geologists, Council of Economics and the Women's Auxiliary to the AIME.

Since its inception in 1871, the American Institute of Mining, Metallurgy and Petroleum Engineers has been recognized as a prestigious voice in the industries represented by its members. AIME has traditionally been involved in the education of member groups and individuals, and always recognized this responsibility in this activities.

The Colorado School of Mines, which has had many of its graduates participate in AIME high offices and educational activities, was particularly well represented in both arrangements and awards for service to the industry at this most recent meeting.

**Jan D. Miller, MSc. Met. E. '66 and PhD. Met. '69**, was a member of the arrangements committee. **Burt C. Mariacher, E.M. '41**, was an out-going vice president of AIME and participated in these also.

A number of Mines alumni received medals for distinguished service and achievement in the minerals industry.

**Joe B. Rosenbaum, Met. E. '34**

**Robert C. Earlougher, P.E. '36**

**Donald O. Rausch, E.M. '54, PhD. '59**

**Alfred G. Hoyl, E.M. '40, Geol. E. '40**

**Roshan B. Bhappu, Met. E. '50,**

**MSc. Met. E. '50, PhD. Met. E. '53**

**Truman H. Kuhn, Hon. Mem. '69**

**James A. Lawver, Met. E. '43, DSc. Met. '56**

**Mark Strever, undergraduate**

**Douglas Medal**

**Lucas Medal**

**President's Citation**

**GEM Award**

**Distinguished Member-SME  
AIME**

**Distinguished Member-SME  
AIME**

**Richards Award**

**SME-AIME Student Paper Prize**

In addition to the several awards received, CSM alumni presented a number of papers during technical sessions, or served as chairmen of sessions.

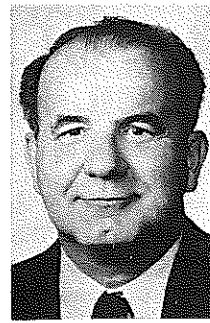
**Gerald V. Jergensen, Chem. E. '65**, was co-chairman of "Mill Design/Crushing and Grinding." **Martin C. Kuhn, Met. E. '63, MSc. Met. '67 and PhD. Met. '69**, co-chaired "Hydrometallurgical Processes for By-Product Recovery." **David J. Spottiswood, PhD. Met. '70**, was co-chairman of the Fundamentals/General Session, held on February 26.

Other session chairmen were **John D. Mac Fayden, Met. E. Geol. E. '62**, who assisted in the "Materials Handling and Process Developments" session and **Arden L. Bement, Met. E. '54**, who was session chairman for "Ion Implantation/Ion Plating of Materials II."

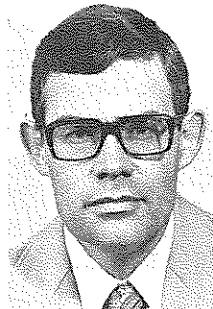
**Carl E. Cross, BSc. Met. '75**, and graduate student at CSM and **David L. Olson**, Dept. of Met. Engineering, CSM, co-authored a paper, "Modification of Eutectic Fusion Zone Microstructure." **Richard Addison, MSc. Met. E. '68**, presented "Rosario Dominicana's Cyanide Tailing Dam Construction and Operation." **K. S. Delfeyes, Geol. E. '53**, was the presenter and author of "Uranium Distribution in Mineral Deposits and in the Earth's Crust."

**L. G. Closs**, CSM Geology Department professor, participated in a paper for the Geochemistry section, "Overburden Exploration Geochemistry Investigations of the Prairie Lake Carbonatite, Northwest Ontario, Canada."

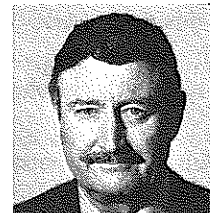
—mm—



Rausch



Addison



Hoyl



Bement



Earlougher



Kuhn

## letters

Hon. Gary Hart  
Washington, D.C.

Dear Sir:

I have been very concerned for quite some time on the public belief as to the excess profits being accumulated by the American oil companies. I am a stock holder of several companies and can assure you neither my dividends or the companies' assets have been as good as several other stocks in other industries.

I believe the most accurate and nonbiased picture of the oil company profits has been presented in the MINES Magazine for March 1980. I provide you my copy and refer you to page 5.

Our major hope for energy relief is with the freedom of their actions.

V. A. Vaseen, P.E.

Dear George:

Referring to your comments preceding the article titled "Beyond Stridency" by Patricia Petty, I tend to agree with the views of Ms. Petty also. By contrast, the letter by Dr. McBride to Senator Hart is, in my opinion, an excellent example of the type of material that is a disservice to the entire mineral industry. Generalized comments such as:

"...our current difficulties...are almost entirely the fault of federal regulation..."

"...the current energy muddle is an unfortunate example of the fact that when government intervenes in the free market..."

serve no real purpose. What law or regulation does Dr. McBride have in mind? Perhaps he refers to the Interstate Highway program that

encouraged the use of the automobile and truck over other means of transportation? Or, perhaps he refers to the land grants made to the railroads in the late 1800's that turned over mineral rights on millions of acres to so-called private industry? Or maybe he refers to the tract sizes in offshore lease sales that favor the major oil companies? Or state unitizing laws? Or proration? Or the depletion allowance?

The first major oil shortage in this country occurred in 1973; what law or regulation caused this shortage? Was there some law that forbade drilling or exploration or refinery building? Or was the shortage more related to the importing of cheap foreign crude that began in the 1950's, and the ultimate dependence of the public on these imports? Dr. McBride objects to government intervention in the free-market. Just read the news:

"...the legislation is a two-phase synthetic fuels program...\$20 billion to provide financial aid to develop..."

"...approved...\$1.5 billion loan guarantee plan to aid...Chrysler..."

