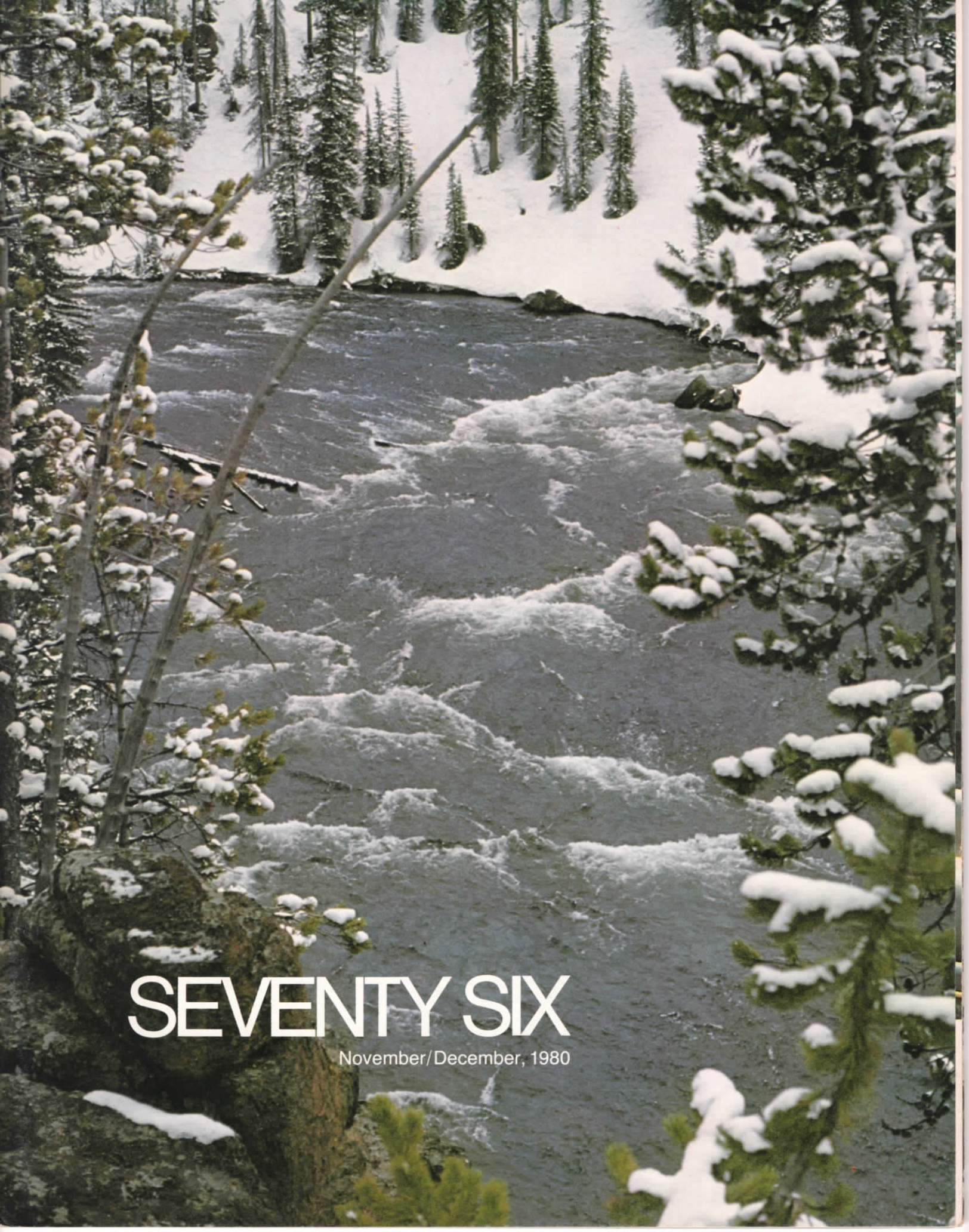


SEVENTY SIX

November/December, 1980

Brawley Geothermal Project on Stream

DEEP BELOW THE surface of the Imperial Valley in Southeastern California—where irrigation and agricultural knowledge have transformed a barren desert environment into fertile farmlands—are large reservoirs of salt water heated by the earth's magna.

The heat energy from one of these reservoirs, near the community of Brawley, is now being harnessed by Union Oil Company and sold to an electrical utility to generate electricity. In October, ceremonies were held to mark the start-up of the Brawley Geothermal-Electric Project.

This Union Oil project is the first venture to demonstrate the commercial use of the Imperial Valley's highly saline geothermal fluids to power an electrical generating plant. Union produces the geothermal energy from the Brawley reservoir using advanced technology and methods developed by the company. The company then sells the geothermal energy to Southern California Edison Company to power an electrical generating plant at Brawley.

More than 200 guests, including local, state and federal officials, as well as company and industry representatives, attended the ceremonies. The event was co-hosted by Fred L. Hartley, chairman and president of Union Oil Company, and William R. Gould, board chairman and chief executive officer, Southern California Edison.

Hartley said that the success of the Brawley project will mean that Union has unlocked the secret to tapping the geothermal energy potential of the Imperial Valley.

"The valley has been termed the 'Saudi Arabia' of the world's geothermal energy resources because of the vast potential which exists here," he said. "We began looking for ways to produce geothermal energy in the Imperial Valley in the 1960s. The challenge has been to develop the technology to produce it."

The Imperial Valley is believed to have one of the world's largest resources of geothermal energy which is potentially capable of powering more than three million kilowatts of electrical generating capacity.

Hartley noted that Union Oil is the world's largest producer of geothermal energy, serving as principal operator of northern California's Geysers Geothermal Field, the world's largest, and two major geothermal fields in the Philippines.

Fred L. Hartley (ctr.), president and chairman of Union Oil, and Carel Otte, president of the Geothermal Division, are interviewed by the press during dedication of the project in October.

Framed by huge vessels that reduce fluid pressure, Union geothermal engineers inspect the equipment at the Brawley plant.

The Brawley project is the first step by Union and Edison to develop and harness the geothermal resources of the Imperial Valley. Union holds leases on more than 10,000 acres of potentially productive lands in the Brawley area and has plans to produce enough geothermal energy to power Edison electrical generating plants with a total capacity of 460,000 kilowatts.

The initial 10,000 kilowatt demonstration plant produces enough electric power for a community of 6,000. Power is sold to the Imperial Irrigation District, the local electric utility in the Imperial Valley. Long-range development of the Brawley Geothermal Field could support generating facilities to meet the electrical needs of a community of approximately 300,000 people. A development of this magnitude would be in increments of 50,000 to 100,000 kilowatt generating plants.

Union is the geothermal energy producer, which includes drilling and operating of the wells, pipelines and other components of the resource production and injection system.

The geothermal fluids are brought to the surface under pressure and moved through a succession of vessels where the pressure is reduced, allowing a portion of

A Union Oil engineer adjusts a large valve at one of the nine wellheads that provide geothermal energy to the electric facility.

