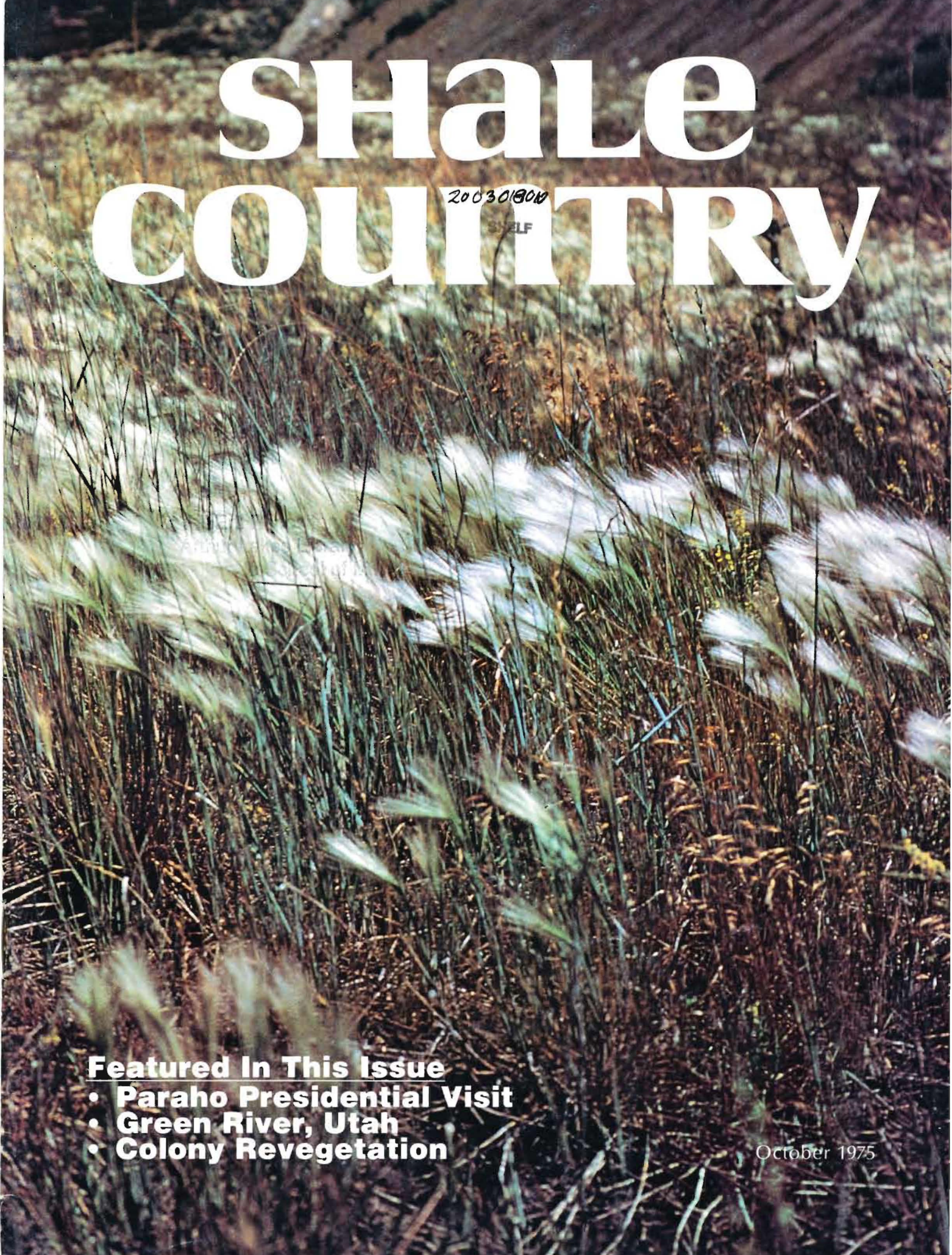
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Featured In This Issue
• Paraho Presidential Visit
• Green River, Utah
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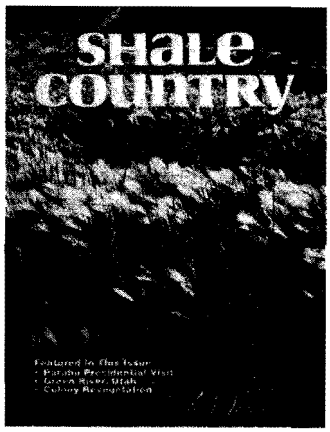

Colony continues its shale revegetation studies.

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SHALE COUNTRY

Volume 1, Number 10 October 1975

Exciting things happen in shale country—both past and present: President Ford visits Paraho (p. 4–6), SHALE COUNTRY visits the Colony revegetation site (p. 12–13), and Green River, Utah (p. 10–11), and goes back into shale country's past (p. 20).

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Guest Editorial

Oil Shale— If Not Now, When?

By Max D. Eliason

Senior Vice President, Skyline Oil Co. and President, Rocky Mountain Oil & Gas Assn.

The time is long past when this nation should have started commercial production of shale oil. Where is the logic in leaving untouched the reserve of more than 600 billion barrels of commercial-grade shale oil, located safely within our borders, when we depend on imports for more than 37 percent of our petroleum supplies?

Never in history has so much preliminary work preceded the inception of any major new industry. Hundreds of millions of dollars have been invested in perfecting oil-shale technologies and in both identifying and solving environmental problems and issues. Yet, not one commercial-scale operation has been launched.

A favorable political and economic climate for oil-shale development is urgently needed now. Those parties willing to prove that oil shale can fill a vital portion of our energy requirements should be given the necessary encouragement to do so. Their task is monumental. The enormous investments required for this capital-intensive industry cannot be made without assurance that prices for the oil produced will not be arbitrarily rolled back to levels below the cost of imported crude oil.

The 1973 oil embargo and its aftermath have provided stark warning that the U.S. is operating on borrowed time, and that this time must be used wisely to tap its vast natural resources, including oil shale. Let us not allow the repetition of a national tragedy such as resulted from the needless delays in building the pipeline from the North Slope of Alaska.

Precious years were wasted in resolving controversies over rights-of-way and environmental disputes, and as a result, the much needed 2 million barrels of oil per day from Alaska is not yet available to the American consumer. Instead, that amount of oil, and more, is being purchased from foreign nations with capital sorely needed at home to provide jobs and an improved standard of living for our own citizens.

Unfortunately, some parties who opposed the construction of the Alaska pipeline seemed to have little concern for human economic and social needs or for our national security. Their opposition was so tenacious that even a special Act of Congress was required before pipeline construction could begin—approximately 5 years behind schedule. That delay resulted in a many-fold increase in the cost of the project, and in a short-fall in domestic supplies of approximately 3.6 billion barrels of oil that could have been produced in the 5-year period.

Like the oil in Alaska, shale oil is of very little value until it is made available for use by mankind. An oil-shale industry in Utah and Colorado could be producing more than 1 million barrels of shale oil per day in the 1980s; this amount is approximately equal to the average daily crude oil production from conventional wells during 1973 in the eight states of Colorado, Montana, Nebraska, New Mexico, North Dakota, South Dakota, Utah and Wyoming.

One million barrels per day of shale oil will replace an equal amount of foreign imports, which, at today's prices of about $13 per barrel, are costing the U.S. $13 million per day, or $4.7 billion per year.

The present yearly outlay of more than $25 billion for petroleum imports poses a dangerous threat to the jobs, standard of living, and basic freedoms of every American. In the final analysis, the American consumer pays the full tab for the foolishness of politicians and for the delays caused by irresponsible opposition to minerals development.

Each citizen should exert his or her influence to help solve the energy shortage. A vital part of this effort should be to encourage rapid production of shale oil. If not now, when?

Looking Ahead

Predicting Social Service Needs for Shale Country

Ever since energy-related growth became a reality in Western Colorado, the specter of the Gillette, Wyo., syndrome has reared its ugly head. That is, a major cause of concern to area residents has been the negative effects of boom growth—especially the negative social effects. One of the difficulties involved is that states such as Alaska and Wyoming, which have already suffered from boom growth, can provide little documentation about the specific social impacts of such growth.

Ron Johnson, director of social services for Colorado's Garfield County, expresses the concern of area residents when he says, "Growth will influence every social service now available, and too, we'll need more auxiliary services. For example, new housing in all four energy-related counties is almost impossible to find—especially low- and middle-income housing. And poor and crowded living conditions lead to a variety of problems in the area of human resources—child abuse, marital problems, delinquency. If something isn't done now, when energy development really gears up we'll be so swamped we'll be left without the ability to respond."

Johnson says Garfield County is in a period of growth right now. "Our estimated population is between 17,500 and 18,500," he explains. "The 1970 census showed a population of 15,000, so percentage-wise, that's quite a jump for us. We need expanded staff and more funds. We're lucky if we can maintain the service levels of 2 or 3 years ago."

Still another problem according to Johnson is where the money will come from—if it comes at all. This year the Colorado state legislature cut administrative costs for social services. Johnson says, "As far as money goes, if the state refuses to meet its share, we'll be forced to produce the money locally, which will mean raising property taxes—and these people out here can't afford that kind of a burden. As for the $10 million in oil-shale lease money—most of that is being used for capital construction, such as roads and schools, and isn't available for social services. Since we're so far behind now, it seems as if we'll always have to be playing the game of catch-up."

Besides money, Johnson says another drawback to planning is a lack of information about the number of people expected to move into the area. "The construction stage will be crucial," he says, "because the figures will be distorted. There will probably be two construction workers for every person retained once operations begin."

A few facts and figures would help

Of course, Ron Johnson's position isn't unique, and that's why the Colorado West Area Council of Governments (COG) was formed. COG is a legal grouping of local governments that was organized to find solutions for just such questions, and to help avoid duplication of effort among its members. Steve Schmitz, a COG staff member and formerly the coordinator of human resources says, "For the time being, we're mainly trying to project needs in the area of human resources as accurately as possible. For instance, we've already started an emergency medical-service program and drug and alcohol abuse programs. And we already know we're going to need more mental-health facilities and more day-care centers. There are predictions that for every full-time job created as a direct result of energy development, there will be at least five service jobs created as an indirect result of this development."