"...approved by voice vote a bill to raise the 1979 target price for wheat and corn by 7 percent. The wheat target...\$3.63 a bushel and the corn to \$2.35..."

"...will seek Senate approval...to put at least 12 percent of the nation's energy research and development funds into small businesses...Billions of dollars may be spent...The concept has been endorsed by the National Federation of Independent Business..."

All of the above items were taken from the Rocky Mountain News. Do these items indicate a free-market where supply and demand rule? What about AMTRAK and CONRAIL? Did our current electronics technology come about because Mines' students were tired of using K&E slide-rules?

There is no need to continue to point up the role of government in our everyday lives nor in the commerce and industry of the

nation. Almost invariably industry has looked to government for support. The aircraft, airline, agriculture, communications, and the petroleum industries, to name just a few, have sought government largesse, in times of low demand; but when demand exceeds supply we hear the cry of stop government regulation. It's always stop regulation that might restrict profit but keep the regulation that prevents loss.

Bear in mind that I am in no way anti-industry; I am only pointing out the way things are. The government has also done a poor job in handling the national economy. It should be working closely with industry, with labor, and with the academic community to set direction for the progress of this nation, instead we see only the imposition or the lowering of the raising of a tax; the raising or the lowering of the interest rates or the money supply; or the imposition or withdrawal of controls as the economic tools of government.

If we each sit in our own little cubbyhole and blame the farmers or industry or the environmentalists or government or some other bogey-man for our ills, we accomplish nothing. Instead of Dr. McBride criticizing in generalities, why doesn't he invite Senator Hart to meet with industry leaders to define the problems we face concerning petroleum; it's entirely possible they might arrive at some intelligent conclusion.

Very truly yours,

Robert F. McMahan

Dear Bob,

Despite my obvious biases in being a Mines grad and in being a Stanford Business School alum, "that bastion of capitalism and free enterprise", I share your view to a large extent. I don't doubt that a portion of our problems result from government regulation, though I think you'll find that most regulation has been at the request of business, essen-

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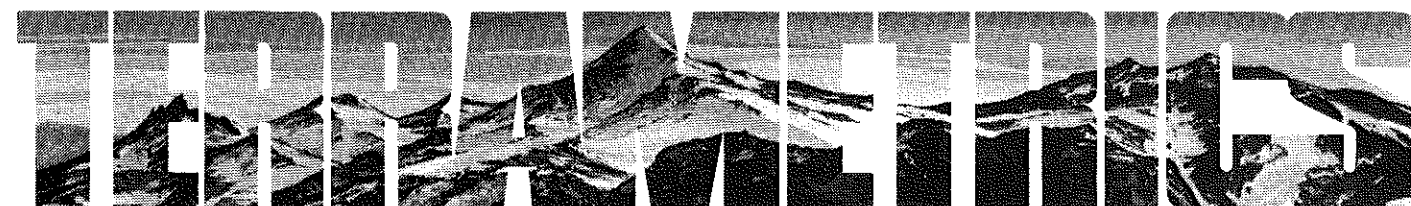
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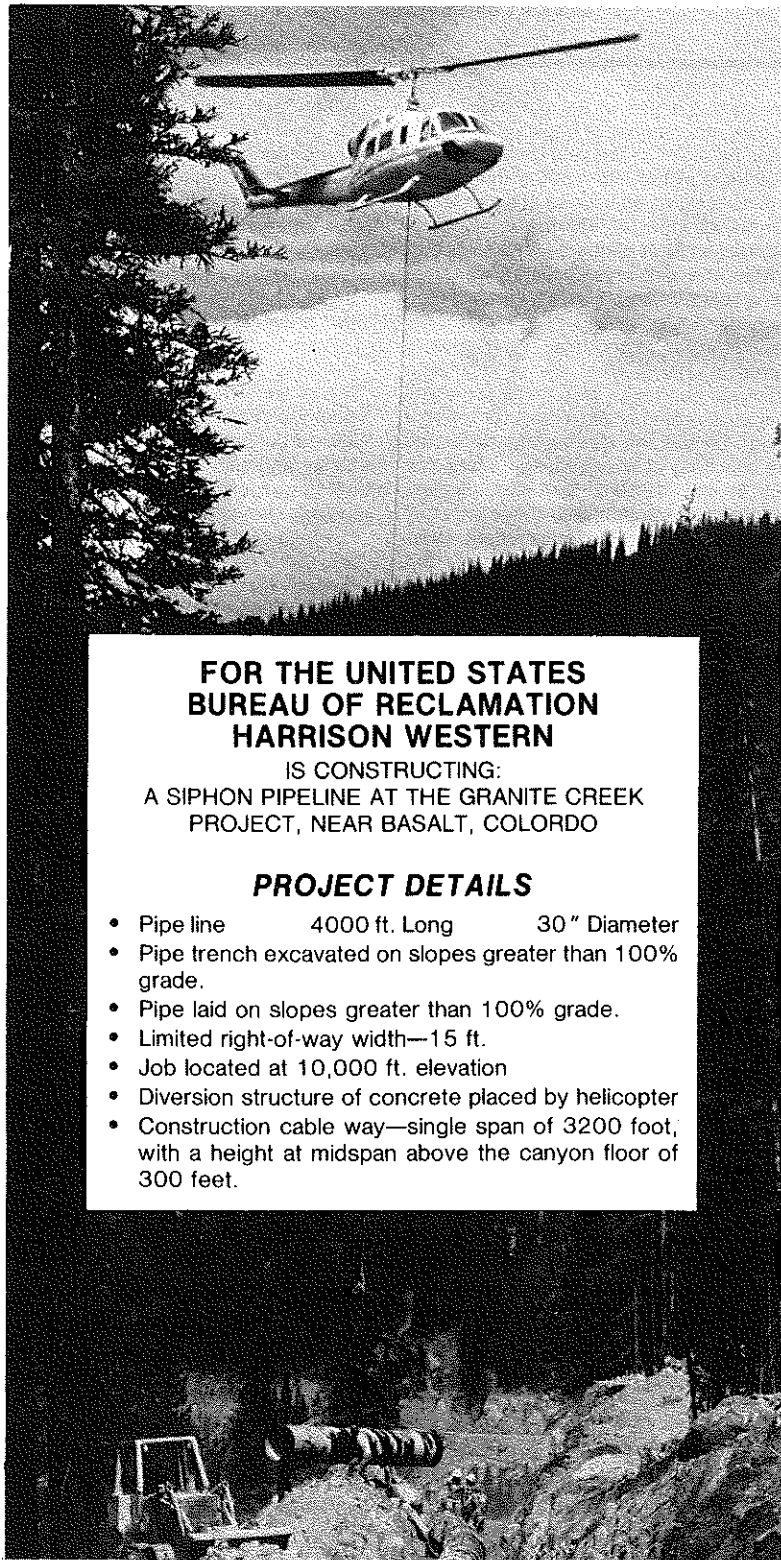
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tially as a competition control mechanism. Having been a businessman for over 20 years in a variety of businesses I don't think I can be accused of being anti-business or a flaming liberal. So I do agree with you that you point out things much the way they are. Since it doesn't seem to me that it is possible at this date to go back to laissez-faire capitalism, it seems we must find accommodation between business and government that maximizes both efficiency and freedom. Perhaps the Japanese model is a reasonable one to look at.