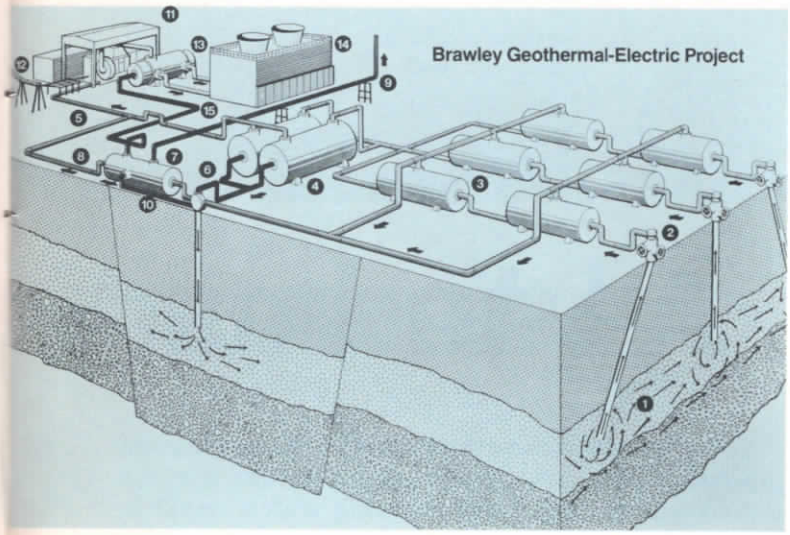
the fluid to "flash" into steam. The steam is cleaned and sold to Edison to power its turbine generator while the remaining fluids are injected back into the reservoir.

At Brawley, Union is demonstrating a continuously operating production system while evaluating methods of controlling the corrosion, scaling and injection-well plugging problems associated with the unique Imperial Valley geothermal fluids.

The power plant allows Edison to conduct performance and reliability studies on plant economics, operations and performance to optimize the design of future plants.

In addition to Brawley, Union and Edison are developing another geothermal energy project near Niland, south of the Salton Sea. Union has a half interest in 30,000 acres of geothermal lands in the area and will operate the geothermal energy production facilities. Other members of the resource venture at Niland include Southern Pacific Land Company and Mono Power Company, a wholly owned Edison subsidiary.

Edison plans to build a 10,000-kilowatt generating plant at Niland to utilize geothermal energy purchased from Union. (76)



Hot geothermal fluids **(1)** *circulate within the underground reservoir. Wells* **(2)** *penetrate the caprock into the reservoir and bring the fluids to the surface. The fluid pressure is reduced by a system developed by Union Oil which utilizes a series of large vessels* **(3)**, *"flashing" off the noncondensable hot gases. A second series of vessels* **(4)** *reduce pressure further, to "flash" steam which is delivered* **(5)** *to Edison. The remaining fluids, containing the "difficult" saline and mineral constituents which have hampered development of Imperial Valley geothermal resources, are injected* **(6)** *back into the reservoir. The hot noncondensable gases enter a reheater* **(7)** *where they are used to reheat condensate returned from the power plant. Steam produced by this process is also delivered* **(8)** *to Edison's turbine. The remaining gases are vented* **(9)** *and fluids are reinjected* **(10)**. *In the power plant* **(11)**, *the geothermal steam enters the turbine generator and electricity generated is delivered to the Imperial Irrigation District* **(12)**. *The steam from the turbine is cooled in the condenser* **(13)** *using fluids from the cooling tower* **(14)**. *The resulting condensate is returned* **(15)** *to Union.*

UNION LEADS INDUSTRY IN GEOTHERMAL DEVELOPMENT

Union Oil Company of California is the world's largest producer of geothermal energy, supplying natural steam to power nearly 1.2 million kilowatts of generating capacity in the United States and in the Philippines.

Many of the technical accomplishments which have made geothermal energy a practical energy source have been adapted by Union from the technology it developed in the petroleum industry. The application of basic earth science disciplines such as geology, geophysics and engineering, as well as specific techniques such as reservoir engineering, have made it possible for Union to develop new technology and move quickly from the research phase to commercial operations.

The Brawley Geothermal-Electric Demonstration Project is the latest step in this technological evolution. Using the knowledge gained from experience in operating at The Geysers in northern California, Union has been able to tackle and overcome the problems associated with the Imperial Valley's highly saline geothermal fluids.

Union is the principal operator of The Geysers Geothermal Field, 90 miles north of San Francisco, the world's largest and most successful geothermal development. Union's production facilities supply natural steam for 746,000 kilowatts of installed generating capacity operated by a public utility. Facilities to supply steam for another 220,000 kilowatts of generating capacity is under construction.

In the Philippines, Union is developing two major geothermal fields on Luzon under an agreement with the government-owned National Power Corporation. At Tiwi, 200 miles southeast of Manila, and Los Banos, 35 miles south of Manila, Union is producing steam to power a total of 440,000 kilowatts of generating capacity, supplying 15 percent of the electrical power for Luzon Island with an additional 110,000 kilowatts under construction.

Union is also developing a geothermal project in the Jemez Mountains of northern New Mexico with a local public utility under a cost-sharing contract from the U.S. Department of Energy. Union wells will provide steam to power a 50,000 kilowatt demonstration generating plant that is expected to be completed in 1982.

The Imperial Valley provides the greatest challenge to the geothermal industry because of the highly saline geothermal fluids. At Brawley, as well as Niland, near the Salton Sea, Union is applying new methods of handling these fluids and extracting heat from them for use in electrical generating plants.

Union holds leases on approximately 125,000 acres in the Imperial Valley. Union's leaseholds encompass four major geothermal anomalies in the valley—Salton Sea, Brawley, Heber and East Mesa.

In addition, Union is exploring for new geothermal reservoirs in Utah, Idaho, Nevada and Oregon as well as Japan and Indonesia.

A Landmark

How many universities can boast a campus building where two presidents were nominated by their political parties to run for election, a stage on which Caruso sang or its being designed and built by two of Chicago's legendary architects? Most modern universities are housed in new brick and cement structures located on sprawling suburban campuses. But Roosevelt University, founded in 1945, is housed in a building more than twice its age in downtown Chicago—a building that was considered the zenith of the modern architectural avant-garde at the turn of the century by men like Frank Lloyd Wright.

"Moving into this building," says Rolf Weil, who has shouldered the duties of president of Roosevelt University for 15 years, "was probably one of the luckiest decisions ever made. In 1947, when university administrators decided to buy the Auditorium Building, it had no future." The old hotel, office building and theater complex was not modern enough to benefit from rebuilding. It was a white elephant, bankrupt with huge back property taxes.

But university officials not only looked at the building for its vast size—it sits on more than one-and-a-third acres—and for the rooms which could be converted to classrooms, labs and library space. They eagerly eyed its prime location. "We are literally in the center of Chicago's 'cultural crescent,'" says Weil. "To the south is the Field Museum of Natural History, the Shedd Aquarium and the Adler Planetarium. Within this building is one of the greatest opera houses ever constructed. To the west is one of the largest business centers in the country and to the north is the Art Institute of Chicago, Orchestra Hall and Chicago's Magnificent Mile.

"The modern university concept," continues Weil, "started in the Middle Ages in the cities: the University of Paris, the University of Bologna." Roosevelt University follows a similar philosophy to those formal education beginnings and recognizes its responsibility to provide an educational opportunity at a time and place convenient to its potential students. One of the basic tenets of Roosevelt is to provide an opportunity for

Left: Historic building houses a contemporary university. Above: Giant ornate arches punctuate the restored lobby.

University

upward mobility for any student who shows the potential to achieve. Founded in 1945, the idea of admitting students on their academic merit alone was unusual. In the last five years Union Oil Foundation has helped foster this idea by giving scholarships to accounting and minority students.

But that wasn't Roosevelt's only strange new concept. Free from tradition the new school could afford to be daring. They also held the idea that class times should be convenient to urban students—even part-time students working their way through school—so they established Saturday and Sunday classes, besides the now normal evening classes. Being an urban school, they decided their enrollment should reflect the various minorities which make up a cosmopolitan city. Years before it became a social concern they integrated ethnic and minority studies into their curriculum. Before teacher's unions and student movements demanded it they ran the school under a democratic governance.

First christened Roosevelt College, the school started its classes in a downtown office building easily able to accommodate its 1,500 enrollment. But as World War II ended and the veterans came marching home, the enrollment began to jump. In 1946 the school administrators began the search for a new home in downtown Chicago.