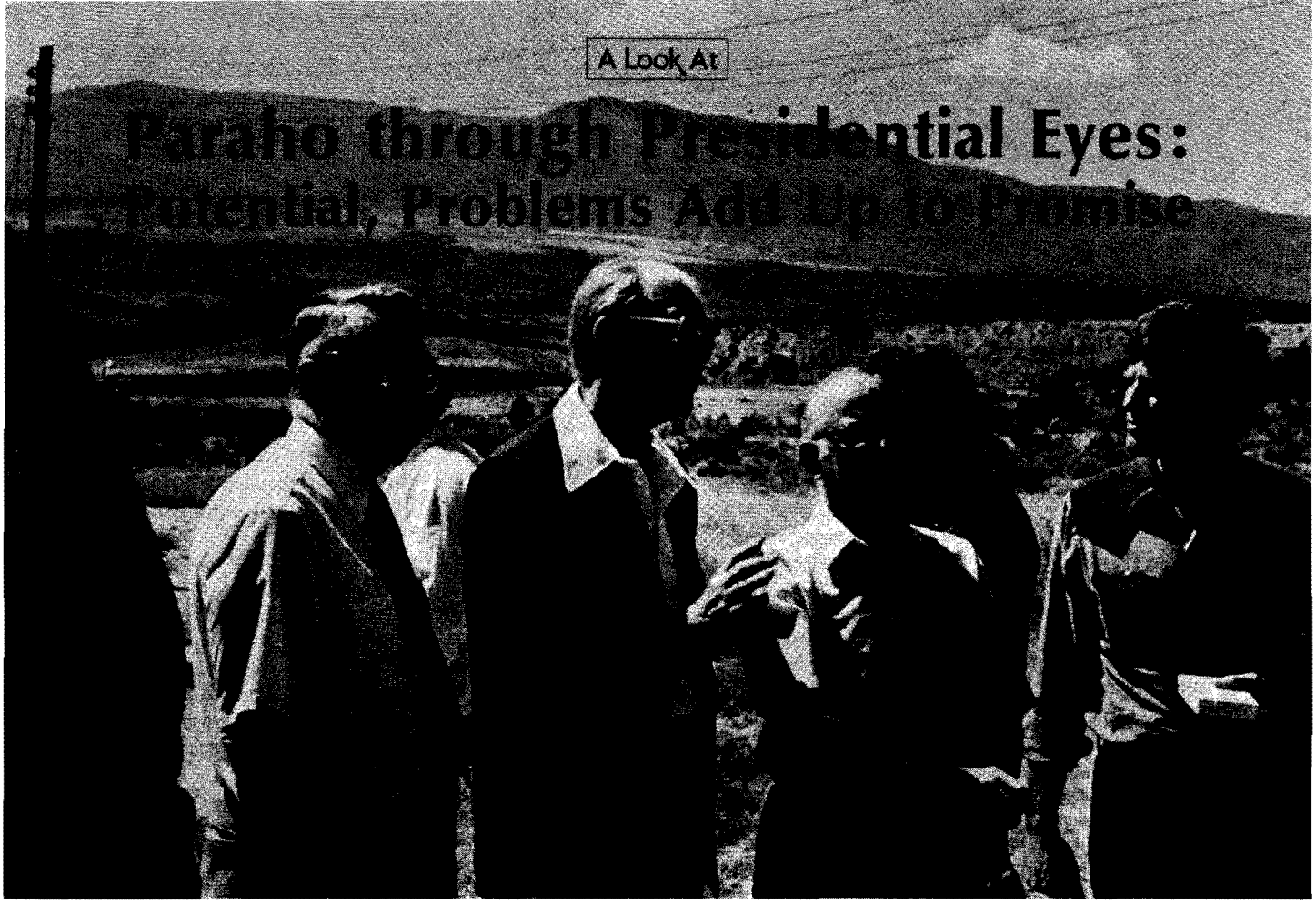
Schmitz also agrees with Johnson that a primary drawback to making plans is the lack of accurate data. But that problem is in the process of being solved. "Right now," he says, "we're working on several studies. We're going to the individual companies and asking for their estimates about the number of people they'll need. We'll have to rely on their information, but they've always been cooperative. We should have some pretty accurate demographics in about 6 months. Of course, we'll still have to make some ballpark assumptions, because we won't know how many of those jobs will be filled by residents and how many will be filled by newcomers. But at least it will give us a start."

But once these figures are completed, and once all the plans are made, where will the money for these services come from? "Your guess is as good as mine," Schmitz says. "Industry will have to help, of course. The local people will try to do as much as they can, but their capabilities are fairly limited. It obviously will depend on the attitude the state and federal governments take toward our situation." *K.C.*

Quality day-care centers will be a social service need resulting from energy-related growth in Northwest Colorado.

A Look At

Paraho through Presidential Eyes: Potential, Problems Add Up to Promise



Technology that doesn't appear to injure the land may evolve into $76-million project

By Carol Edmonds

Off on the tour—John Jones, President Gerald Ford, Harry Pforzheimer and Sen. Gary Hart begin inspection tour of Paraho oil-shale project.

For some 2 weeks before President Gerald Ford visited the Paraho Oil Shale Demonstration near Rifle, Colo., White House staff and the Secret Service trekked in and out of Paraho offices and plant. They observed the 200 to 250 barrels of Paraho shale oil being produced daily at Anvil Points, 10 miles west of Rifle and just off I-70, and they concluded that Paraho was well worth a Presidential inspection.

Once Paraho was chosen, its program director Harry Pforzheimer urged that the presidential tour include the mammoth mine as well as the processing of oil shale at Anvil Points. But while White House advance men found the oil-shale mine impressive with its 50-ton trucks and spacious, well-lighted corridors, they pronounced the twisting, 6-mile switchback dirt roadway "too dangerous." Pforzheimer pointed out that the 50-ton trucks traversed the road daily without accident, and that a mine tour would convey a much better appreciation of why it costs so much to produce shale oil. Skeptical Secret Service men scoured the mine, scanned the Roan Cliffs, listened to Pforzheimer, practiced driving up and down the mine road, and at last approved the mine tour.

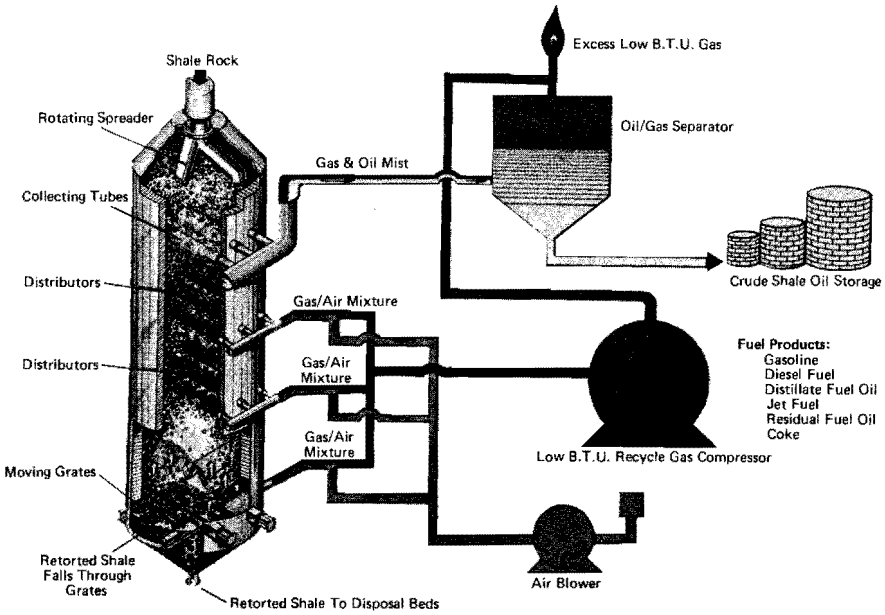
Artesian spring for Ford

So on August 18, when the Marine One helicopter landed at Anvil Points for a 2-hour tour, Paraho was ready for the President. Former Fourth District Congressman Wayne Aspinall, who rode in Paraho's four-wheel drive vehicle with the President and the project's leaders, afterwards described the tour: "The President's mind didn't waver. This was Harry Pforzheimer's and Johnny Jones' show. Pforzheimer was the man who had to get the story across. John Jones was the scientist." (Jones, inventor of the Paraho technology, is president of Development Engineering, Inc., operator at Anvil Points.) Aspinall observed, "Pforzheimer is so knowledgeable, yet he knows he must not oversell. He didn't. It just flowed out as he talked, as if it were an artesian spring. With Pforzheimer and Jones, you couldn't beat the

Full-Sized Modules at a Commercial Plant: Paraho Profile

SIZE: 42 feet in outside diameter, 104 feet tall
HOW MANY: 10 or more modules for a large commercial plant (one for the Paraho proposed experiment)
OUTPUT: 100,000 barrels per day (per plant)
COST: $850 million (in 1975 dollars, for the plant operation alone)
EMPLOYMENT: 1,800 persons
PRODUCTS: Synthetic crude oil, liquefied petroleum gas, ammonia, coke and export gas for nearby power generation

(Source, Paraho Oil Shale Demonstration, Inc., estimates)



Portrait of simplicity—Paraho retort has few moving parts, low construction and operating costs, which make its process and mechanical design relatively simple. With a counter-current flow and the ability to burn most of the carbon in the retorted shale, the retort has a high thermal efficiency. Heat produced in the retort fuels the process. Paraho hardware consumes no water. Shale is fed to the retort in lumps up to 3 inches in size. Raw shale enters at the top of the retort and emerges at the bottom virtually the same size and shape but with most of the energy value removed. Retorted shale, emerging cool enough that it can be touched, is placed immediately in a stable land fill.

combination."

What did Pforzheimer and Jones tell the President and FEA chief Frank Zarb?

They explained that Paraho is a research development project, started in late 1973, and that the results have been encouraging. Pforzheimer reported that current results "demonstrate that the Paraho process works, that the equipment is durable and that the operation is environmentally acceptable on a pilot and semi-works scale."

The site, located on a Naval Oil Reserve and leased by the government to Paraho, is inspected daily by the Energy Research and Development Administration (ERDA). Two Paraho retorts (vertical cylinders that process the shale) have been constructed at Anvil Points. The smaller retort, 4½ feet in outside diameter, is called the "pilot" retort. A 10½ foot diameter retort is built on an "semi-works" scale.

Work is being financed by 17 participants, who originally pledged support for a $7.5-million project that was slated to end after 30 months, in February 1976. All 17 project participants have since authorized another $1 million in expenditures, and extended the project's life to May 1976. The reasons are twofold—more inflation and more delays than expected. Another $500,000 of proposed expenditures bringing the total project cost to $9 million will allow further research on how best to fire the retort. Two methods to decompose the organic matter in the rock and to yield oil vapor and gas have been tested: directly heating the shale rock by internal combustion and indirectly heating the rock by piping in recycled gases heated outside the retort. A third method that will also be thoroughly tested involves a combination of direct and indirect heating.

Fuel for ship, state

Among encouraging results to date has been a 56-day continuous run on the semi-works retort. Completed last March, this run produced 10,000 barrels of shale oil, which were trucked to the Gary Western Refinery near Grand Junction. Refining of the crude shale oil into seven different fuels for the U.S. Navy amounted to the largest conversion of shale oil into military products ever accomplished.