With very best regards,  
George

Dear George:

Thank you for your January letter regarding the country's economic condition; I quite well agree that we shall probably never return to the laissez-faire capitalism of the late 19th century.

You people have been doing an excellent job on the Mines magazine; I particularly enjoyed the January issue which arrived earlier this month. The articles by Kessler on rail shipment of coal and by Case on energy used in transportation were both thought-provoking. Pat Petty's comments were also of interest, particularly with regard to the past reactions of the American people to crises; I doubt however that the energy industry can by itself solve all of today's problems.

Enough of the soap box; but please keep up the good work.

Very truly yours,  
Robert F. McMahon '52

Dear Miss Editor:

I have just been reading the February issue of Mines Magazine regarding the production of fuel from oil shales and I can find nothing about Dr. Armand Hammer and the work of Occidental Petroleum Corporation.

You can learn a lot if you will get yourself a copy of Oxy's pamphlet on the production of oil from shales in large quantities. This enlightening treatise just came in the mail this week. It will be well to give credit to this great man Armand Hammer for his wonderful work.

Sincerely,

Chet Neiswender '12  
28890 Snead Drive  
Sun City, CA 92381

—mm—

**OPEN HOUSE**

Colorado School of Mines  
Geology Museum  
May 9, 1980  
3:00 p.m. to 6:00 p.m.

**book review**

**Tundra Examination**  
by Beatrice E. Willard

A new publication by Colorado School of Mines' Quarterly, "Plant Sociology of Alpine Tundra, Trail Ridge, Rocky Mountain National Park, Colorado". A valuable tool for both the applied ecologist (in search of the elusive baseline) as well as the student of vegetation.

The work is by Beatrice E. Willard, Professor of Environmental Sciences at the Colorado School of Mines. Willard employed a study technique developed by the Zurich-Montpellier School of geobotanical phytosociology. Requiring detailed knowledge of flora and infinite patience, the technique can describe, in depth, the plant associations of a region.

With mining development in the high country of the Rockies, ecologists are concerned with the impact on the fragile, yet tough tundra, where plants endure Arctic conditions, but take decades to recover from the effects of a careless footstep.

Under the current law, mining developments cannot begin without preparing an environmental impact study, which establishes a baseline of information on the surrounding area. The need for this information is obvious—you can't restore a disturbed area back to its original state, if you don't know what that state was!

Willard's treatment of Trail Ridge is intricate, complex and definitive. It may very well be the environmental impact statement of the future.

—Brodie Farquhar

**Forgotten Fundamentals  
of the Energy Crisis**

by Albert A. Bartlett

*Mineral and Energy Resources, Colorado School of Mines Publications Department, Golden, Colorado, Vol. 22, No. 5 & 6; Vol. 23, No. 1*

Energy crisis.

You read, hear or talk about it every day, yet you'd never suspect that your perception of it is fundamentally distorted.

Never, unless you had read "Forgotten Fundamentals of Energy Crisis" by Albert A. Bartlett, professor of physics of Colorado University and recently published by "Mineral and Energy Resources", a bi-monthly publication of the Colorado School of Mines.

Bartlett seems to be coming from a highly pragmatic viewpoint, based on the elementary arithmetic of growth. Step by step, using math that any high school graduate (or, maybe college graduate) could follow, Bartlett introduces the reader to the alarming world of exponential growth.

Exponential growth is characterized by doubling in a fixed period of time and that a few doublings can quickly lead to enormous numbers.

Exponential growth may seem like a

mathematical gimmick, but it has applications in a real and finite world. Using this simple tool, Bartlett destroys the optimistic talk of energy experts who claim that the United States alone has oil, gas or coal to last for decades or even centuries, if the government would just get off the backs of the energy industry.

Predictions of 100, 200 or even 1,000 year fossil fuel supplies don't stand up to exponential growth, according to Bartlett's calculations. Those estimates are valid only if the U.S. economy switches from a state of steady growth, to no growth at all—a freeze of current consumption patterns!

That's anathema to every Chamber of Commerce, industrialist and businessman in the country! Bartlett goes on to document how energy experts, the national media, politicians and even Ralph Nader all ignore the impact of exponential growth on finite resources, with a section titled "A Compendium of Horror Stories."