They found it in the neglected, abused Auditorium Building.

Hailed as one of the finest works by Dankmar Adler and Louis Sullivan—leaders of the "Chicago School of Architecture"—the Auditorium Building was one of the forerunners of today's modern skyscrapers. For its first 40 years it was the cultural center of the Windy City. But when Roosevelt administrators explored the building it was already in its 57th year, an ancient structure by American standards.

Walking through the ten-story main building must have tested the hopeful buyers. Electric lights didn't work, plaster was falling, theater seats were missing. Luxurious hotel suites had been stripped. Sullivan's intricate stencil wall and ceiling decor was obliterated by paint. The stained glass windows of the main banquet room were veiled by black enamel. Only a person with an historical bent or the memory of an elephant would remember that this was the building that secured Chicago's reputation as a modern architectural center. And only an optimist would ever think that this building could be restored as a mecca of higher learning.

Ferdinand Peck, a Chicago businessman, recognized Chicago's need for an opera house. But he also knew that culture and the arts often need to be subsidized. So in 1886, when he commissioned Adler and Sullivan to build a new theater, he specified a multipurpose office, hotel and auditorium building to help defray the theater's overhead. Fifteen years earlier the infamous fire that started in O'Leary's barn had destroyed more than 13,500 Chicago buildings, including every hall suitable for opera or conventions. In the preceding decade-and-a-half orchestras had performed in places as unlikely as the depot of the Chicago, Rock Island and Pacific Railroad. Peck was determined to change that image by building the greatest opera house in the world. He soon had organized the Auditorium Association to fund the project.

Adler and Sullivan submitted a portfolio of designs for the new building and the Association finally accepted one in which the design for the three divergent purposes formed a total unified mass—not a sum of busy, tiny decorative elements. Massive arches punctuated the facades and an office tower—soon to be the highest point in Chicago—dominated the design. Construction crews began the raft footings to anchor the building in Chicago's notorious sand, clay, water and gravel "mud" blanketing the bedrock in some places by more than 125 feet. They worked day and night—utilizing the new incandescent lamps invented in the preceding decade to keep the building on schedule—no mean feat when Peck, finding new funds, kept changing his mind and altering the plans until the building had grown in height

→

and doubled in size from the original plan.

The building still wasn't finished in 1888 when the Republican convention met in its confines roofed by canvas. Benjamin Harrison was nominated, and the next year, after being elected president, he returned to Chicago to christen the Auditorium Building, although construction actually continued into 1890. Later Theodore Roosevelt would be nominated to head his Bull Moose Party in this same building.

The opening of the structure established it as Adler and Sullivan's most famous building. The 4,200-seat auditorium was the largest permanent theater ever constructed. There were 400 luxury guest rooms—replete with a new fangled call system between the rooms and the main desk—136 offices and stores and the seventh floor housed a separate recital hall seating 500.

The building was a forerunner in engineering feats. It was one of the first buildings wired during its construction for electricity, boasting two electric light and power plants with 11 generators. It was the first basement waterproofed against pressure and had an elaborate hydraulic system for 13 elevators and 11 stage lifts. When built it was the most thoroughly fireproofed building in the country.

Sullivan's organic forms blossomed everywhere. They were molded in plaster, carved in rare hardwoods, grew in mosaic tile, cast iron stair rails and were pieced into leaded glass.

But Peck's theater was the crowing jewel in the architectural tiara. It occupied more than one-third of the new building. Its acoustics were perfect and a normal whisper on stage could be heard six stories up in the "peanut gallery." No supporting pillars marred the audience's view, and the arches and ornamental plaster were covered in elaborate 22-carat gold leaf and ivory enamel studded by hundreds of clear carbon filament lamps. It was a paragon of adaptability, too. Platforms raised the floor of the orchestra to stage height for large balls, banquets, sports events or conventions. The 98-foot wide and 62-foot deep stage—still one of the largest in the country—could be decreased in size by lowering a 10-and-a-half ton gold leaf reducing curtain to shrink the stage apron to a mere 75-feet wide (a normal stage is 47-feet wide).

And the glittering jewel wove its spell. Enrico Caruso, Lillian Russell, Sarah Bernhardt, George M. Cohen, Rimski-Korsakov and Will Rogers were among the famous who performed on the giant stage. Opera singer Dame Nellie Melba said, "I wish I could fold it up and take it with me everywhere, to open up for every performance."

But Frank Lloyd Wright, only a 21-year old draftsman in the firm of Adler and Sillivan when the structure was completed, summed it up when he later commented that the Auditorium Building was 50 years ahead of its time.

But in this country there is nothing more ancient than an old "new" building. In 1928, almost 40 years after its opening, the Chicago Opera Company moved. By the next year the Auditorium Association was bankrupt. The depression had hit Chicago. By the early 1930's the landowners were pricing demolition of the grand old building, but it cost more to remove it than the land was worth. It continued to operate on a minimal basis. Again 10 years later they estimated demolition costs—and again the building was saved only by the fact of being too costly to destroy. Reluctantly, during World War II, the city of Chicago took over the building modifying its giant spaces into a servicemen's center. While more than one million men were fed and entertained under its roof, the building was still deteriorating when the Roosevelt officials eyed it in 1946 as a lame and very grimy white elephant. Although it was not yet crippled, it would take a great deal of money, sweat and tender loving care to make the ivory and gold interior shine again.

Many Roosevelt professors—including business, journalism and chemistry—bring work experience into the classroom.

Purchasing the building, the great clean up began. Hotel rooms and offices became classrooms, faculty offices and labs. Old chimney flues were neatly converted to lab exhausts. The grand hotel dining room evolved into a library reading room, library stacks were placed in the four-story kitchens, storerooms and housekeepers' quarters. In some places up to 20 layers of paint were peeled back to reveal solid mahogany panels.

Through the years Roosevelt University's (as its name was changed in 1954) goals have remained the same. To provide an educational opportunity with a quality faculty and in a quality fashion. "But," as President Weil points out, "we had another problem of how to treat a national historic landmark with reverence; how to

Re-opening night drew 4,000 Chicagoans to the gold and ivory Auditorium Theater.

Most students work part or full time while attending classes.

change it from its original purpose into an educational institution without doing offense to the original architectural characteristics. It's a goal that is very important to the community."

It seems that Roosevelt has been able to accomplish both ends.