Preliminary findings from a nationwide testing of the shale oil are promising. Laboratory testing by industry and government of the synthetic oil-shale fuels is being coordinated by the U.S. Navy, the Dept. of Defense, ERDA, the Dept. of Interior and other federal agencies. Operating tests have been made in Air Force jet aircraft, an electrical generating plant and U.S. Army vehicles. A Cleveland Cliffs Iron Co. ore carrier used Paraho heavy fuel oil for a 7-day Great Lakes cruise and found the vessel's stack haze level was "far below anything ever experienced with other hydrocarbon fuels."

Another "satisfied" user of shale oil is Utah Gov. Calvin Rampton. Last June Pforzheimer personally delivered 10 gallons of Paraho's 92-octane unleaded motor gas to the Capitol steps for the Governor's 1975 Cadillac. Further testing of the shale oil, which is being used largely by the U.S. Navy, will be completed in mid-1976.

Meanwhile, testing of other phases of shale-oil production at Anvil Points will include:

—Continuous runs of the semi-works retort, for as long as 60 days.

—Retorted shale management research, involving compaction of 1.6 acres of processed shale. DEI, Paraho's site manager, has been granted $440,000 for a 2-year cooperative project with the Bureau of Mines to study handling and disposal of retorted shale. Among the field findings: Paraho's retorted shale can be laid out and compacted with rubber tires to a density greater than the original rock density. Such a shale membrane, lacking any permeability, can act like a swimming pool to prevent any seepage while the water evaporates or is drained to an evaporation pond.

—Vegetation studies, being conducted by researchers from Colorado State University to study plant growth on processed shale.

So, Pforzheimer and Jones explained such details to President Ford, and then introduced him to their most pressing and promising concern: a Paraho proposal to add to the original, $9-million project an expansion costing approxi-

mately $76 million. Objective: to build and operate a full-sized retort 42 feet in outside diameter (compared to the 10½-foot diameter of the semi-works retort) with 20 times the throughput (rate of production) of the semi-works plant. The full-sized retort would stand 104 feet tall—about the height of a 10-story building. Such a structure would be the identical forerunner of commercial retorts. Large commercial plants will require 10 or more such retorts.

Before getting into the mechanics of a full-sized retort, Pforzheimer was careful to explain to the President how the proposal would benefit the oil-shale industry, and how the oil-shale industry would benefit the nation. Paraho engineers estimate it would require 18 months and $52 million to build a full-sized retort, which could begin operation in 1977, if an environmental assessment rather than a full-fledged environmental-impact statement is acceptable to the government. A 30-month operating period would cost an additional $24 million. If that single full-sized retort proved successful, then as many as three commercial plants, each producing 50,000 barrels a day or more, could be on board in the early 1980s. And by 1985 each of these plants could boost production to 100,000 barrels per day, supplying the nation with 300,000 barrels of oil a day.

Pforzheimer stresses that a full-sized module could be built and tested faster and at less expense using Paraho's existing organization and the Anvil Points facilities. Open to government inspection, the full-sized retort would be built on a hogback at an altitude of 7,000 feet in a prevailing breeze area "where everybody can see it." Movement of the rock from the underground mine down to the retort, located at an elevation 1,200 feet below the mine, would be via conveyor belt for a distance of three-fourths of a mile through an ore pass and tunnel inside the mountain—rather than via truck over the switchback dirt road. Pforzheimer envisions "quite a showplace, a very beautiful sight," though he concedes, "Beauty is in the eye of the beholder." Regardless of any beauty, the open location would permit complete monitoring for environmental impact. The retort and support facilities would be built three-fourths of a mile south of the existing mine. The shale oil and fuel storage tanks as well as the canyon used now as a disposal site would continue to be used by Paraho in the scale-up.

Restoring the land—President views Paraho revegetation research plots under study by Colorado State University.

Now that the $76-million proposal has been spelled out, Paraho is broadcasting an appeal to any interested company: those who are willing to pay advance royalties of $5 million or more to own rights to the use of the Paraho technology. Pforzheimer figures it will require $60 million in commitments to trigger the expansion project. All necessary arrangements would be completed by the end of this year, he says.

Forecast: shale can compete

For now, Pforzheimer is encouraged by the Presidential visit, and he remains a self-declared optimist about oil-shale development. With the current price of oil on the world market, production using the Paraho technology could be economical, if the oil companies aren't required to build roads, railways, utilities, dams and new communities, he states. It is estimated that such additional projects could increase costs by as much as 50 percent.

For his part, the President remarked several times during the tour that what he saw was "very interesting." At the tour's end, Ford declared it had been "a first-class opportunity to see the operation from one end to the other." He also said it appeared the operation could be carried out without injuring the environment. Ford continued, "Until you see the actual operation, I don't think you can appreciate the potential or the problems."

At Paraho, Pforzheimer adds some thoughts of his own on the government role in shale development: "The first and most important thing government needs to do is to let the free enterprise system operate, let supply and demand determine the price of energy." Pforzheimer is confident that oil shale, using the Paraho process, can compete on the world market.

Situation Report

Superior's Oil-Shale Process: Trying To Live Up To Its Name

Superior says its processing method is economical, environmentally-sound—and is being delayed.

Suppose you are an oil-shale developer and you have a process that you feel is both economical and environmentally-sound. You have pioneered a retorting and mineral recovery process that allows you to extract four products from the shale, rather than only shale oil. You also report that the process allows you to use saline processing water, and that you need no off-site lands for permanent spent shale disposal. The process is going into its final pilot testing stages and has proved to be "viable." So what's the hold-up?

A land exchange with the Bureau of Land Management of the U.S. Interior Dept., which has yet to be consummated, is delaying the start-up.

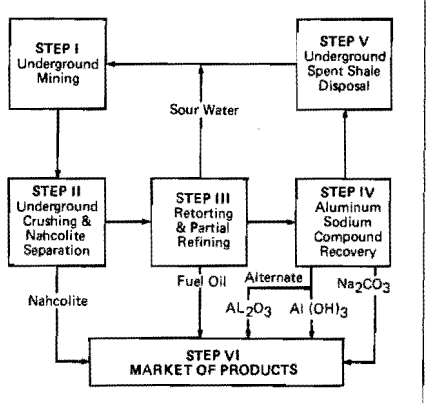
The situation described above is the situation of The Superior Oil Co., headquartered in Houston, Tex. According to Ben Weichman, manager of Superior's Oil Shale Dept., "The Superior process is called an 'integrated process,' since four products result from the steps in the process. This year we are pilot testing all the steps in the integrated process, and will be ready to proceed as soon as we get the go-ahead—which means the land exchange."

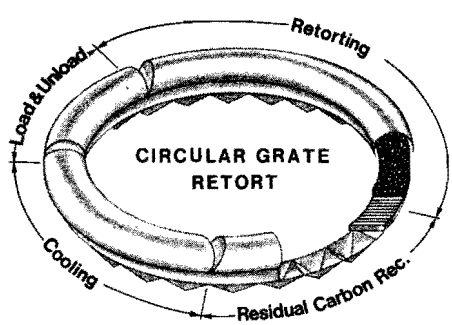
Unique property

To go back in time a bit, Superior became interested in oil-shale development because the company had held some 6,500 acres in fee land in the Piceance Basin for about 40 years. In 1967, Weichman says, "We attempted to determine if it was viable to develop this acreage. We began a drilling and geologic evaluation program and made a significant discovery that influenced our future direction: we found that the oil shale on the property contained nahcolite and dawsonite, which made it unique from all other sizeable blocks of fee acreage in the Basin."

What this discovery meant in practical terms was that, in addition to the oil that the shale might produce, three other products could potentially be extracted from the material. To do this, says Weichman, "We had to develop a process that was two things: economical and environmentally desirable. So we developed the integrated process, which we have patented."

Step-by-step diagram of the Superior process for extracting shale oil plus three other products.





Looking somewhat like a big doughnut, the circular retort is heat-efficient and allows for extraction of other products in addition to shale oil.

Through the application of the process (see 6-step diagram), shale oil, raw nahcolite, alumina and soda ash can be extracted from the rock, claims Weichman. And he says the markets for three of these products are already established. Shale oil, after upgrading, would be used as a fuel oil. Alumina is used in the production of aluminum, ceramics and abrasives. Soda ash is used in the chemicals, glass, and the pulp and paper industries. Thus, it appears that the only one of the four products for which a market would have to be made is nahcolite, and Weichman says that there are potentially several ways this material can be used. For example, he says, "We have pioneered and tested using nahcolite in a 'counter-current contactor,' which is used in air-pollution control. In this process, effluent gas is passed through granules of nahcolite, and the air is cleansed. No one, however, is using this process yet because no nahcolite is being produced. Also, federal government sponsored studies on ways of harnessing solar energy show that sodium sulfate (which can be processed from nahcolite) is very good for storage of solar heat."

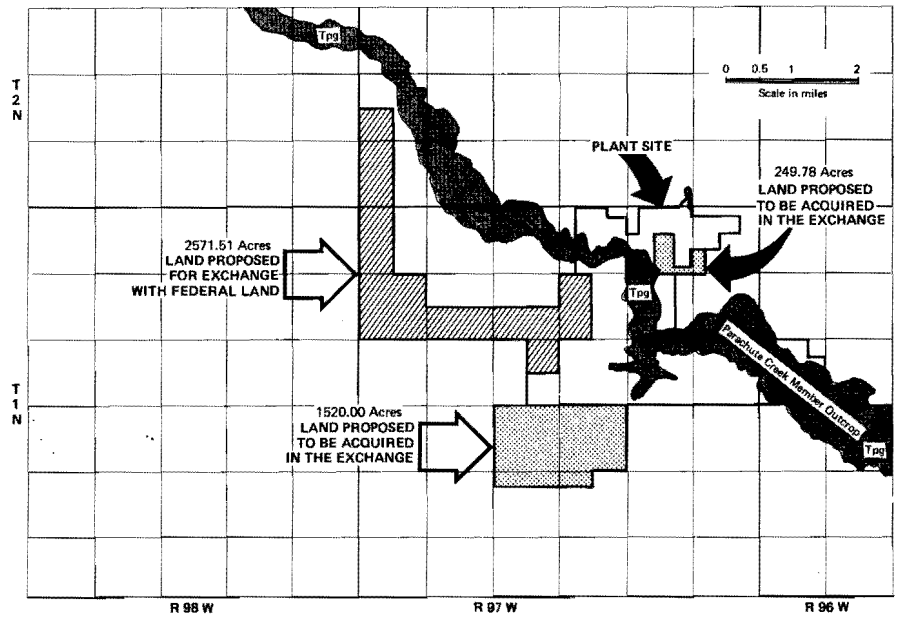
In addition to the four products it is expected to yield, the integrated process holds some other pluses. One of these is in the area of spent shale disposal. In the Superior process, says Weichman, since products other than kerogen (shale oil) are removed, the volume of the spent shale is less than if only kerogen were removed. "Hence," he says, "the spent shale can be disposed of in the original mine from which it was taken, and there is no problem of surface disposal."