For example, he notes that the rate of world oil consumption has grown steadily at 7.04 percent per year for the past century. How much longer could this steady growth continue if our oil supply was a spherical tank the size of the earth? The grim answer is 32 years.

Bartlett does relieve the numbing pessimism of exponential growth with some practical suggestions and even a few rays of hope... from the sun.

It should be required reading for energy spokesmen, reporters, politicians, indeed, anyone who contributes to the consumption of our finite fuels.

—Brodie Farquhar

—mm—

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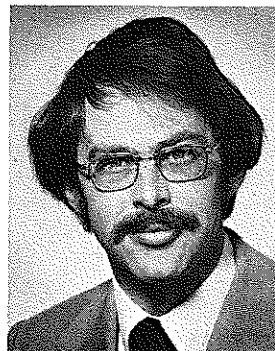
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## Farquhar Appointment



Colorado School of Mines President Guy T. McBride, Jr., has announced the appointment of Brodie Farquhar as public information officer for CSM.

Farquhar is the former managing editor of the *Chaffee County Times*, a weekly newspaper in Buena Vista, Colorado. A graduate of the University of Northern Colorado, Farquhar has been a professional journalist since 1974. Since that time, he has won Colorado Press Association awards for best story, community service, editorial excellence, general excellence, best ad of the year and in layout, typography and design.

In addition to his responsibilities as public information officer, campus photographer and sports information director, Farquhar hopes to serve as a technical resource for CSM student, faculty, alumni and foundation publications. He will also assist the CSM staff in planning, development and public relations responsibilities, said McBride.

Farquhar plans to move his wife Sharon, and eight-month-old son Eric to the Golden area in the near future.

Farquhar replaces Leanne Gibson as the CSM public information officer. Gibson, who held the position since September 1977, resigned her position to enter the CSM mineral economics department as a master's degree candidate.

In addition to her course work, Gibson is a staff member with the CSM Western Energy Field Institute, an effort to bring Congressional energy aides to the West, in order to see energy development firsthand.

## Traveling Scholarship

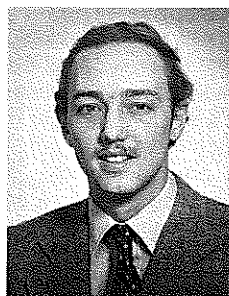
WAAIME, an active service organization in the mining industry, recently sponsored two students from the Colorado School of Mines on week-long trips to two industrial sites. Winners of the annual award, both metallurgists, were Valerie Berry and David Noble.

The purpose of these trips is to acquaint the young engineer with procedures and processes in industry, to supplement the training received in the classroom and laboratory. WAAIME, Women's Auxiliary of the American Institute of Mining, Metallurgical and Petroleum Engineers, has been awarding such trips to students for many years. The program began when a chapter of the group in Peru sent young Peruvian engineering students to the United States to view mine and mill sites in this country. The Denver chapter adopted the idea from hosting a number of these students and has since been responsible for sending people to mines, foundries, pipeline installations, steel mills and other industry-related areas.



Ms. Berry, a physical metallurgist, spent a week in Bethlehem, Pennysl-

vania, observing techniques and processes at the plant and laboratories of the Bethlehem Steel Company. She was able to view several interesting techniques in steel forming and manufacture while there as a guest of the company.



Mr. Noble traveled to White Pine Mine, Michigan, a Copper Range Company. In this remote area of the Upper Peninsula, he watched the special processes involved in extracting and refining copper ore. White Pine is well-known in the roster of interesting copper mines.

WAAIME awards these travel scholarships on the basis of grade point averages, desire to participate and recommendations of the department involved. The award is circulated through three departments; mining, petroleum, and metallurgy. All expenses for the travel are paid by WAAIME, and the participating company houses and entertains the student while on site.

## Last Game for CSM Women

The Colorado School of Mines women's basketball team was knocked out early in the AIAW tournament in Grand Junction. The Orediggers were defeated by Denver University, 74-51.

Mines was only three points behind DU at the half, but ran into some serious foul trouble as the game continued in the second half. With 10 minutes left to the game, the Orediggers lost three of their starters to fouls—Sara Tougaw, Lauri Myers and Sandy Wrobel.

From there, the DU team expanded their seven point lead to 23 points.

The outstanding player for Mines was Mary Meagher, according to Coach

Willa Meylink. Meagher scored a total of 21 points and was the game's leader on rebounding—16 of them. Robinn Yale and Tougaw both scored seven points, while Wrobel and Myers contributed six each. Michelle Bell hit for four points.

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## E-Day Scholarships

Three Colorado high school seniors were recipients of Engineer Day Scholarships from the Colorado School of Mines. The four-year tuition scholarships were presented to the three students by Colorado Governor Richard Lamm April 11, at Guggenheim Hall on the Mines campus.

The three are Susan Kane of Littleton Senior High, Michael Gorder of Highland Senior High School in Thornton and Randall Mackie of Wasson High School in Colorado Springs.

Every Colorado high school is invited to have its outstanding seniors take a special test, administered by the Engineer of E-Day Scholarship Committee. A total of 384 students took the test this year. The test designed by the respective departments of Colorado School of Mines, is composed of required English and Math segments, then the best score achieved in Chemistry or Physics. Three scores are added up and the top three scorers are invited to attend Mines.

Susan Kane, a senior at Littleton Senior High School, will be following her father's footsteps into the Colorado School of Mines, thanks to the Engineer Day Scholarship.

A. V. Kane, of 5760 Oak Creek Lane, Littleton, is a petroleum engineer graduate of Mines in 1955. His daughter Susan is one of three high school seniors who were awarded the tuition scholarship.