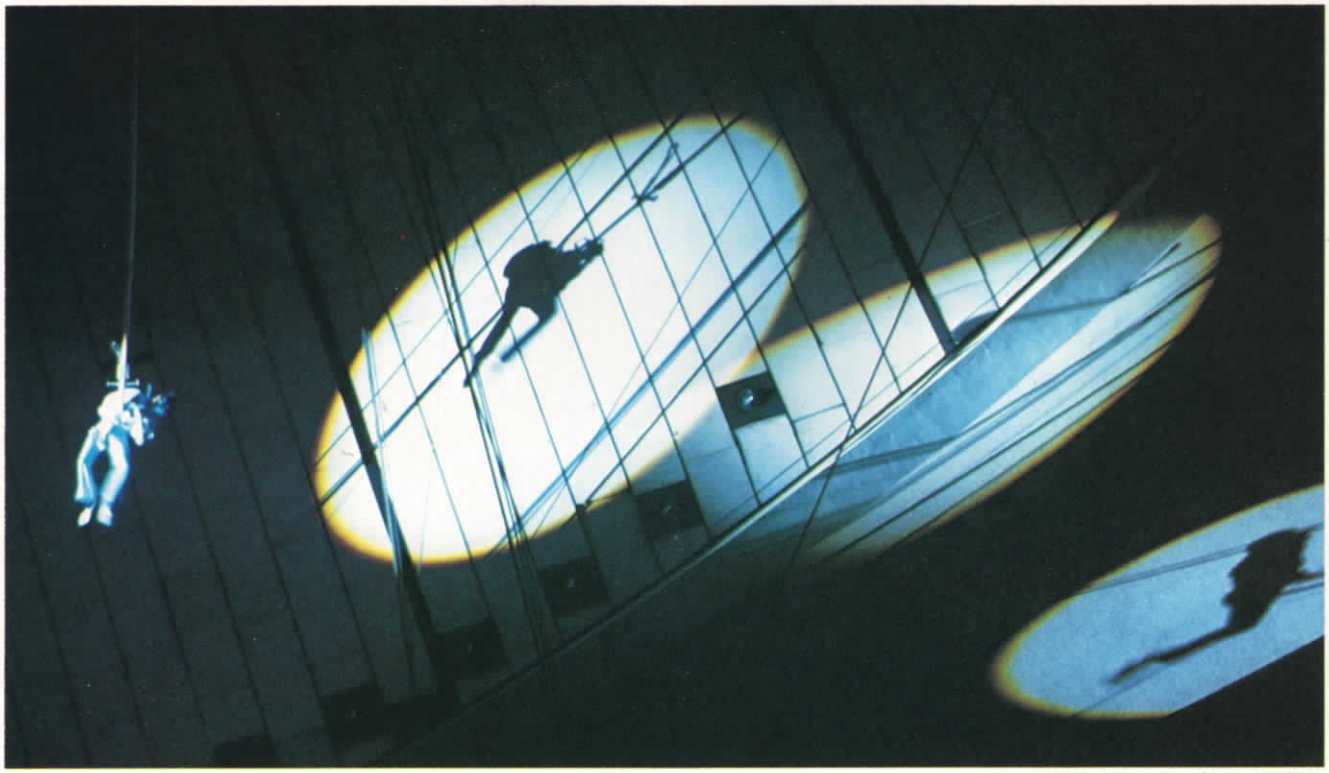
Since 1952, after agreeing to an easement by the city through the southern 20 feet of the building to widen one of Chicago's main thoroughfares in lieu of back taxes, the university has worked to raise special funds to both restore significant rooms within the building and to upgrade its own curriculum. While restoring lounges, the recital hall, the grand banquet room, the original hotel lobby, massive lead glass windows and the tower, the administrators have managed to operate the independent, non-sectarian, urban university on a balanced budget—unusual in today's climate of red ink universities.

But the university soon realized the abuse and neglect of the auditorium theater was beyond its finances. In 1960 the Roosevelt University Board of Trustees established the Auditorium Theater Council to restore and operate the massive theater. Careful research found the structure sound. Much of the 22-carat gold leaf only needed to be cleaned and some of Sullivan's original intertwining stencil designs were yet undamaged. Private donations and hard work allowed the theater to reopen its doors in 1967 to *A Midsummer Night's Dream* and 4,000 Chicagoans attended—some buying tickets for $250 each.

One well-known architectural historian says, "The building has earned a new acclaim as an example of how a landmark building can be preserved by adaptive use to serve contemporary needs."

Roosevelt has earned impressive marks in quality education, too. It is ranked among the top five percent of 2,800 colleges and universities whose graduates go on to earn a doctorate or a comparable degree. *Chemical and Engineering News* states that Roosevelt is among the top 25 institutions awarding Master of Science Degrees in chemistry. Its alumni are leaders in many fields, for example it includes a dean of the Graduate School and Management at Northwestern University, a president of a medical college, numerous international concert violinists and pianists, a director of the HEW Audit Agency, a professor of government at Columbia University and a metropolitan opera star. And Union Oil's participation has paid off in other ways as a number of Roosevelt graduates work in the company's accounting, tax and marketing areas. Not bad for a "newcomer" in the educational field with a brief 35-year history and a student body of 7,000. Especially when one more fact is cranked into these statistics: More than 90 percent of Roosevelt's student body are part-time students working their way through college.

Weil sums up, "The future of this country is intrinsically tied up with the future of its cities, their tensions, and the resolve of their people to find solutions to the problems of urban life. Roosevelt University remains a prototype institution of independent higher education in the city. Our teaching, research and public service are all directed toward making Chicago, our city, a better community for its many different kinds of people." 76



John Saunders, Jr.—Circus acrobats.

PHOTOGRAPHY CONTEST

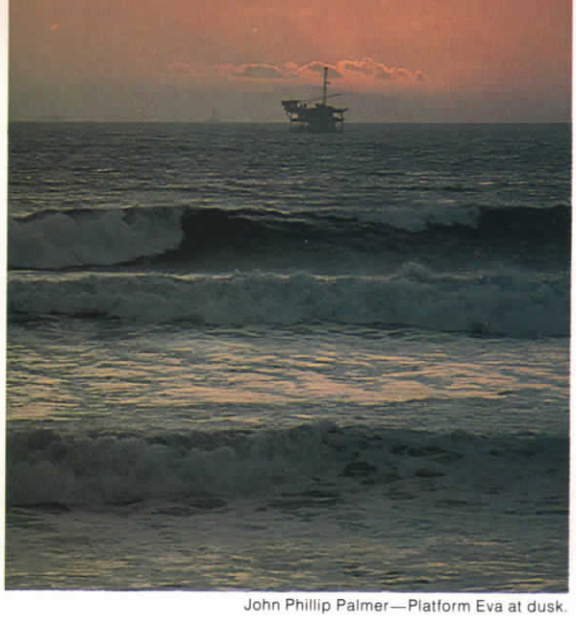
energy efficiency

ENERGY—NATURAL OR MANMADE—surrounds us. It may be the blurred motion of smoothly moving pistons in a finely tuned automobile engine, concentric ripples on a glassine pond generated by the plop of a pebble, or a lonely horse head pump steadily seesawing up and down as it produces crude oil in a field populated only by cattle. From a thundering waterfall, to a gentle sprinkler rinsing daffodil petals of dust—the possibilities are endless. Capture this theme—ENERGY EFFICIENCY—on film and you will have a good chance to win $400 in our photo contest.

Employees* and retirees of Union Oil, its subsidiaries and divisions, their spouses and children living at home, are eligible. There will be two categories and a total of 17 prizes, including a grand prize of $400, but a participant can win only one prize per category.

The seven highest award-winning photographs will be announced and published in the May/June issue of SEVENTY SIX.

**Staff of* SEVENTY SIX *and their immediate families are not eligible.*



John Phillip Palmer—Platform Eva at dusk.

Sergio Ortiz—Port-au-Prince street scene.

HOW TO ENTER:

Number of entries. There will be two categories—color and black and white. You may submit up to three entries in each category. For example, one color transparency and two color prints add up to three color entries—the total allowed for that category.

Mounting and labeling. Full 8 x 10 prints can be submitted unmounted, 5 x 7 prints must be attached to 8 x 10 single-weight mounting boards. No framed prints will be accepted. For your protection, slides should be mailed in the boxes that come with developed film, glassine envelopes or plastic mounts. Fill out the entry form then tape it to the back of each print. Do *not* write on the back of prints. Write your name and title of the entry on each slide mount. Each entry must be accompanied by a completed entry form or a facsimile of the form.

Mailing. Mail entries in Manila clasp envelopes, including your return address and entry forms. Include any cardboard necessary to protect photographs.

Liability. All entries are to be submitted with the understanding that neither Union Oil Company nor any of its employees will be responsible or liable for loss or damage. Entries may be held beyond the publication date of the contest, but we will attempt to return all entries.

Right to publish. Union Oil retains the right to publish or re-publish any photograph submitted in the contest. Entrants waive any claims for royalty payments or copyright infringement.