Another environmental plus, according to Weichman, is that water used in the integrated process would come from a saline aquifer located in the Basin. This aquifer contributes to the salinity of the Colorado River as it moves toward Mexi-

co, so, says Weichman, "During the process, we use the salt water, help dry up the salt, and any effluent is pure water. This pure water can be run back into water pipes and used in other places at the site. And, there is the potential for pure water left over, which could be used for agricultural or other purposes. Thus, we anticipate no use of surface water, and no competition for water from other developers or agriculture."

Finally, Weichman points out that "For a little bit more capital investment, we can get four products instead of one, and in an environmentally acceptable way. The value of the four products increases our profitability by a factor of three, and we can expect to reach profitability much faster."

The retort used in the integrated process is called a "circular grate retort," and is in fact circular in shape (see diagram). Says Weichman, "It is a desirable method of retorting because it seals itself easily, thus allowing us to put the shale through several processing zones. In each zone, the shale is treated differently, thus preparing it for extraction of alumina and soda ash. (The nahcolite is removed during the crushing step.) Second, this retort is an adaptation of equipment used in several fine ore industries, and the basic machinery has already been proven." Outside observers point out that Superior's integrated process has yet to prove itself via extensive test programs. In this regard, Weichman reports that at this time, the retort is being prepared for testing in a pilot size (10–20 tons per hour capacity) at Cleveland, Ohio, and if all goes well, a full-sized retort (with a 20,000-ton-per-day capacity) will be built on Superior land in the Piceance Basin.



Land in question—shaded portions show land Superior wants to exchange with the BLM.

Delayed exchange

This will not happen, however, until the land exchange is consummated, Weichman asserts. And when that exchange might occur is almost anybody's guess right now. The land involved is 2,500 acres of Superior land, which the firm wants to exchange for 1,700 acres of federal (BLM) land. The reason Superior wants to exchange the land is because of the economics of mining, says Weichman. As the diagram shows, the land Superior already owns and wants to exchange is long and narrow, while the BLM land that would be acquired is more square. Thus, Weichman explains, "Through the exchange, we would be putting the land to be mined in a block that exhibits essentially one geologic setting. Without the trade, the land we currently own poses one geologic condition on the west side of the site, and another in the middle. Also, the cost of long conveyor and ventilation ways would be very high on the property as it exists without blocking-up. Thus, if we cannot work out the trade, it almost becomes uneconomical to mine the site."

Weichman points out that the lands involved in the trade are of equal economic value—the shale on both sites yields about the same amount of oil per ton from the shale that can be economically mined and processed for oil, and while there is more nahcolite on the land Superior would acquire in the trade, the amount of extractable alumina is greater on the land it presently holds. "Thus," says Weichman, "it's a trade-off of equal value."

A final point Weichman makes on the merits of the exchange is that the government owns 98 percent of the land from which the four products appear to be recoverable. And, he adds, since the land exchange would facilitate private investment in proving and using the technology, "It would seem much to the government's advantage to exchange the land, let us prove the process, and then later use it themselves to exploit the resource."

Weichman continues, "We feel that we have a moral obligation to go forward on this because of the economics and the environment. It would be a bonus for the country, especially since the country owns 98 percent of the resources. However, governmental delays are holding up the progress on this project. We have done everything we know of to insure the exchange—we have supplied all the required data and more. We have done archaeological studies, soils and vegetation studies, and collected a great deal of baseline data. Now we are just waiting for the exchange to be consummated. How much longer can we wait? That's a senior management decision that will have to be made, and I honestly don't know—but I don't think we can wait a whole lot longer."

J.P.

Newcomers

C-b's Bob Loucks: "Never Has A Project Fit Me So Well"

Recently, a management assignment officially signaled the arrival to two "newcomers" to shale country: On June 1, Bob Loucks of Shell Oil Co. became project manager of the C-b Oil Shale Project, and Shell became C-b project operator. Of course, Shell, as one of four equal partners in the C-b and Colony Development shale projects, can't qualify as a real newcomer to oil shale. Neither really can Loucks. He says, "I feel comfortable in this assignment because I have been representing Shell on the Colony management team for some time."

Loucks, a metallurgical-engineering graduate of Montana School of Mines (now Montana Tech), joined Shell 17 years ago. Since then, Shell assignments have taken him from Washington state to New York City to Los Angeles to Houston. Many of these involved refinery construction, including "stakeouts" in various contractors' offices.

Now Loucks is based in Denver, and he's liking it. He says, "I was born in Montana, so I and my wife and our three children are delighted to have the opportunity to live in Colorado. In fact," he says, "I lobbied to get the C-b job. I felt I had the background and I've always wanted to work in oil shale. So I welcomed this assignment. I'm strong in the processing area and my experience is applicable. When we invest this kind of money in a project, we need to rely on major contractors, and thus I feel my experience working through contractors will be very helpful.

"My boss, Bob Meeker, says I'm unreal because I get so excited about this assignment. But I've never had a project fit me so well before. I like living here, and I like the project because I feel the oil-shale business is certainly an integral part of the country's solution to the energy crisis."

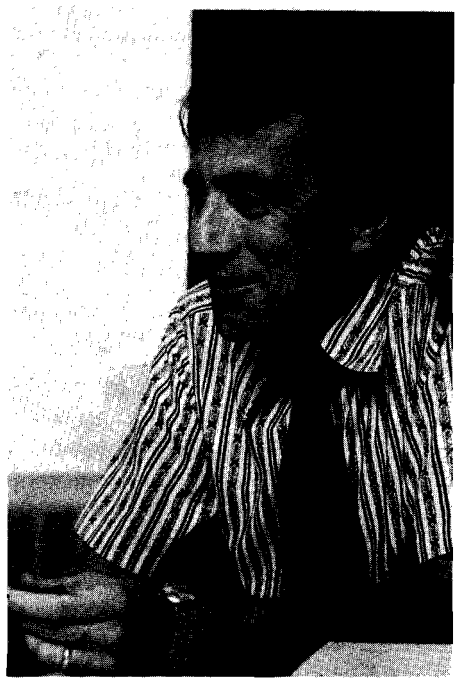
In regard to the specifics of his role as C-b project manager, Loucks says, "We have a limited, very clearly defined primary objective for C-b. We are pursuing the last two bonus payments." (Under the lease terms, the lessee may credit against the fourth and fifth bonus installments any expenditures incurred prior to the third and fourth lease anniversary dates that are directly attributable to operations on the leased lands for the development of the leased deposits.) Loucks adds, "So we basically are not looking past April 1978, which is the fourth anniversary date. By that time, of course, we would expect to have guidance from the government and a release from management to proceed more definitely. However, our team objective is limited to what happens from now to April 1978."

Loucks points out that in comparison to normal refinery construction, this project has many other unique features. He says, "The primary one is that we are breaking new ground. Of course, we have Colony's work behind us so we have a leg up. Even so, we are doing some things differently on tract C-b. Another difference is the intense public exposure. I don't think any other development has attracted so much attention as oil shale.

"I feel the situation in Colorado is one we can live with, but we need the public to clearly tell us what it wants. Then we think we can supply it. Therefore, I feel it is my job to make myself available to the public. I also recognize that our principal responsibility is to the Area Oil Shale Supervisor—to supply him with the information he needs."

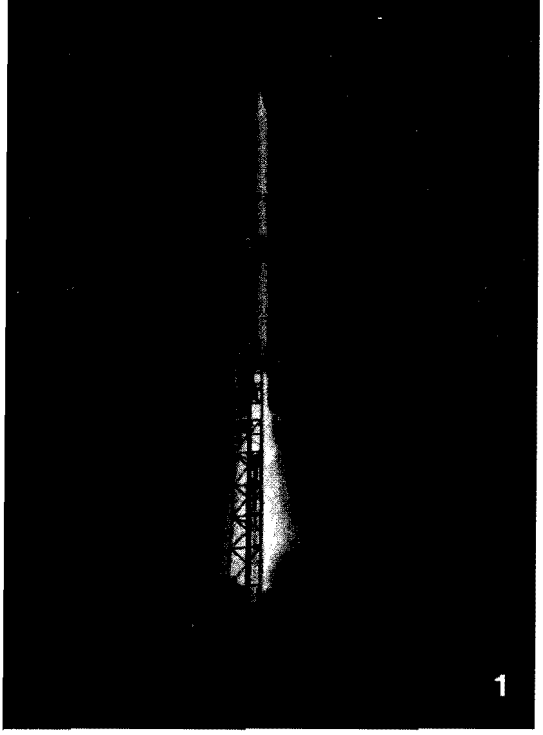
Asked what key messages he would like to send to SHALE COUNTRY readers, Loucks replied: "First, I want everyone to know that the objectives of the C-b project have not changed because of the transfer of the operator role from Atlantic Richfield to Shell. Second, I want outsiders to realize that the primary perspective of the project is limited to April 1978 and not beyond. Third, I want individuals interested in C-b to feel free to contact me."

Describing himself, Loucks uses words like "impatient." He explains this description in this way: "I am highly motivated; very goal-objective oriented. I can't stand a project where I can't see light at the end of the tunnel. When I have a definite objective, I have been able in the past to meet that objective."



About the oil-shale industry, Loucks says, "I'm optimistic that this time the industry will make it—that the government will find it proper to let the oil-shale industry prove itself, at least to the extent of one or two plants. And I feel that C-b has an excellent chance of being one of these."

A.N.



Athena Missile Launch (1): one of many in the 60s located from the Green River Launch Complex to White Sands Missile Range, N.M. The base east of Green River now operates with skeleton crew. Siren song (2): the Green River was described by one writer as "beckoning with one hand and thumbing its nose with the other." Rafters are beckoned to Green River, both the stream and the town, as main street poster shows. Wild Bunch writer (3): Pearl Baker, a secretary working for a uranium company, is a Robbers Roost native who has lived her life in the Green River area. She has written books

Community Profile

Green River, Utah:

Shale takes back seat to

Signs of Green River, Utah:

"No services available on I-70 next 107 miles"
(Posted for west-bound traffic)
"Welcome boaters"
(Large red lettering on the storefront of a tavern)
"Robbers Roost Motel"
"Uranium Motel"

The signs suggest Green River is related to uranium, tourism, river running and nearby Robbers Roost, a hangout of outlaw Butch Cassidy. The "107 mile" sign hints of Green River's isolation; it's just west of the Emery County line, on the desert's edge. Sometimes its remoteness makes Green River an "orphan" of Emery, even though the town's 1,200 residents constitute one of the county's two most populous towns. Green River is framed on the north by the Book Cliffs, those arid, low-lying plateaus and mesas that form an "impregnable barrier" in the words of Green River airport manager, Jim Hurst. Barrier to what? Oil-shale developments, for one thing. No north-south roads connect Green River directly to shale exploration and developments in the Uintah Basin. So, instead of looking to oil shale, Green River continues to depend on tourism, mining—especially uranium mining—agriculture and the government's missile base just east of town.