Susan should be well prepared for a career in energy development. She has lived in Venezuela, Australia and Texas. A National Merit Finalist at Littleton High, Kane has also attended the 1979 Air



Susan Kane, a senior at Littleton Senior High School receives her Engineer Day Scholarship from Colorado Governor Richard Lamm.

Force Academy Summer Scientific Seminar and the American Legion Girls State.

Gorder is a senior at Highland High School. A talented musician who plays both the euphonium and trombone, Gorder is also a member of the National Honor Society, Future Business Leaders of America and the Boy Scouts.

Mackie currently aims toward a career in geophysical engineering. He is the son of James and Ruth Mackie, a CSPD detective and a judicial clerk. Randall Mackie is a member of the National Honor Society and has a 4.25 grade point average at Wasson.



From left to right are CSM President Guy T. McBride, Jr.; Randall Mackie of Wasson High School; Michael Gorder of Highland High School; Susan Kane of Littleton High School; and Colorado Governor Richard Lamm.

## Basketball Honors

According to the NCAA Division II Statistics Service, Colorado School of Mines ranks seventh in the nation in field goal percentages. The Oredigger netters made 790 field goals out of 1470 attempts for a percentage of 53.7. The best percentage in the nation was Pembroke State in North Carolina, with 55 percent.

Jeff Rhodes was fifteenth in the NCAA in the rebound statistics. Rhodes, a 6'6" sophomore center from Pueblo Central, made 319 rebounds in the season for an average of 11.8 per game. The best average in the nation was by Ricky Mahorn of the Hampton Institute, with an average of 15.8 per game. Rhodes was last year's MVP in the Oredigger team. This year, he was selected to the Second Team of the All-RMAC as well as the First Team NAIA District 7.

Bert Fleck was named the Oredigger MVP this season. The 6'4" sophomore forward from Thornton High School was also 46th in the NCAA Division II scoring statistics. Fleck averaged 19.4 points per game, with 234 field goals and 57 free throws for a total of 525 points. No one else from RMAC or NAIA District 7 was ranked in the top 50. Fleck was chosen All-RMAC Honorable Mention.

The third honored Oredigger was sophomore guard Tim Hermann, a 6'5" Thornton High teammate of Fleck. Hermann also made the All-RMAC Honorable Mention squad. He had 18.8 points per game and led the conference in the percentage of free throws at 76 percent.

Coach Jim Darden, in his 26th year at Mines, was also honored as coach of the year in the NAIA District 7.

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## Mineral Bowl

The Montana School of Mines and Technology Hard Rockers outclassed the field to claim the 1980 Mineral Bowl title in the second-annual intercollegiate mining competition.

Colorado School of Mines Orediggers scored 18 points to place fourth in the competition behind Montana School of Mines, Arizona University and Missouri Mines. Others in the competition were South Dakota Tech, Idaho University, New Mexico Tech, Nevada University, Utah University and Wisconsin University.

The teams were timed and measured in the classic mining competition events of single-jacking with hammer and hand steel, 3-man hand mucking, individual feed leg drilling, and 5-man track standing.

The ten schools competed in this second annual Mineral Bowl at the University of Arizona's San Xavier Mining

Lab south of Tucson, on Saturday, March 23rd. The Arizona Wildcatters were the host team by virtue of their 1979 win at the University of Idaho in Moscow. An enthusiastic crowd of spectators, friends, and mining industry sponsors cheered each contestant and each event.

A traveling trophy was presented to the winning Montana Tech team who have now been designated as the host for the 1981 competition. The distinguished "Carbide Lamp Award" from Gardner-Denver Company was given to the winning team and winning participants in each event.

Commercial sponsors for regional mining areas provided personnel, equipment, and funds.

The Orediggers who represented Mines at the Mineral Bowl were Rick Siminon, Scott Neunuebel, Herbert Gibson, Pete Borer, and Mark Ludwig.



Perspiring under the hot Arizona sun, this team of muckers is making both muck and dust fly in the annual Mineral Bowl competition.

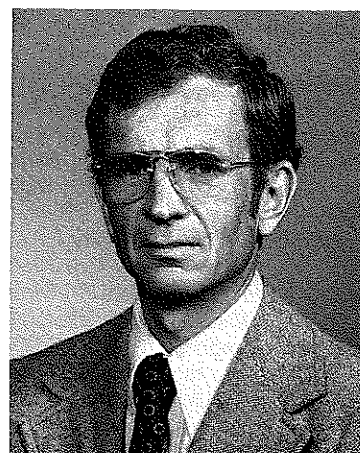
## Mines Netters Dumped by Pioneers

The Colorado School of Mines tennis team lost their first match of the season April 9, dropping a 9-0 decision to the University of Denver. The Orediggers were forced to play the match without their number one singles player, Brian Housman.

Mines could have averted the shutout, but they failed to win two tiebreakers and other close sets.

Both the Orediggers and the Pioneers from Denver will be represented at the NAIA tournament. The tourney will be held in Pueblo in early May.

## Phillips at E-Day



Patrick E. Phillips

Patrick E. Phillips Met.E. 1961 was tapped to give the feature address for the E-Day celebration at CSM this year. Continuing with the emphasis of the past two years, Phillips emphasized today's graduate and the role of graduates in the mining and energy industries.

Remarking on the fact that 260 men and women will graduate from Mines in just a few days, Phillips talked about the requirements for these students in the developing world of public interaction with the mining industry, the constraints and restrictions of legislatively imposed regulations, and the need to constantly upgrade the basic knowledge acquired at Mines.

Citing his own experiences as overseer of the research and development aspects of uranium, coal and other minerals of interest at Rocky Mountain Energy, where he has been employed since 1974, he urged the students to broaden their areas of interest and be aware of the necessity of assuming a public responsibility role.

Prior to joining RMEC, Phillips worked for the Oil Shale Corporation in Denver. He holds, in addition to his Mines degree, a masters of business administration degree in finance, acquired from the University of Colorado in 1972.