Model release. Contestants must be able to furnish a written "consent to use" statement upon request for recognizable people appearing in the photographs.

Judging. Three professional photographers from outside the company will judge the contest. Their decisions will be final.

Deadline. All entries must be mailed by midnight March 15, 1981.

Awards.

Grand Prize $400

Color

1st place $200
2nd place $100
3rd place . . . . . $ 50

Black-and-White

1st place $200
2nd place $100
3rd place . . . . . $ 50

Ten honorable mention awards of $25 each also will be given. These awards will be selected from both color and black-and-white entries.

Entry Form

Send to: Editor, M-17
Union Oil Center
Los Angeles, CA 90051

Name: _____

Job Title/relationship to employee: _____

Division/Subsidiary: _____

Office Location: _____

Home Address: _____ Zip code: _____

Phone: _____ (Network) _____

Title of Entry: _____ Print ☐ Slide ☐

I have read and agree to the official rules of the contest.

Signed: _____ Date: _____

If under 18, signature of parent or guardian: _____

Deadline: March 15, 1981

Better Refining Through

At the Union Oil refinery in Beaumont, Texas, there is a large building near the administration facilities where workers study the most basic of things—the elements. It is a clean, no-nonsense place, a chemical laboratory that not only houses sophisticated equipment capable of allowing scientists a glimpse at the precise composition of the various refinery products, but also to know the exact make-up of the raw materials being fed into the refinery's massive vessels.

This is a typical, albeit extremely modern facility that resembles its sister laboratories in the other Union Oil refineries in Chicago, San Francisco and Los Angeles.

Generally speaking, all the laboratories look alike, but their functions are varied and delicate. Rows of machines sitting on work benches perform exotic duties sometimes bubbling, sometimes using pressure to break down complicated blends into the basic chemical elements.

It is an exact science, that practiced by refinery chemists. It allows little room for error or speculation and, thanks to the task these highly trained scientists perform, engineers at the refinery can do a better job.

And what exactly does a refinery chemist do?

Jack E. Coler, laboratory supervisor at the Los Angeles refinery, and Denise Michaelson, chemist, work on an automatic titrator which tests gasoline for mercaptan content.

Chemistry

"We are not a research laboratory," explains O. B. Parham, resident chemist at the Union Oil refinery in Beaumont. "Our function is that of performing control work. In other words, what we do is to evaluate materials to control the operations of the plant. We test the raw materials we might use. Then we do testing on the unit streams to be sure that they meet all specifications for which they were designed. In addition we test all the diesels, gasolines, naphthas, the lube oil and the various petrochemicals produced here."

These control tests are all complicated procedures that require much time and know-how. Since a refinery's units operate continuously, the streams of production are tested at regular intervals.

"We must test the various streams to make sure they are producing to specification guidelines," Parham continues. "We, too, must monitor the product streams at various stages to ascertain the result will be that of proper blends."

For these duties, Parham relies on a staff consisting of six supervisors, 42 technicians and assistants—workers who constantly monitor all facets of operations from the entire refinery.

Some 2,000 miles from Beaumont, the San Francisco Union Oil refinery fronts the estuary known as San Pablo Bay. There, another large laboratory serves that refinery in a similar way as the lab in Texas.

"Our laboratory function here is split into two paths," explains Fred Swingle, foreman of the chemical lab. "One half of the laboratory is the inspection lab where physical tests of various substances are conducted. We work closely on things like density, boiling range and viscosity, which do not involve much chemical reaction. The other half is the chemistry section where we test chemical reactions of more volatile materials. A great deal of work in the chemistry lab is very technical."

Prime concern in the laboratories, as most technicians and chemists will agree, is to have persistent quality control. But in all of the Union Oil facilities, the task of ensuring an ideal co-habitation between industry and environmental

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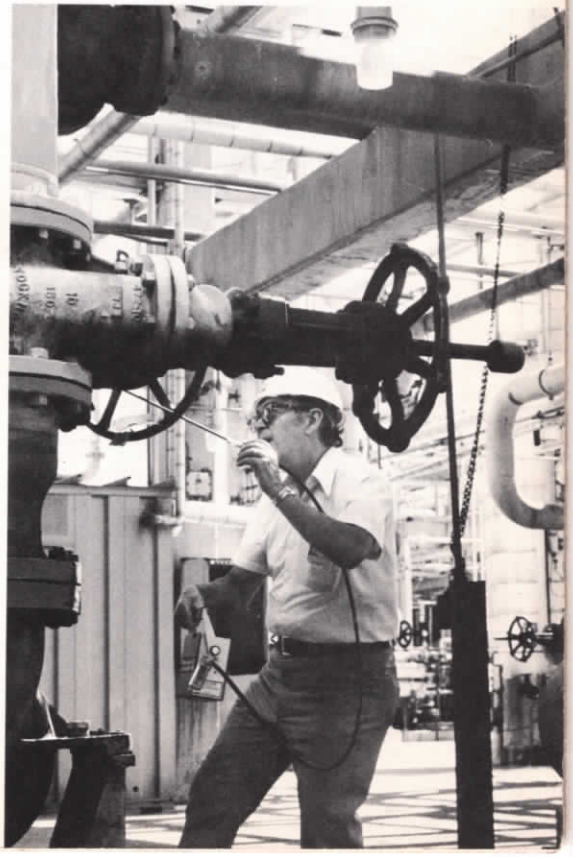
Betty Kimmich, at the San Francisco refinery, was one of first women chemists hired.



At the Chicago refinery, Don Scully, a chemist, gathers gas samples in the refinery for later chromatography tests in the chemistry laboratory.

standards also takes precedence.

Betty Kimmich, a 37-year veteran with Union at the San Francisco refinery, generally serves as the laboratory's coordinator for the Regional Water Quality Control Board samples.

"My role in the laboratory is to determine that the water discharged from the refinery is about as clean as the Bay water we bring in," says Kimmich, who was one of the first women hired as a chemist during World War II.

Water is an essential tool in any refinery since it is used in a great variety of processes and to heat and cool many units within the complex.