Peaches to yellow cake

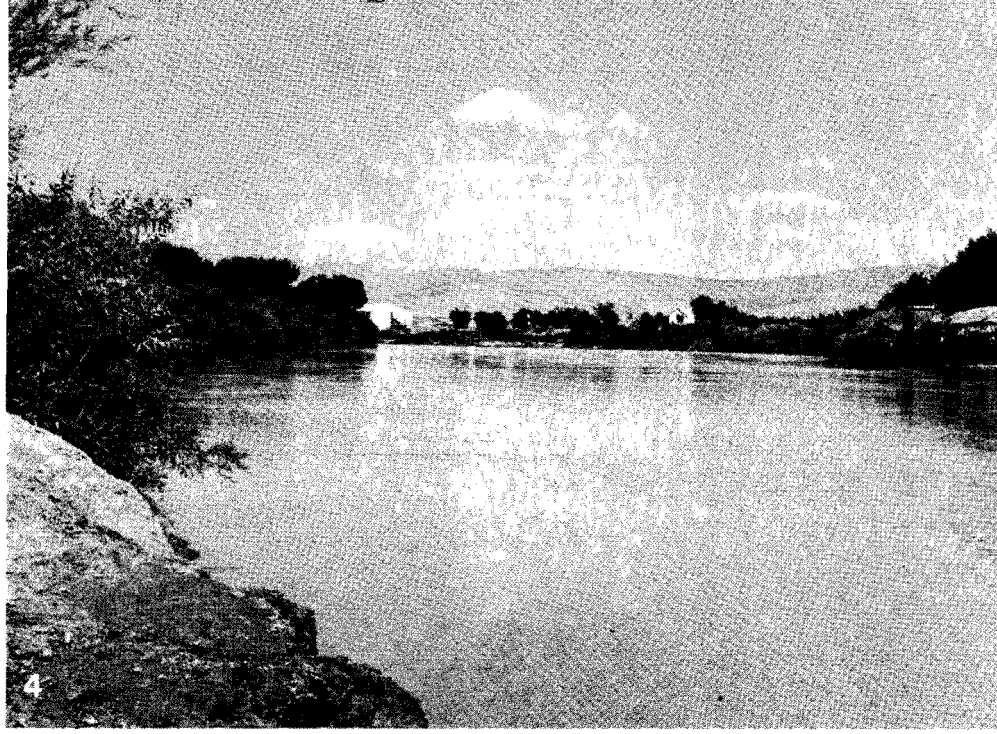
Settled in 1878, Green River was a mail relay station between Salina, Utah, and Ouray, Colo. In 1882, the Rio Grande Railroad brought a brief land boom to the town. In the mid-20th century, peaches, then apples and later melons were farmed. Each of these peaked out as weather; labor and freight costs soured the market. In the 50s, yellow-cake uranium brought prospectors to town.

Today, tourism has replaced agriculture as a main source of revenue for the town of Green River. The airport's charter flights bring in tourists (who have flown into the area via commercial flights to Grand Junction, Colo.) for river rafting trips, usually part of a vacation package. Hurst says people from around the world fly into Green River to ride the river that gives the town its name. A 6-day river tour advertised by one outfit touts "the incredibly colored and carved stretch of Utah where the Green and Colorado Rivers join like the letter 'Y' . . ."

Another prime source of local income has been the missile base. But like outlawing and uranium mining, the missile base has been a fickle financial resource. Lee Woodard, general engineer and one of the handful of Civil Service employees still at the base, says that, historically, employment swelled during testing of Athena missiles and, as recently as last spring, during launching of Pershing missiles. But now the base's row-upon-row of trailers supply a virtual ghost town, tended by some 18 employees of a subcontractor who at one time employed 80 persons, many of them from Green River. The impact of the missile base on the little town can be gauged by a remark of Jim Ramsay, city councilman, former Green River school teacher, and current owner of a sundries store. He says of the impact of streamlining at the missile base, "I don't think Green River is going to die." Instead, he expects "lots of people to come inland" from the coasts to live in smaller towns. "If something booms, we stand to boom also." He predicts any natural-resources boom will come from oil or coal development. Emery County's most promising resources are tar sands—west of the Green River—and coal—in the Hanksville area, according to Ramsay and Hurst.

Like Ramsay, the Green River school principal Thomas Burr doesn't expect an

about Butch Cassidy's gang and about Green River's airport manager. Rafter mecca (4): The Green River, with its head in the Wind River Mountains of Utah, flows 60 miles, touching the town that bears its name, before its confluence with the Colorado River. Scene shows part of a state park at Green River.



Desert Outpost

coal, uranium, tar sands

oil-shale flood to hit Green River. Burr comments, a mite wistfully, "We're a little remote. But there are rumors we're sitting on oil shale. We sure could stand a little bit of industry." Burr points out that the school's small population—a total of 300 students in one building serving all Green River students in grades kindergarten through 12—means that when any one business in town falters, the student population declines significantly. The small enrollment limits course offerings, and requires that one large room serve for basketball, dances, boys' and girls' sports and graduation. But, advantages of smallness mean that "Every student can participate if he wants to. If a boy wants to go out for football, he knows he's going to be in a uniform and on the team. We get every inch we can out of every student," says Burr.

Many are multi-talented

The same might be said of every citizen. Mayor of the town is Rey Lloyd Hatt, a cattle rancher. Paid a salary of $1 a month, Hatt doesn't sit with his feet on a city hall desk. Instead, he is likely to be found irrigating his lands or bailing hay or attending a town council meeting. He speaks with optimism about starting construction by next spring of a city-county building for the town of Green River and Grand and Emery Counties, providing office space for the State Highway Patrol, county library, courtroom, jail and juvenile holding center.

Such cooperative efforts and improvisation are hallmarks of Green River. The town has no doctor, for example, but special grant funds permit the employment of family-nurse practitioner Sue Allen, who serves as a liaison person between patients and doctors in hospitals 52 miles away in Moab, 102 miles away in Grand Junction and other area hospitals. She is trained to suture, apply casts and perform other first-aid emergency measures. She can take x-rays and prescribe medication with a doctor's approval in Provo. Prescription drugs are bused into Green River, since the town has no pharmacy. Once a week, a doctor flies in from Grand Junction to treat patients. So, Green River is small and adaptable.

The smallness isn't always comprehended by tourists. Recently, a woman walked to the metal terminal airport building, adjacent to the runway, where five or six small aircraft were parked, and asked Airport Manager Hurst, "Is this the airport?"

"No," he answered with a grin, "it's the stockyards." As she started to leave, he explained his little joke. The woman didn't laugh, but pressed her inquiry, "What time does the next flight leave for Las Vegas?" Hurst explained there are no scheduled flights in such a sparsely populated area. "We serve less than 2,000 people within a 50-mile radius," Hurst said. He added that plans are underway to move the Green River airport and build a 6,000 foot runway. Still, the woman wasn't convinced she was at the airport.

But, then, the tourist doesn't necessarily know about "these parts." A woman from Iowa traveling through Green River stopped at a cafe, and when she heard the words "oil shale," asked for a definition. Green River residents know the words, but, in Mayor Hatt's opinion, "We aren't likely to see development or much impact from oil shale south of the Book Cliffs." However, the mayor adds that the town's new water plant, its abundance of water, the major railroad and the interstate highway running through the city limits all make Green River "ready for any oil-shale development or other industry that establishes itself here." And the river will always be alluring.

C.E.

Environment

Lilies in the Shale Fields?

Revegetation studies yield waist-high grasses

Colony Development Operation, 18 miles north of Grand Valley, Colo., is a pioneer in making grasses and other plants grow on processed oil-shale piles, having begun its revegetation studies a decade ago. Working for Colony for the past 4 years has been range conservationist Ed Baker, who recently was hired by Shell Oil, one of the Colony partners, to continue revegetation work on the federal prototype oil-shale lease C-b, which Shell manages.

A measure of awareness and concern about revegetation can be gleaned from a *National Geographic* magazine story printed in June, 1974. Baker was quoted in that story as being optimistic about Colony's revegetation work; the reporter observed native grasses sprouting "shin high." But the *National Geographic* story concluded that oil-shale development was handicapped by fears of "torn-up, poisoned land."

Baker, a Grand Valley resident whose great-grandfather homesteaded in Roan Creek in 1883, has a vested interest in protecting his home-lands, in guarding against "poisoned land." As he walks amid waist-high revegetated soils on Colony's experimental plots, Baker explains that Colony plans to place its processed shale in two side draws off Davis Gulch, located atop the Roan Plateau on the venture's private land in Parachute Creek. The TOSCO II process of vaporizing oil from shale rock also leaves a fine, powdery residue known as processed shale. This spent shale will be deposited on 800 acres near the Colony commercial-sized complex, which will produce 50,000 barrels of oil a day.

Baker lists four main problems associated with revegetation of spent shale:

First, salts are part of the residue that accumulates when the rock is broken into fine material and processed. "So we must leach the salts far enough down into the processed shale so they won't come back up," Baker explains. Leaching is done before plants are seeded. Then regular watering of the seedlings is done for about the first two growing seasons. In addition to natural precipitation, some 48 inches of water are required for leaching the salts and watering the seedlings.

Second, the fine, black spent shale is infertile. Of the 17 basic life-giving nutrients in ordinary soils, processed shale lacks just two, nitrogen and phosphorous. Both of these are lost or vaporized when the shale is processed. Thus the nutrients must be applied to the soils over a 4 to 5 year period, until the plants are able to survive on their own.

Third, the black color of processed shale soaks up heat from any direct sunlight falling on it, and can make the surface temperature of the shale pile a blistering 170 degrees F. To prevent such killing temperatures, a light-colored mulch material, such as straw, is placed on top of the shale to reflect the solar radiation. Colony will probably use 6 inches of topsoil, taken from the canyons where the shale is dumped, to enhance growth. Like "robbing Peter to pay Paul," the topsoil will be saved from beneath the processed shale embankment in the canyon, then placed on top of the shale pile.

Fourth, low infiltration rate of water in the spent shale means that watering the compacted embankment can be "like pouring water on a duck's back—it runs right off," as Baker observes. The addition of topsoil and mulching material to the embankment increases its moisture-holding power.

After spoonfeeding, what?