An active member of the CSM Alumni Association, he is also program chairman for the Colorado Section of the AIME.

—mm—



## All-Tourney Player

Colorado School of Mines Mary Meagher was named to the AIAW All-Tournament team. The Oredigger freshman center was one of six women athletes honored so by the coaches and sports writers of the AIAW's Region 7, Division II.

Meagher, a standout player from Jefferson County, played only one game in the regional playoffs, where Denver University handed Mines a 74-51 defeat. Yet Meagher was the second top scorer in that game, after DU's Linda Raunig—named Most Valuable Player in the playoffs.

Along with Meagher, the all-tourney team includes Michelle Johnson of the Air Force Academy; Lorna Kollmyer and Arlene Green of Colorado College; Debbie Gilbert of Adams State; and Raunig as the MVP.

"Mary did a fantastic job of playing against taller centers and holding her own, particularly in rebounding. She's only a freshman, so you'll be hearing more about her in the years to come," said Oredigger Coach Willa Meylink.

—mm—

## Sports Update

In lacrosse, Colorado College whipped the Orediggers 10-1.

In track and field, the University of Southern Colorado edged out a win over the Miners, at Mines Invitational, 91 to 87.5. Western State followed at 62.5, while Colorado College garnered 21 and Metro State collected 9 points. The only record set was by USC's Turner, who set a mark of 6'11" in the high jump.

—mm—

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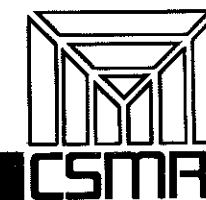
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## Mines Coach Honored



**Coach of the Year**

Willa Meylink, women's basketball coach at the Colorado School of Mines, was named "Coach of the Year" by her fellow coaches in the Intermountain Association for Intercollegiate Athletics for Women (Region 7, Division II).

Colorado School of Mines women's basketball Coach Willa Meylink was named "Coach of the Year" Monday by

officials of the AIAW, Region 7, Division II. The coaches of the 16 member schools voted her that honor after she produced the Cinderella team of the region—the CSM Orediggers.

The Orediggers were winless, a third of the way into the season, when they started winning, and kept winning, right up to the game for the Rocky Mountain Athletic Conference crown. Although they lost to Mesa College, the Orediggers went on to the AIAW playoffs—a place they never expected to be.

"I think the other coaches were surprised that Mines did so well, and particularly with only eight girls on the team," said Meylink.

This is Meylink's last season at Mines. After three years with the Orediggers, Meylink is leaving to pursue a Master's degree in counseling at the Conservative Baptist Seminary in Denver.

—mm—

## Mines Stickmen Rout Rams

The Colorado School of Mines lacrosse team took its first win when they overwhelmed the stickmen of Colorado State University April 9 at Ft. Collins, 12-3. The Orediggers were led by attackmen Porter Fleming, Andre DeBakker and Roger Cohen in the scoring onslaught.

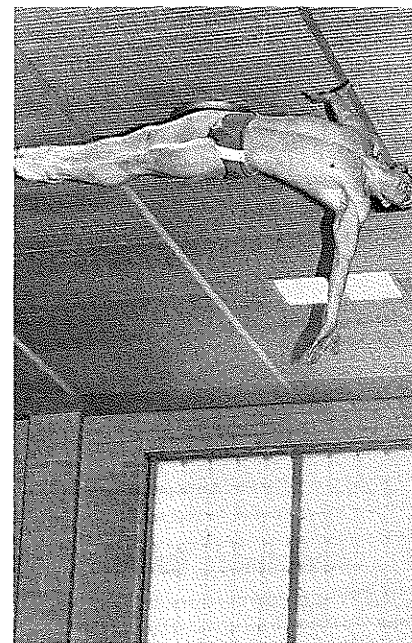
The Miners established a 2-0 lead in the first quarter, built to a 5-0 lead at the half, then slumped in the third stanza when they allowed the Rams to score three goals. However, the Miners answered right back with four of their own, then shut out the Rams in the fourth quarter with three more goals.

Fleming, a sophomore from Katonah, N.Y., scored four goals. DeBakker, a freshman from Altoona, PA and Cohen, a freshman from Englewood, CO, each scored three goals. Alan Tolg, of Calgary and Scott Penfield of Delta each scored one goal. Mike Ribarich, a freshman of East Meadow, N.Y., led in assists for the Orediggers with three to his credit. The Orediggers managed a total of 17 saves against the Rams.

The season record now stands at 1 and 2.

—mm—

## Miner Takes Wing



Rick Williamson, a CSM junior, displays some of the form that took him to the NCAA, Division II Swimming Championships in Youngstown, Ohio. There, he took third honors in the three-meter diving event, with a score of 421.05. A graduate from Northglenn High School, this is Williamson's third year as an NCAA All-American. "Rick has a good chance of winning it all next year," said Oredigger coach Bob McCandless. (Photo by Public Information Office)

## Sports Shorts

There will be a few staff changes for the Colorado School of Mines athletic program next year, according to Athletic Director Bruce Allison. With one exception, all of the changes will be accomplished by some internal personnel shifts of responsibilities.

Most of the changes were prompted by the upcoming retirement of Joe Davies, Mines track and field coach for the past 32 years. Davies will hang up his spikes, whistle and grounds rake at the end of the current season. He will stay on as professor of physical education and cross country coach until the end of the 1980 fall semester.