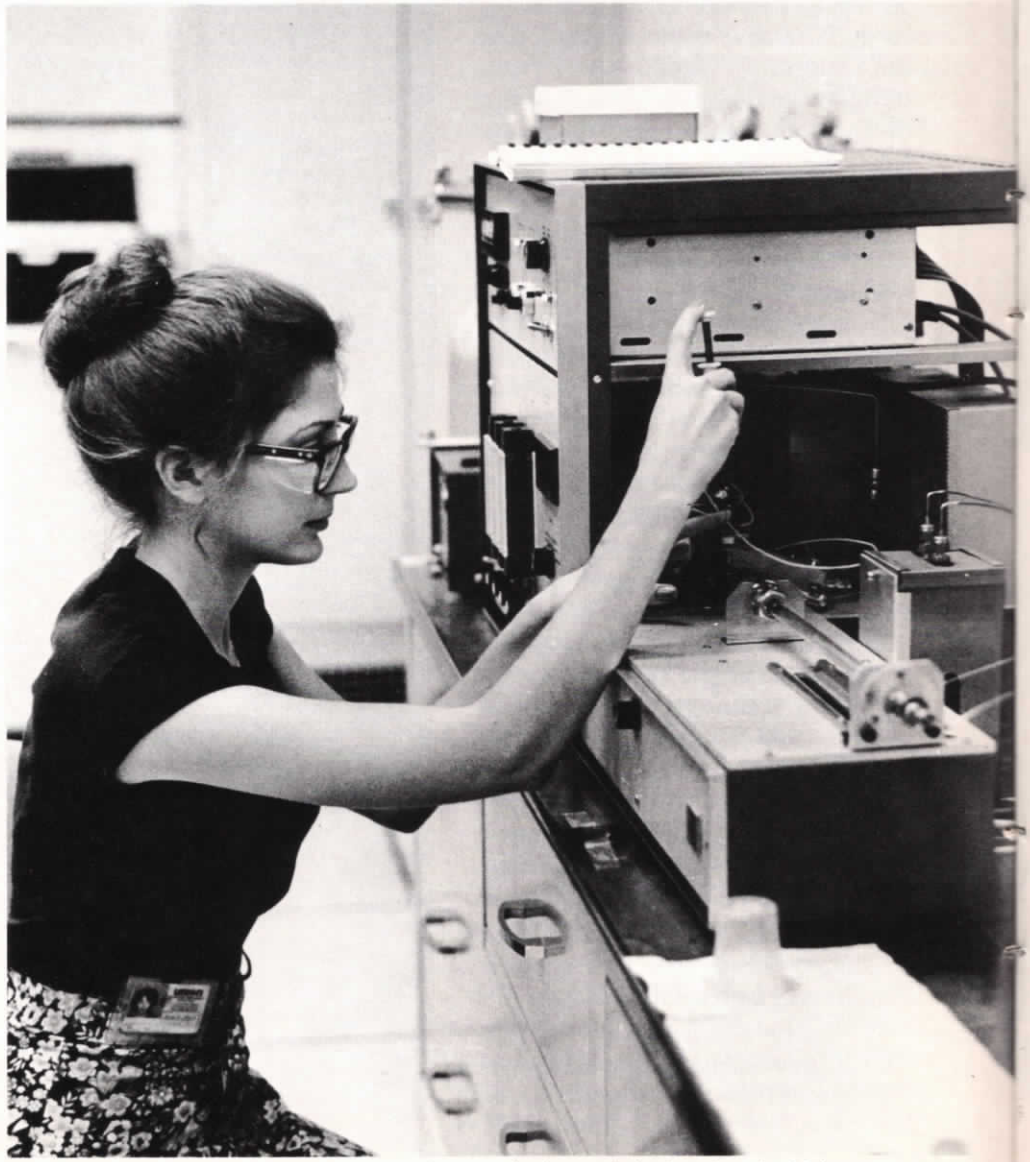
At the San Francisco refinery, two chemists take a boat into the water every month to conduct tests of quality of the water at San Pablo Bay. Union has been monitoring the bay's water quality since the 1940's.

"Over the years the company has done a tremendous amount of improvement as far as reducing water pollutants, both natural and man-made, in the bay," says Kimmich. "We constantly study both the oil and acidity contents in the water."

Since the San Francisco refinery relies heavily on water from the bay, its problems are similar to those in the other refineries. The Los Angeles refinery uses the municipal sewage system to dispose of its waste water, which must be treated before discharging.

At Chicago, waste water treating

Testing the water quality near the San Francisco refinery is Jeff Wheeler.



Mary Dauzvardis, Chicago chemist, works on a fuel sample in the chemical laboratory.

facilities within the refinery give primary and secondary treatment to the refinery effluent waters to the degree needed to meet effluent standards. In addition, all Union Oil refineries go to great extents to ensure that water collected in drain ditches after a rainfall is thoroughly cleaned.

It is up to chemists, therefore, to analyze the various samples of water taken to see what effects the refinery's output has on the acquatic life of the bays and rivers nearby.

"Anyone discharging waste or water into a body of water must meet certain government criteria," Kimmich adds. "Like everything else in the refinery, we keep a regular sampling schedule to test the water in the bay."

At one time, the analytical work on environmental samples at the San Francisco refinery was parceled out to private laboratories, but soon it became evident that it was more convenient and economical to have full time chemists at the refineries involved in this type of work.

According to Swingle, strict observance of environmental standards "take up about one-fourth of our (laboratory's) time. This is time," he adds, "when the chemists are directly involved in the National Pollution Discharge Elimination System (NPDES) requirements. That is why the chemists themselves are directly involved in reading, studying and interpreting the regulations."

Like the other refineries, Union's Chicago facility is heavily concerned with environmental matters. "We have a pollution van equipped to monitor the air for a number of parameters and we move this van around the refinery to test the presence of pollutants," explains William "Bill" E. Vreuls, supervisor of the laboratory.

In addition, this van is often dispatched around the neighborhood to see that the air in the surrounding area is of acceptable quality. Like the other chemists, Vreuls and his staff of 20, also perform intricate studies of water pollution.

"Water for the refinery comes out of the Metropolitan Sanitary District canal and it flows eventually to the Illinois River, rather than to Lake Michigan," he adds. "Usually

Scully works with a mobile lab recording air quality around the Chicago refinery.

we get water—and there are occasions when we may use up to three and a half million gallons per day—that is actually more polluted than when we return it. All this is thanks to the efforts we have made in water studies to break the chemical make-up and find ways to eliminate undesirable materials."

All of the Union Oil refineries keep abreast of the technology which is constantly being either renovated or introduced in their fields.

"I make certain that we go out to seminars or visit manufacturers who have new instruments we might use," Vreuls continues.

This is a statement to which Parham in Beaumont would agree. "We also are constantly on the alert for advances in technology," he says. "If we see something that is new and can help us do our job better, we try to get it."

At the Los Angeles refinery, the duties of the chemists are the same as in the others. Jack E. Coler, laboratory supervisor, explains, "Essentially the Los Angeles refinery is what we call a fuels refinery. The major products are various fuels such as diesel, gasoline, fuel oil and jet fuels.

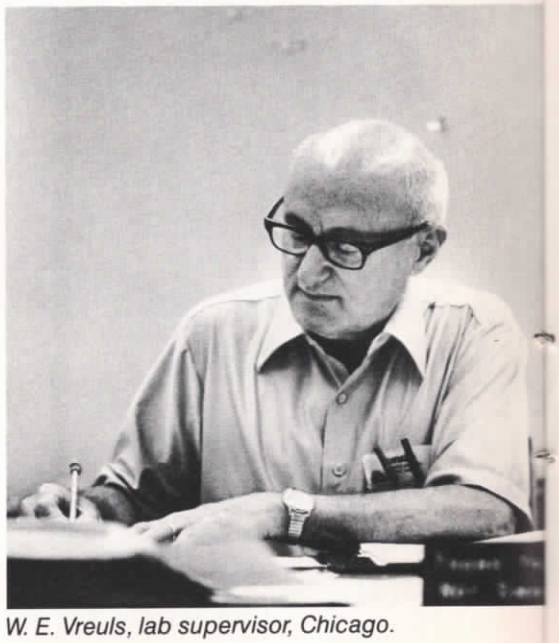
"The chemists at the Los Angeles refinery are concerned with quality assurance as far as the chemical aspect of our products is concerned," Coler explains.

The Los Angeles refinery presents a unique problem. It is a sprawling complex designed to handle a variety of crude oils. "We get crudes from all four corners of the world," Coler says, "and they are mixed when processed in the crude distillation units. These crudes have certain specifications, whether it is boiling range, flash point, octane ratings, and many variations.