The big question in revegetation is whether the grasses or plants will live and reproduce on their own once watering and fertilizing is completed. Baker says the evidence points to "yes." Colony has experimented with more than 60 species of grasses, shrubs and flowering plants on at least eight processed shale sites. In most cases, watering and fertilization have been continued through two growing seasons, and the plots have been left on their own, some as long as 6 years. Baker concedes that no one can say with certainty that the plant life pres-

Early in the revegetation studies, spent shale was watered extensively to leach salts out of the soil; this was done before fertilization and seeding.

Ed Baker, (above) range conservationist for the Colony Development Operation, kneels waist-high in some of the plants grown on spent shale. **Showing its size**—(below) one of the plants grown on spent shale at the Colony site; more than 60 species of plants have been experimented with on eight processed shale sites.

ent on the processed shale will continue forever. "We wish we'd been studying it for 50 years. But the signs look good. There are no indications of deficiencies (in the current field growth). It looks like we can turn the water off in 4 to 5 years and the fertilizer off in 5 years. We are planting plants that grow in this precipitation zone. If they grow in nature, there's no reason they wouldn't grow in processed shale." He observes that the oil-shale processing to be used by Colony simply speeds up the physical breakdown of the parent rock, eliminating the usual chemical changes that exposure to weather produces over decades. Colony is hastening the creation of native soils, in effect.

Baker also points out that revegetation of spent shale is relatively inexpensive, costing $3,000 an acre. That means a cost of about one-tenth of 1 cent per barrel of shale oil. "At that price, I could revegetate sidewalks," Baker says. *C.E.*

***(Editor's Note:** More and more such revegetation studies are now in process and SHALE COUNTRY will report on their progress in upcoming issues.)*

Real Estate Corner

Industrial Parks: Some Have Them and Some Don't in Shale Country

Foresight Park for Industry, in Grand Junction, presently is the home of two tenants, Capco (upper building) and Smith Tool (lower building).

Two distinct situations exist in the Colorado and Utah shale regions in regard to industrial parks. Although both areas have a thriving industrial sector, the Grand Junction, Colo., area has two industrial parks, one of which has been in the city for almost a decade. In Vernal, Utah, however, there are no industrial parks, although there is a healthy industrial area.

Ken Fisher, Vernal city planner, explains, "There are no industrial parks within the Vernal city limits, because historically, most industrial users have been located along U.S. Highway 40 on the east side of Vernal, which is outside city limits. This is due in part to a rather unique provision of the zoning ordinance entitled 'Highway 1,' which extends the entire length of U.S. 40 through Uintah County. Although this zone was intended for roadside commercial services, rezoning has caused 'strip industrial' to develop along the highway. There have been no blocks of industrial development, such as you would find in an industrial park."

Most industry around Vernal is connected with the oil industry (not oil shale) in the area, and includes oil drilling and service companies. Because of the strip development in the county, Fisher's feeling is that an industrial park close to the city would be welcomed. He says, "I believe that there is room for a well-planned industrial park. The only prerequisite would be finding a landowner or developer who would be interested in this type of thing. The Vernal City Council has expressed interest in the annexation of industrial areas. If this were done, the piece, if not already zoned properly, would be provided with an industrial zone. The city would then make provision for utilities and other conveniences to facilitate orderly development. This, I feel, would appeal to industries outside of the area, and might provide some incentive for them to locate here."

Keeping youth close to home

In Grand Junction, Colo., the situation is quite different. Gordon T. O'Brien, coordinator for Industrial Development, Inc. (IDI), and Colorado West Improvements, Inc. (CWI), the economic development arms of the Grand Junction chamber of commerce, points out that the city has had one industrial park, Foresight Park for Industry, since 1968, and another park, Colorado West Development Park, Inc., since 1972. "Basically," says O'Brien, "both these parks are a by-product of chamber work. IDI and CWI are non-profit corporate entities of the chamber, and were set up to attract industry to the area. The way it has worked is that we have offered the land in the park to industry so they can build a plant to their specifications. They must, of course, adhere to the restrictive covenants of the park, and right now we have two beautiful buildings in Foresight Park. In most cases we have sold the land outright to the company; however, lease-purchase arrangements are available. The land currently sells for 35¢ per square foot in Foresight Park, and 35¢–41¢ in Colorado West Park." O'Brien says that there is room for more tenants in these parks, since only 40 of a possible 160 acres have been developed in Foresight Park. And, he says that there is "some acreage" left in the newer Colorado West Park, although it is limited.

"There is a need in the city for more industrial acreage with access to a railroad," O'Brien says. However, he adds, the city's and county's attitude on zoning for industrial development has been "positive and more land is being programmed for probable industrial use. There is a keen awareness that aesthetic values can be maintained and marginal non-agricultural land made available for industry."

O'Brien says that the chamber's involvement in the development of industrial parks has actually been "altruistic." He says, "We wanted to find a way to keep our young people in the area, and to do that, you have to provide jobs. I can say that it is a result of the chamber's efforts that Grand Junction has attracted its electronics industry, which employs about 1,500 people, and has assisted other industries such as Smith Tool, Fibreboard and Coors Porcelain in their plant expansion programs. We felt that we had to stop Grand Junction people from going to other cities, and I feel that we have had moderate success along these lines. We are confident and optimistic of the future and our economic potential."

J.P.

Vignette

Walter Herget: Smoother of Waters

In 1942, Walter Herget, a recently-graduated chemical engineer from the University of Illinois, joined Amoco Oil Co., the marketing-refining subsidiary of Standard Oil Co. (Indiana). In 1974, Herget became president of Rio Blanco Oil Shale Project, a joint venture of Amoco and Gulf Oil Corp.

To reach this presidential position, in the intervening 32 years Herget climbed a number of Amoco management steps and worked in a number of locations. These included serving as: general manager, manufacturing (New York); director, technical service and operating procedures (Chicago); vice president, refining, engineering and purchasing for Amoco International Oil Co. (Geneva, Switzerland); general manager, manufacturing for Amoco International (New York); and general manager, domestic refining (Chicago).

Asked about these management steps, Herget replies: "I just got promoted. Actually, I like management, and don't particularly miss engineering." In comparing his past experience with his present position, Herget says, "The shale business is a lot like the refinery business. In each you are dealing with big investments and big equipment, and with many government agencies." He goes on to say, "Management problems are much the same in every job, every place. It's a matter of keeping things on schedule, keeping in budget, and keeping people working together."

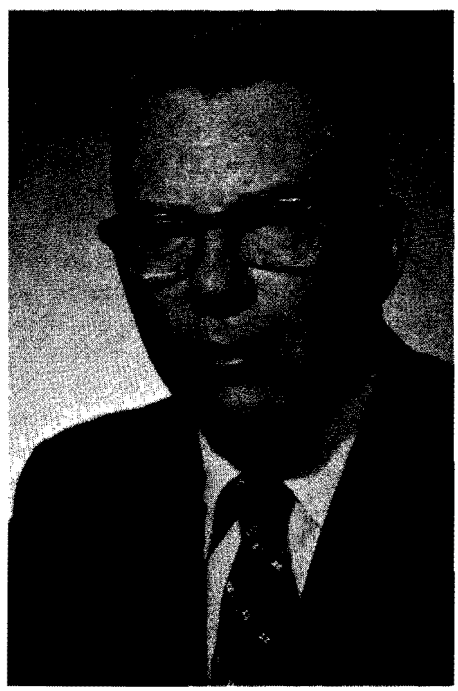
Asked how he got this particular job, Herget responded: "I had no idea they would ask me. But I can say what appealed to me—the totality of the thing, the starting from scratch, the 'glamour' of working on the inside of a new industry. And I feel Standard considers shale as a long-term proposition. It looked at the domestic oil reserves—not only for the company but also for the country—and decided that shale was one of the places it had to be. So I think it'll be in the shale business for a while, even though the problems are massive. The key example: the front-end investment involved."

Herget explains that, "As president, one thing I try to do is to interpret Gulf's and Standard's desires, to blend them together so the relationship goes smoothly and goes forward. I am a member of the Rio Blanco management committee composed of Gulf and Standard people and I try to initiate policies this committee will accept. Then I interpret these to our people working on the project. Each company has three members on the committee and so far we've never had an impasse. It's part of my job to see that we don't have any.

"Our approach on this project, I feel, is unique," says Herget. "The partners, Gulf and Standard, have formed a separate entity, the Rio Blanco Oil Shale Project, into which they have blended their staff people. We also use contractors extensively as part of our basic work force. About 85 percent of our effort is via contractors, making this project far more contractor-oriented than the refinery business."

What's a day in the life of a shale project president like? "Meetings, meetings, meetings," says Herget, who adds, "I spend a lot of my time smoothing the waters—and working hard to control expenditures." Two immediate problems facing Rio Blanco, Herget reports, are its need for off-tract land for spent-shale disposal purposes and the need for "realistic air-quality standards." The major learning experiences he's had since becoming Rio Blanco president: "One, I never knew we had so many laws, so many environmental acts. Two, since I came here from the East, I did not realize how much government land there is in the West. That was an eye opener," says Herget.

Herget, who now lives in a suburb of Denver with his wife and son, lists golf, hunting, fishing and collecting coins and bank notes as hobbies. He also lists Colorado as number one on his home hit parade. "Colorado," he says, "is just about the tops. I've spent a lot of time in



New York and Chicago and they're just too big. Here the climate is wonderful, and the size of Denver is more to our liking."

One Rio Blanco staff member has said: "This project will go because Herget has the enthusiasm and determination to make it go." Herget responds, "I'd like to see this thing get built. There's only one trouble with this project—the time element. I've never been in a project like this before, one with such a long potential life. We could operate the C-a tract for more than 200 years, and somehow I can't get too enthusiastic about the last 150 years." *A.N.*

"Integration" of data into a meaningful picture of the landscape is stressed by Dr. Thad Box. Here he inspects bug-infested service berry west of tract C-a.

Voice of the People

Dr. Thad Box— One Ecologist Who

'Far too often people collect data to meet

Add Southern charm and a sense of humor to a scientist in Utah, and you describe Dr. Thad Box, a natural-resources specialist. His persistent questioning of colleagues can seem to fluster even the most knowledgeable expert. And he has quite an opportunity to question as a member of the Oil Shale Environmental Advisory Panel (OSEAP) that advises the Interior Secretary on environmental issues related to oil-shale development. He is also Dean of the College of Natural Resources at Utah State University (USU) in Logan.

At a recent oil-shale panel meeting, Box questioned the value of pages of data contained in a thick quarterly report on one of the federal oil-shale tracts. He observed, "We have a whole bunch of figures, and many times they don't mean a thing, because they don't represent a population."