The changes, as announced by Allison are the following:

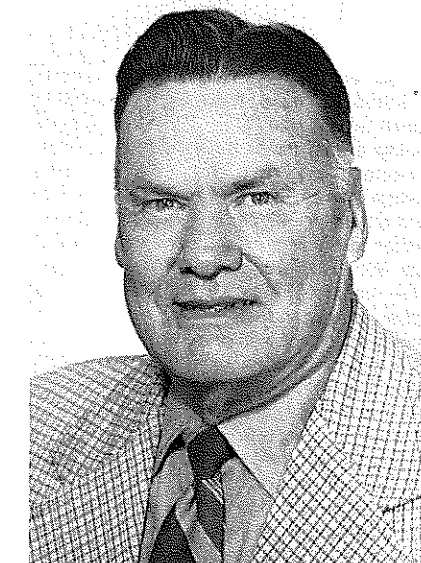
**Dick Stapp**, CSM's defensive football coach, will take over as the track and field coach next January. Stapp was the track coach for Durango High School from 1958 to 1962, before he came to Mines in 1967. Stapp, an associate professor of physical education, also coordinates the activities of the Oredigger Quarterback Club.

**Bob Pearson** will shift from the desk of business manager to the soccer playing field. Previously, the varsity soccer program has had only sponsors, not full-time coaches. Pearson started the Golden Recreation District soccer program in 1961 and was a director of the Metropolitan Soccer Association from 1962 to 1966. He was the Oredigger soccer team sponsor in

1970 and 1971. He will continue as the men's assistant basketball coach and will take on the responsibilities of directing the CSM intramural athletic programs.

**Bob McCandless**, the CSM swimming coach, will replace Davies as director of physical education.

**Marv Kay**, head football coach at Mines, will be the school's assistant



Joe Davies, retiring CSM Coach

athletic director for business affairs.

**Bruce Allison** will add the title of business manager to his position of athletic director.

The position of women's coach has not been filled, according to Allison. He noted that he is still interviewing candidates to replace Willa Meylink, who is leaving to pursue a master's degree in counseling.

—mm—

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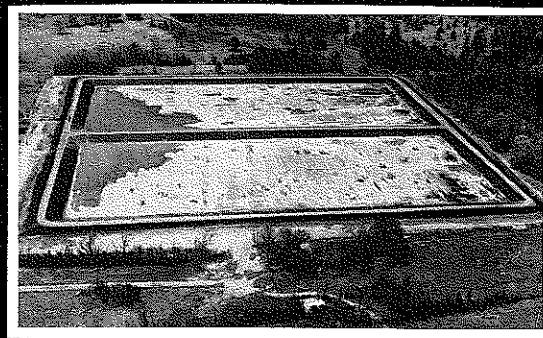
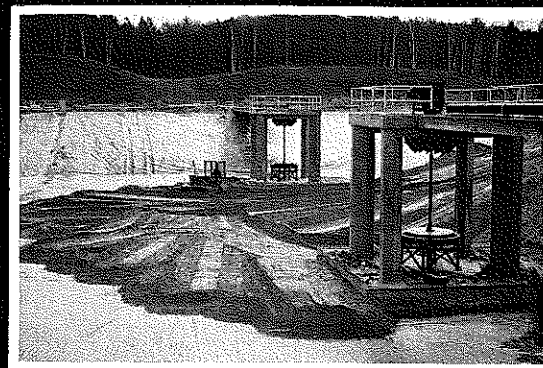
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## CSM Women Writers Honored

Colorado Press Women honored two women from Colorado School of Mines at the 1980 CPW Convention. The two were Patricia Petty, editor of Mines Magazine at CSM, and Leanne Gibson, former CSM public information officer.

Petty was a winner in the 1980 Colorado Press Women communications contest. She took first place for editorials, other publications; and third for publications regularly edited in the other publications category.

Gibson took first place for special articles; second place for magazine interviews; second for public relations, press releases; and third for multi-

picture photos.

As first place finishers, Petty and Gibson's entries now go to the National Federation of Press Women communications contest. Winners will be announced in the spring, according to Colorado Press Women officer Nancy Clark.

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At the recent uranium symposium, held at the School of Mines, there was a lot of discussion about the difficulties involved in opening a new mine; the miles of red tape connected with permits and permissions and hearings and deviations and allowances. We heard about the EPA's unyielding stance on radiation and degradation of the surrounding areas. We also heard some, but not enough, of the very real fear in the uranium and nuclear energy industries today, that soon even these things will become history. The EPA's stance will only be important as it applies to those tailings and areas left behind when the industry closed down. For, given the bleak future of nuclear energy today, the uranium activity, already slowing, is sure to come to a virtual standstill.

Over and over one reads in the mining news that another utility has ended its search for uranium. Current supplies are enough for those plants on line and no new nuclear plants are being ordered. Utilities, responsible to stockholders and investors, are afraid to pursue the nuclear alternative. They are cancelling orders for power units which were to have become operative in the very near future. Where will the industry sell its production, if not to the utility companies? Much of the exploration and development which has taken place in the West in the past few years has been at the instigation of, and financed by, large utility conglomerates or single companies which saw this power source as being ideal for the future. Now that these companies are being forced to re-examine their options, what is in store for the uranium industry?

Both the guests writing in MINES Magazine this month, Mr. Cherry and Mr. Shapiro, insist that the nuclear alternative is a safe one. More voices such as theirs are being heard all across the land... raised in a chorus which is not being heard by the majority of people. The Kemeny Commission stated that the major result of Three Mile Island was nervousness and fear. Fear. What kind of facts can be told which will cope with fear—unreasoning, unknowing, ignorant fear? There is a company in Denver which sells a T-shirt, emblazoned with an atrocious depiction of a supposed victim of nuclear exposure. Its message is clear—who wants to look like this, or see one's children look this way? That's fear, and hysteria, reduced to a common level, and made available for \$4.95 to anyone who wants to wear this gruesome item of apparel. The person wearing it knows what the message is, and supposedly agrees with it—what about those

people who know little or nothing of nuclear energy—and see this message? It's pretty powerful stuff. It can convince—and does.