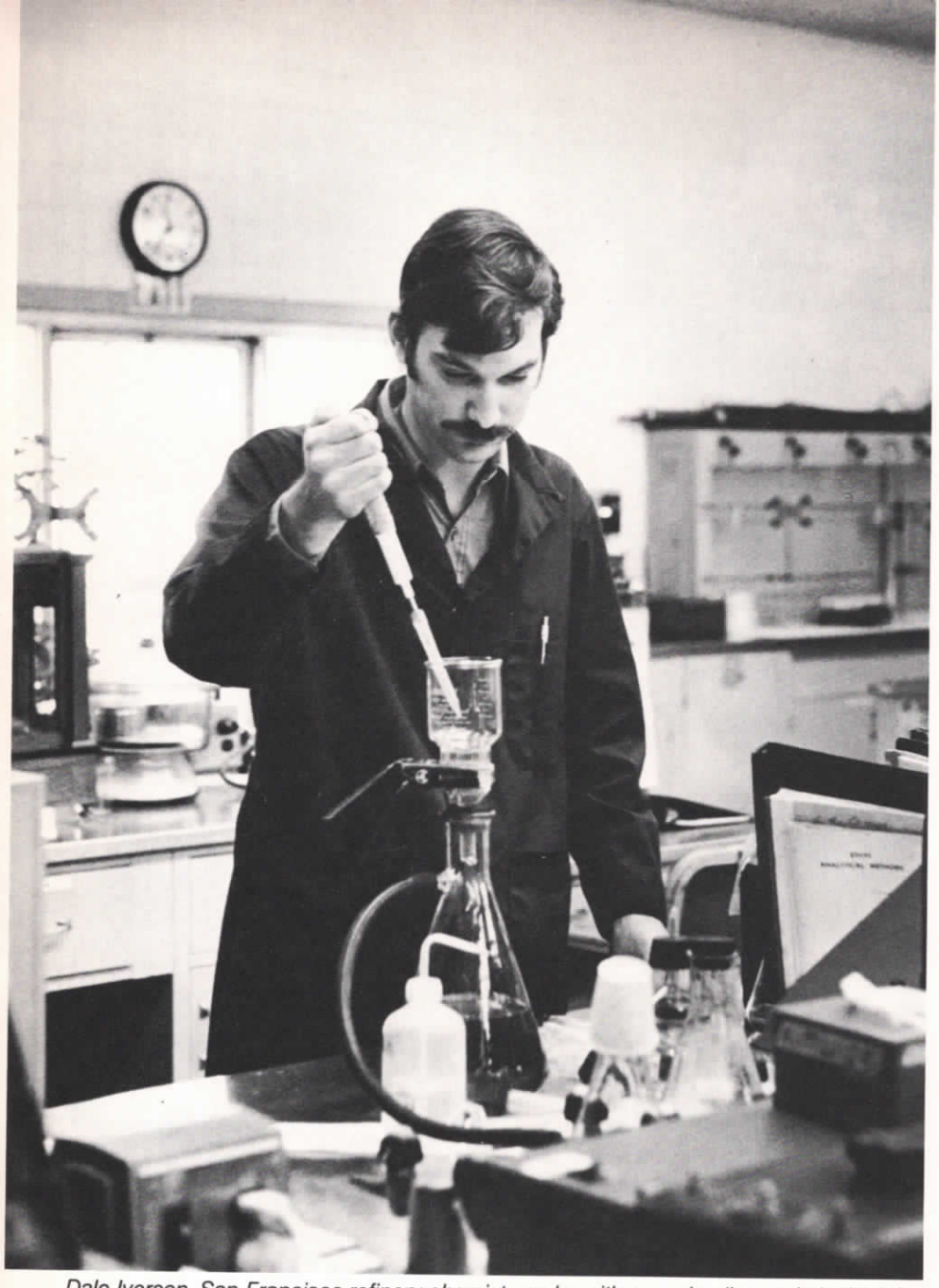
"We are primarily concerned with quality assurance, to let a unit operator know when he needs to change the operation of his unit to keep his products (on grade).

He relies on a staff of nine chemists and 30 petroleum inspectors workers who worked in the inspection laboratory.

O. B. Parham, resident chemist at Beaumont, inspects a machine that tests oils.



W. E. Vreuls, lab supervisor, Chicago.



Dale Iverson, San Francisco refinery chemist, works with a crude oil sample in the lab.

Like the other refineries, the Los Angeles refinery laboratory has two sections, the chemical lab and the inspection laboratory.

In the inspection lab the physical aspects of a sample are tested. These are items like flash point distillation, pour point and vapor pressure. The analytical lab tests the chemical aspects of a sample. There, workers can determine the exact make-up of the final products.

Like in most sciences, refinery chemists rely on modern, sophisticated equipment that makes their task easier.

In Beaumont, Parham claims that instrumental analyses have undergone a radical change. "This new technology," he says, "is one of the most dramatic things that I have seen. For example, when I first came to work for Union Oil, we were doing gas analyses by low temperature distillations, using liquid nitrogen to literally refrigerate the samples. This way we could liquefy all our gas samples and then allow them to warm up and fractionate in order to catch the gases and measure them for analysis.

"This was a literal break-down of the different gases. Then chromatography came along."

Chromatography is a very complicated process that, through the aid of computers, allows the chemists to determine the composition of various samples.

"The computer picks up various traces and calculates the make-up," Parham continues, "thus allowing us to run a gas analysis in from 20 minutes to an hour for some of the larger, more complicated mixtures. In the old days that whole thing would have taken us anywhere from six to 24 hours for one sample."

According to Vreuls in Chicago, the science of chemistry is a must in order to run a refinery in an efficient manner. "Sometimes a gasoline might be tested six or seven times to ensure it meets specifications," he says. "We check the blender unit and we will check the product while it's in the finished storage tank. We might even recheck the gasoline after it's shipped. All that takes time and patience."

And it is know-how, accuracy and patience that can make the difference in the chemistry lab. Thousands of samples are evaluated each week in the four refineries allowing the staff to inform engineers of what is going on in the chemical world.

Symbols from ancient China, massive gilded lions guard an inner palace doorway in Beijing's famous Forbidden City.

Union Oil employees assemble at an oil camp near Dunhuang for the day's activities. L–R: Roland Krueger, Chung Yu, Vance Lynch and Doyle Paul.

Thirty-Two Days in China

FOR MOST PEOPLE, it's an elusive dream to explore the country of China. The site of the oldest continuing civilization on earth, China shelters almost one billion people. Since 1292, when Marco Polo first returned to tell fellow Italians about his odyssey to Cathay, as it was called in the Middle Ages after a Chinese dynasty of Mongolian origin, the third largest country in the world has teased the imagination of men and women. But, to seven employees of the Union Oil Company, visiting sections of China rarely seen by foreigners has become a reality.

Last September the China National Oil and Gas Exploration and Development Corporation wrote to Union Oil Company asking if it would consider sending a delegation to see and analyze its petroleum operations in four geological basins in the interior of China. The following month six members of the International Division and a representative of the Science and Technology Division arrived in Beijing. They were W. K. Lewright, vice president of operations; W. A. Sax, vice president of

The People's Hall, where China's congress meets, is the hub of the country's modern political system as well as a cultural center.

exploration; Doyle Paul, chief geologist; Ben Talley, director of drilling; Vance Lynch, chief geophysicist; Chung Yu, petroleum engineer; and Roland Krueger, supervisor of production mechanics, the Science and Technology Division.

In the next 32 days they would travel by air, rail and roadway more than 6,000 miles, from Beijing in the east, to Xian and on to Karamay and Kashi in the western Xinjiang-Uygur Autonomous Region. Visiting cities, oil camps, production facilities, producing wells, outcrops, carpet factories and temple caves, it would be a journey not to be forgotten.

And for one member of the party it was more than just a chance to visit a country with strange sounding names. It was an opportunity to travel to his homeland. This was the first chance Chung Yu had to see the land of his birth since he and his family had left it when he was four years old. Since that time, he only had returned once, and that, too, was a Union Oil business trip. During that whirlwind trip he saw only a glimpse of his native land.

"This was my first real trip to mainland China," says Yu, five years with Union Oil. He was born in Shandong Province on the peninsula near Korea, speaks Chinese, was educated in the United States and has no relatives in China today.