Box's insistence that "data for data's sake" is worthless could become a monotonous claim; yet, instead, his remarks ring with common sense and his humorous asides take the sting out of criticism and downplay his own expertise ("I just raise questions, I don't answer them," he says.) The panel's chairman, William Rogers, noted during a meeting, "We're indebted to Dr. Box for continuing to hammer away at this question: 'Just how good are your data?' "

Box's service on OSEAP is not his first stint with a prominent group concerned with the environmental impact of natural-resources development. Three years ago he chaired a National Academy of Sciences study on the rehabilitation potential of Western coal lands. The remainder of his resume is also impressive: 6 years as director of the International Center for Arid and Semi-Arid Land Studies at Texas Technological College in Lubbock and head of the college's range management department, which he established in 1962; 1 year with the Australian government to study arid lands in central Australia; 3 years teaching and research in range management at USU; doctorate research in wildlife problems on rangelands in his home state of Texas (where he grew up on a ranch).

Today, in addition to his administrative duties as college dean, Box has chosen to teach two classes, at graduate and freshman levels, on natural resources and man's future, particularly man's energy and food needs. One of his students has been Jack Ford, the President's son. Box aims to instill in his students a "land ethic."

While Box calls himself an environmentalist, he does not always hew to the popular environmental stand. Box says, "I'm an environmentalist in the sense that I want us (the oil-shale panel) to know what we're doing to the environment. Once all the data are in and we look at the alternatives and we make a cold-blooded decision to destroy something, then we can say, 'Hooray, we made (the decision) out of a data base, not out of ignorance.' "

In an interview with SHALE COUNTRY, Box made these comments:

Q. *Why do you rail against 'data for data's sake?'*

A. Far too often in this oil-shale situation, people are collecting data to meet the requirements of the *Federal Register* or some other man-made criteria rather than anything to do with the functioning of the ecosystem. It comes back to the inception of this (oil-shale) panel: people interested in ecosystem dynamics didn't sit down and ask, 'What questions do we want answered?' Check any of these (oil-shale) reports and you will find long lists of species of plants and animals and air-quality parameters. How well do these sets of figures represent the population that is there? Does it (the information) really measure anything we're interested in knowing?

What really brought this into focus for me was the passage of the National Environmental Policy Act (NEPA). The act required us to do environmental analyses on practically everything. While I supported NEPA and worked for its passage, I've been quite concerned that many environmental-impact statements have deteriorated to a set of boiler plate plus great long lists of data. There's very little interpretation or looking at alterna-

Spurns Data for Data's Sake

the requirements of the Federal Register . . .'

Humor frequently softens Box's criticism. After revegetation project in the Texas panhandle, Box revealed to a reporter his most significant finding: "Plant immediately before a rain."

tives.

Many times there isn't enough interpretation possible because there isn't enough research there. The people involved in the research haven't worn out enough pairs of boots. (After the passage of NEPA) hundreds of firms sprang up, hiring all sorts of people who haven't had the experience to do these environmental-impact statements.

I don't want to sound pessimistic. People in government and industry are trying hard. We are much ahead of where we were. But environmental-impact statements in general haven't looked closely enough at the tradeoffs.

Q. *Such as?*
A. Water is a good example. Do we use the water for coal, gas, oil shale, for agriculture or to run down the river to provide for the fish?

Q. *Where does the oil-shale panel fit into your critique?*
A. One of the panel's main defects is its size. But its limitation is also its strength—the diverse interests and backgrounds of panel members. Its main function is simply an overview of the environmental impacts of development. I doubt we have much impact on specific items; there's not that much scientific muscle here. But we do raise a lot of questions about the adequacy of what (the companies) are doing, and why.

One of our problems is that we are focusing in on oil shale where we probably ought to be taking one or two steps backward and looking at energy development. If there is a better source of energy with less environmental impact, then we ought to be looking at it.

Q. *Turning to your area of expertise, rehabilitation, do you think rehabilitation of spent-shale sites is possible?*
A. I think it's possible. There are still some scientific questions to be answered and some engineering questions. But the big problem is going to be in the art of getting it done, getting somebody with a green thumb. You can get two wheat farmers side by side and one will harvest 80 bushels of wheat and the other will have a crop failure. There are no certified rehabilitation experts. But we do know enough now where we can do a pretty darn good job of rehabilitating the sites.

The biggest issue in rehabilitation is how to handle the high salt contents of the soils: how do you put the shale pile together? How do you get the plants to grow in this zone? How do you handle the salts?

Q. *Do you think it is important to plant native species on rehabilitated sites?*
A. I would break with my environmentalist colleagues here. No, I don't think it's necessary or even makes good scientific sense to plant native species the first time around even if your objective is to reclaim the native species. We had the same hassle on coal. Some people said, 'We want it just like mother nature had it with little blue stem on the prairie.' Well, if you want little blue stem, you may have to get there like mother nature did—through a series of plant succession steps. Maybe you should plant broom corn rather than little blue stem. (On oil-shale lands) you may want to plant a weed—it may be barley—to get back to the native plant cover.

Most of my optimism about revegetation is based on revegetating other sites. If you pin me back and ask, are there examples of can we do it with oil shale, examples that can be extrapolated to other sites, I'd say no. But there has been a lot of work in other areas such as revegetating road cuts and coal sites.

Q. *You have criticized the location of the Plant Materials Center in Meeker as being of little value to oil-shale sites in Utah. Why?*
A. Meeker is too high an elevation, too far south.

Q. *What do you see as the key environmental issue in oil-shale development?*
A. Water. One has only to live in a Western state to realize water is a most valuable, elusive resource. This will be an overriding issue. *C.E.*

Guest Column

Oil Shale— An Ace In The Hole For National Security

By P.A. Petzrick, Cdr.
Director, Navy Energy and
Natural Resources R&D Office

During a recent visit to Colorado and Utah, I was impressed by the depth of understanding of the nation's energy problems displayed by the local citizenry. Their modesty, however, suggests they do not fully realize the tremendous importance to our national security of the resources they are looking at each day. To attempt to put these resources into perspective, I have used the simple gambit of distorting the world map to proportion a country's size according to the relative amount of each critical fossil fuel available to that country. A quick glance at the resulting figures tells an important story.

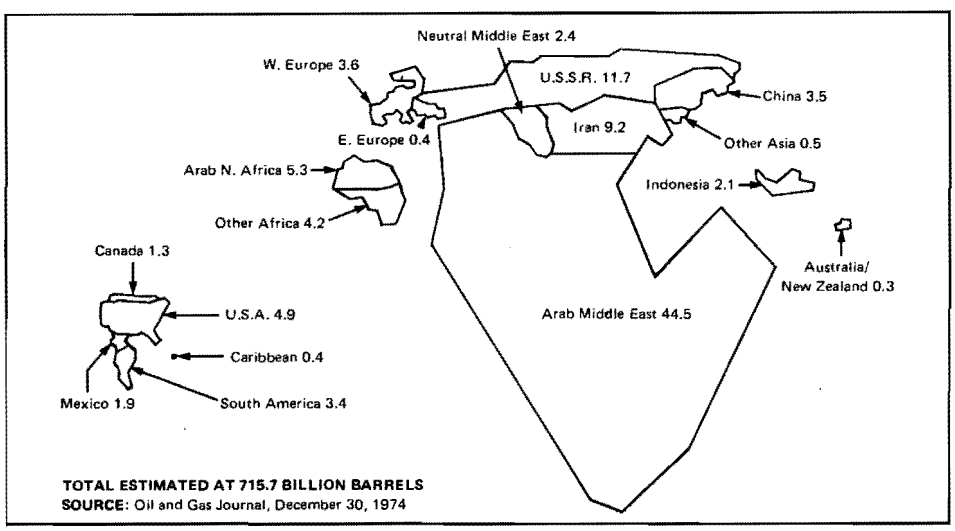


Figure 1—World Recoverable Crude Oil

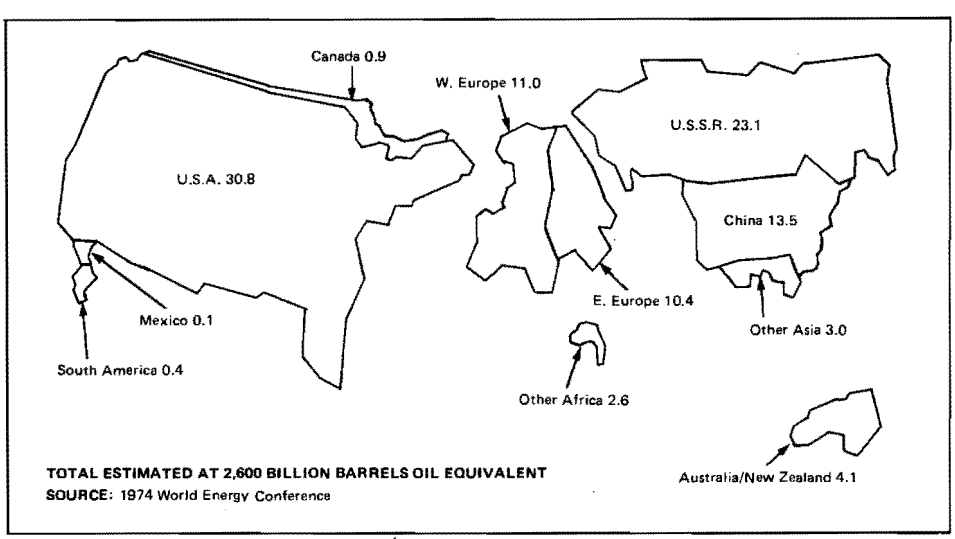


Figure 2—World Recoverable Coal

The basis of our energy problem is shown in Figure 1. With only 4.9 percent of the world's crude oil, America has a standard of living and a level of industrial development that accounts for one-third of the world's demand for crude oil. From a national security point of view, the story is even more disturbing. We have a large inventory of ships and airplanes built to consume liquid hydrocarbon fuel, which has traditionally been derived from crude oil. It is no accident that our military machinery is such a heavy user of oil. Liquid hydrocarbon fuels have offered the best combination of energy density and safety of even the most sophisticated fuels that could be developed for military applications. For those vehicles—land, air and small ships—where nuclear power is impractical, liquid hydrocarbon fuels are still the best bet for the future. As shown in Figure 1, dependence on crude oil for military fuels creates uncertainty as a result of the inequitable worldwide distribution of this resource. Unfortunately, national dependence on crude oil contributes to world tension, increasing the need for military forces.

Referring to Figure 2, the distribution problem is largely resolved if one could consider coal as the source of these liquid hydrocarbon fuels. For this reason, the Department of Defense is vitally interested in coal-liquefaction efforts of the Energy Research and Development Administration (ERDA) and those of other nations. From a practical point of view, however, liquid fuels prepared from coal will be expensive; they must compete with direct use of coal as a fuel; and they will give rise to the environmental problems associated with mining coal.