I've been told that when the public realizes that there is no other way to keep warm, when they realize that the CO<sub>2</sub> effect is a side effect of coal and other fuel use that we cannot afford to live with, why, then, of course, the people will "understand." There will be a miraculous turn to the other direction, in favor of current or advanced reactor technology, and we will have cheap, efficient nuclear power. I'm not a betting type—but I'd lay some nice odds that that is not going to happen. Who among us would like to explain that to a member of the Clamshell Alliance? Just because Ralph Nader can indict all of big business and have a special day set aside to vilify the stockholders and business people of this country—all with impunity, do we really think that we in the energy industry can do the same? I doubt it... unless. By the time the necessary facts can be indeed hammered into the public mind, the legislative mind, it will be virtually too late to change the march of events which has already begun. We have had several voices crying in the wilderness of ignorance and superstition and misinformation long enough now. It would be a great relief if all those voices could get together and shout loudly enough to be heard. Heard in Washington, in state legislatures, in local county planning boards, and most of all, in that segment of the public which really believes that there are a lot of us greedy miners and power developers out there just waiting to kill them off, to deform their unborn babies and to destroy the American dream.

While utilities are pulling back from uranium development, and uranium miners are

worrying about their jobs, Utah International has announced that it is cutting back on its Trapper Mine, near Craig, Colorado. The coal mine, with good reserves, will be phased out because of the heavy tax burden it is forced to carry, according to company spokesmen. Taxes needed to implement programs for people who don't want mining to continue. We used to hear about the short-term options of coal, which would allow us to develop long-term stable energy sources. Are these short-term options also going to disappear, as we contemplate a future devoid of innovation and technological progress—because of fear?

*Patricia Loutis Betty*

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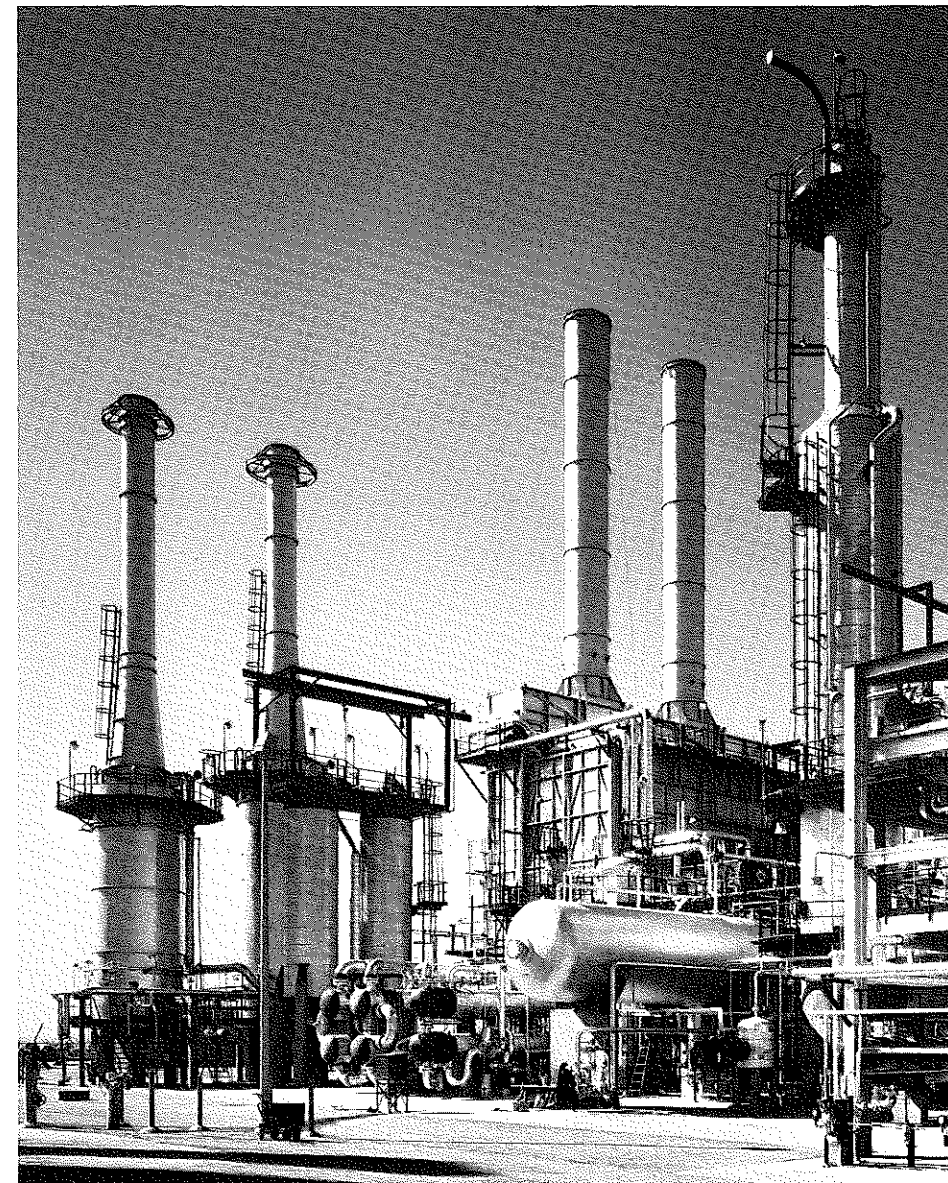
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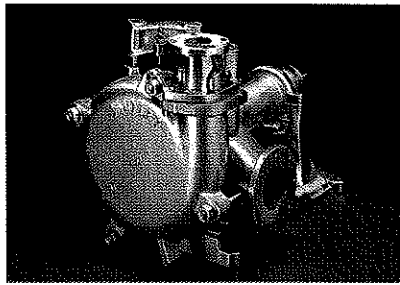
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