The alternatives of special interest to the citizens of Colorado and Utah are tar sands and oil shale, the distribution of which is shown in Figures 3 and 4. While

U.S. reserves of tar sands are relatively small, they could be very important to the security of the nation and the western hemisphere. Navy testing of Canadian tar sands products suggests an exceptionally good yield of high flashpoint, nonaromatic jet fuel. These fuels are essential for safety aboard ship and very desirable in all aircraft operations. Thus, even the small U.S. resources could be an important source of military operational fuels. The technology developed in utilizing U.S. resources might be the basis for substantial development of South American resources so that their full potential could be realized for western hemisphere security.

It is oil shale, however, that gives the real edge to the United States. This tremendous resource at almost the geographical center of the United States is probably the most important long-term source of liquid hydrocarbon fuel available to the nation. Recent testing of fuels derived from shale oils from the Naval Petroleum and Oil Shale Reserves shows that oil shale is an excellent source of military operational fuels. There may be some special refining problems; but, in general, the work of the Bureau of Mines and of industry over the past decade has demonstrated that we could rely on oil shale as a source of fuel for the Department of Defense and related critical industries.

In summary, as shown in Figure 5, this abundance of oil shale gives the United States an overall edge in the aggregate of important fossil fuels available in the world. It should be noted that in this aggregate, America does possess one-third of the world's recoverable resources to match our present one-third of the world's demand. Perhaps more importantly, the availability of technology to efficiently utilize all sources of fossil fuel presents a world map with far better distribution of these critical resources. This distribution will, in itself, help to promote world stability, thus enhancing our own national security.

The key edge in resources—the ace in the hole—lies in western Colorado and Utah.

(The opinions reflected in this article are those of the author and do not necessarily reflect those of the Dept. of Defense.)

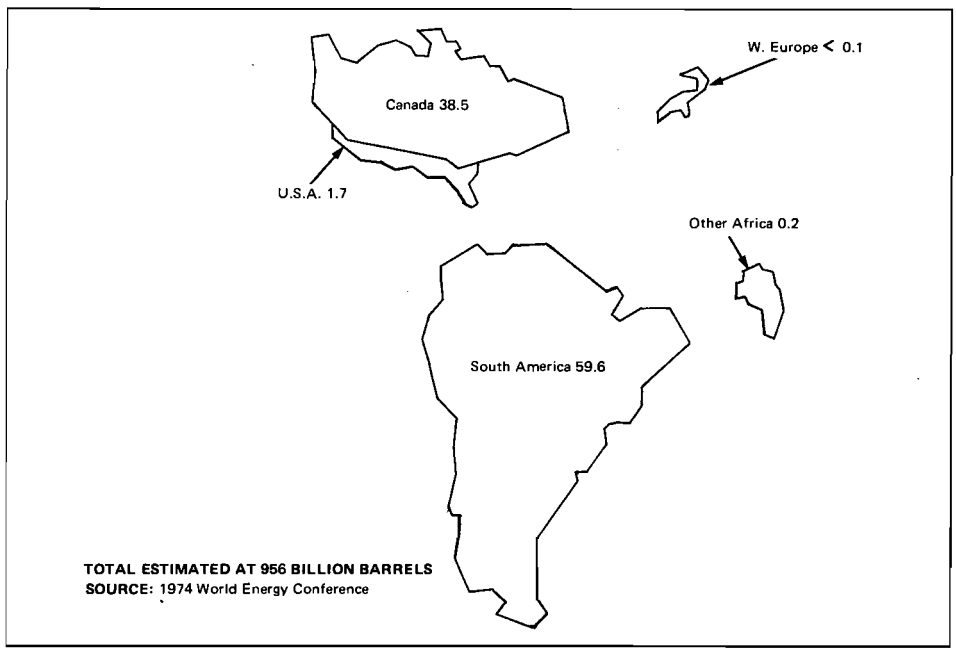


Figure 3—World Recoverable Tar Sands

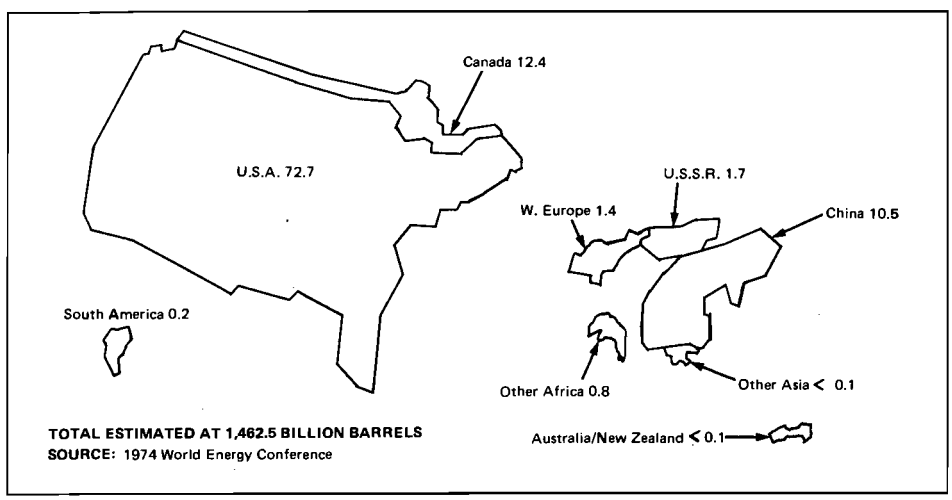


Figure 4—World Recoverable Oil Shale

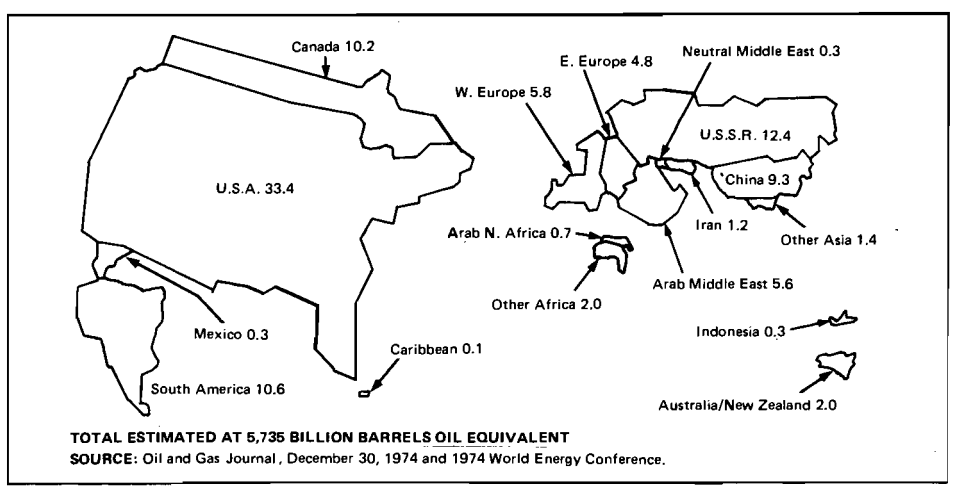


Figure 5—World Recoverable Fossil Fuel

Potpourri

Digging Into Shale's Rocky Past

Almost everyone in shale country is familiar with the story of Mike Callahan, who in 1882, accidentally discovered oil shale in Rio Blanco County. According to legend, Callahan invited a few neighbors to his housewarming, which turned out to be more literal than he had expected. Unwittingly, Callahan had built the fireplace from shale rock found in the area—and when he lit the fire the cabin went up in flames.

The discovery of "the rock that burns" may have brought Callahan fame, but it certainly did not bring him fortune. Shale development has always been marked by ups and downs—mostly downs. For example, according to Paul Russell, research director with the Bureau of Mines in Denver, "Oil shale was not new. The Mormons at Juab, Utah, produced oil from shale as early as 1855." And back East, 53 companies were producing oil from various bituminous substances, including oil shale, by 1860. But, two decades later, the budding petroleum industry in Pennsylvania already had ruined the incentive for developing an oil-shale industry.

Interest in shale died down after Callahan's time, and wasn't reawakened until 1913, when the U.S. Geological Survey began investigating shale reserves in the Green River area. During the summers of 1915 and 1916, the USGS sent Geologist Dean Winchester out West to survey the shale lands. Winchester calculated that approximately 40 billion barrels of oil were available from shale in the area.

Winchester's report was the beginning of an oil-shale boom. Speculators rushed to the Western Slope in droves, and under the 1872 Mining Law, approximately 30,000 claims were staked—some on top of each other. The 1920 Mineral Leasing Act brought an end to most of the claim-jumping, but by this time many land titles were in dispute, and Russell points out that repercussions are still being felt today. "Unless the proper fees have been paid and the proper assessment work has been done, the government considers all claims prior to 1920 invalid."

World War I and threats of an oil shortage gave further impetus to the oil-shale boom. People were lured by the magic of the word "oil" itself—not realizing, of course, that developing oil shale had little relationship to discovering crude oil. And many of those who plunked their money down on oil shale were not able to distinguish between investment and speculation. Often they were taken in by fake promotion. There were at one time, for example, more than 100 companies apparently organized solely to bilk the gullible public with phony oil-shale stock.

Further hampering the development of oil-shale were the unanticipated problems encountered by the shale prospectors. Everyone, for example, expected to use coal mining methods on oil shale, but these were never tried. There were many designs for retorts—few of which worked well. And, unlike gold, an oil-shale claim couldn't be worked by a single man. During the early 1920s, there were some 200 oil-shale companies in existence, many made up of four or five operators who sank their savings into these ventures. By the end of the decade, most of these companies had either dissolved or gone bankrupt.

Despite such problems, interest in oil shale ran high during the 20s. For instance, in 1925 the Bureau of Mines started a project near Rifle, in an attempt to determine equipment and methods for retorting shale. But they couldn't compete with the East Texas oil fields and the project closed down in 1929. It didn't matter much anyway. By this time interest in oil shale had almost disappeared—killed by fake promoters, the Depression and once again, new discoveries of low-cost oil.

But oil-shale interest experienced a reincarnation. The advent of World War II brought fears of an oil shortage and so oil shale came back to the front burner. The Bureau of Mines began yet another project for the Navy and opened a mine at Anvil Points in 1944. Activities were discontinued in 1956, however, when Congress refused to make any more appropriations for the project. The research done at Anvil Points did prove valuable, however, because as Russell explains, "While technology has improved, oil-shale mining methods and equipment design basically haven't changed much since the days of the shale pioneers of 1944–46."

During the Anvil Points era, and until the leasing of the federal oil-shale tracts in 1974, private industry made little effort to develop shale. But now, even though some of the obstacles encountered in the past still have to be dealt with, the future of oil-shale development appears to be bright. Improved technology is smoothing out some of the problems, and once again, high oil costs and lack of new oil sources are back in the picture. This time around, it looks as if oil shale is on its way to becoming a full-scale commercial industry. *K.C.*

President Ford comes to shale country (left to right) John Jones of Paraho, Ford, Harry Pforzheimer of Paraho, Sen. Gary Hart (D-Colo.).

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