The first impression of the group was the "fantastic

Camel carts are common work vehicles in western China.

Many people live in cave houses dug into the hillside. Often these are passed on in a family for two or three hundred years.

At Yecheng oil camp the group visited a blowout well during their trip to see and analyze China's petroleum operations.

number" of people. "We landed late in the afternoon and it was almost dark as we drove to the hotel. The streets were crowded with people walking and on bicycles," Krueger says.

That evening the seven were guests at a Beijing ballet. Watching *Swan Lake,* the men were surprised when, between acts, singers, violinists, opera singers and a string ensemble performed classical music. "It was more of a variety show," says Sax. "It was a pleasurable evening, except we were still suffering jet lag."

The journey through China started with briefings of sites to be visited and of China's exploration and production problems. Yu comments, "The Chinese company emphasized to us that it wanted to learn from us for their own self-reliance.

"They have a great respect for the United States petroleum technology," says Yu. The entire group stresses that being candid with the Chinese delegates about oil exploration and production problems was important. If possible they would try to point out workable solutions using knowledge and materials the Chinese already owned, instead of hypothetical answers about what they would do if they were in the U.S.

Zigzagging across China via short air hops, long train rides and minibus the seven oilmen explored outcrops, studied producing fields, stood in the black misty, shower of a blowout well and discussed reservoir production and drilling engineering with their Chinese counterparts. And, at the same time, they learned more about a country which had been a nebulous entity to Americans until it opened its borders to U.S. passports in 1971.

All of China is on one time zone—even though it is wider than the United States. "They just adjust their work schedules to fit the daylight hours," says Krueger. Yu questioned an interpreter and he explained, "It started this way. If we changed it now everybody would be confused."

While in Beijing several of the men found time to visit legendary sights such as the imperial palace of the Ming and Qing dynasties, the Forbidden City. Before the revolution of 1911, ordinary people were not allowed near, much less in, the expansive royal grounds. Today the palace serves as a museum and houses part of the imperial collection, including gold bells, jade chimes, a dragon robe made of peacock feathers and a five-ton jade nugget carved into a "jade mountain."

"China's congress meets in the People's Hall," says Yu. "The hall is huge and its many rooms are each named for a particular province or part of China. Each

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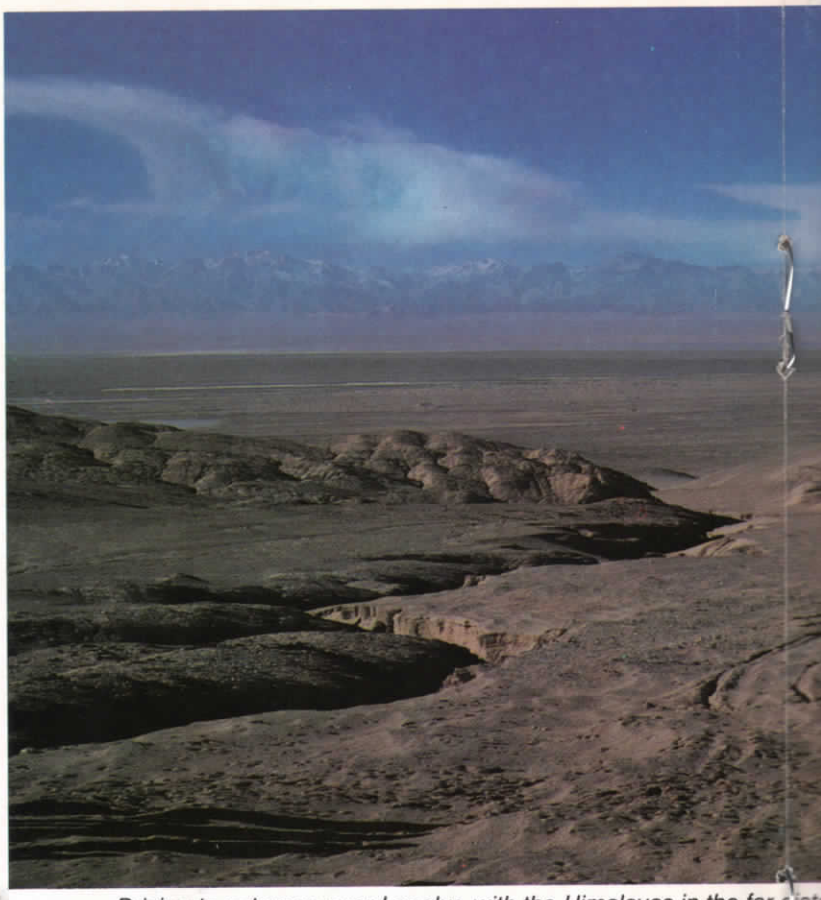
room displays the handicrafts or art that is unique to the particular region for which it is named."

Each city or stop brought new experiences. Leaving Xian, the ancient capital of China, they drove by clusters of dwellings carved out of the side of hills. In some places they saw how people had excavated a courtyard and then dug back into the earth to create a home. It was explained that often these cave houses would be passed on for two or three hundred years within one family. "We saw more than 100,000 of these homes," says Sax. Later, in an oil camp, the Union Oil delegation ate in a dining hall "cave" which they found pleasant, if windowless. "This particular dining area," Sax adds, "had been one of Mao's headquarters in the late '40's during the revolution."

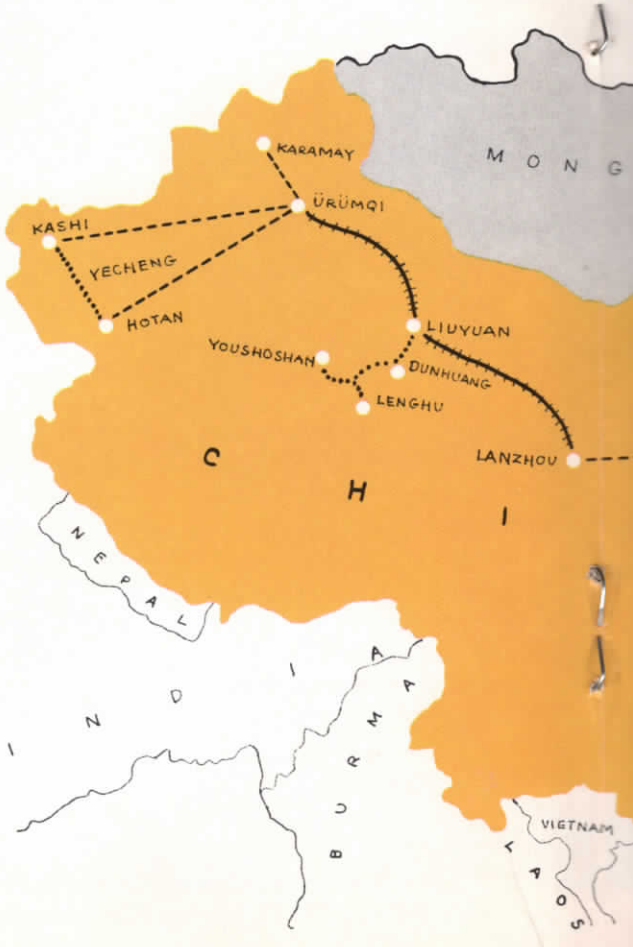
The further they journeyed from Beijing, the more of a street-blocking curiosity they became to the people of China. "In Qingyang," says Sax, "we went for a walk. We were standing on a corner sightseeing for less than five minutes when more than 300 people gathered around us. We went into a department store and there must have been 75 people following us up and down the aisles. They are a mixture of shy and bold. They came very near us to look, but if we tried to take their picture they would hurry away."

All seven agreed that wherever they went the Chinese

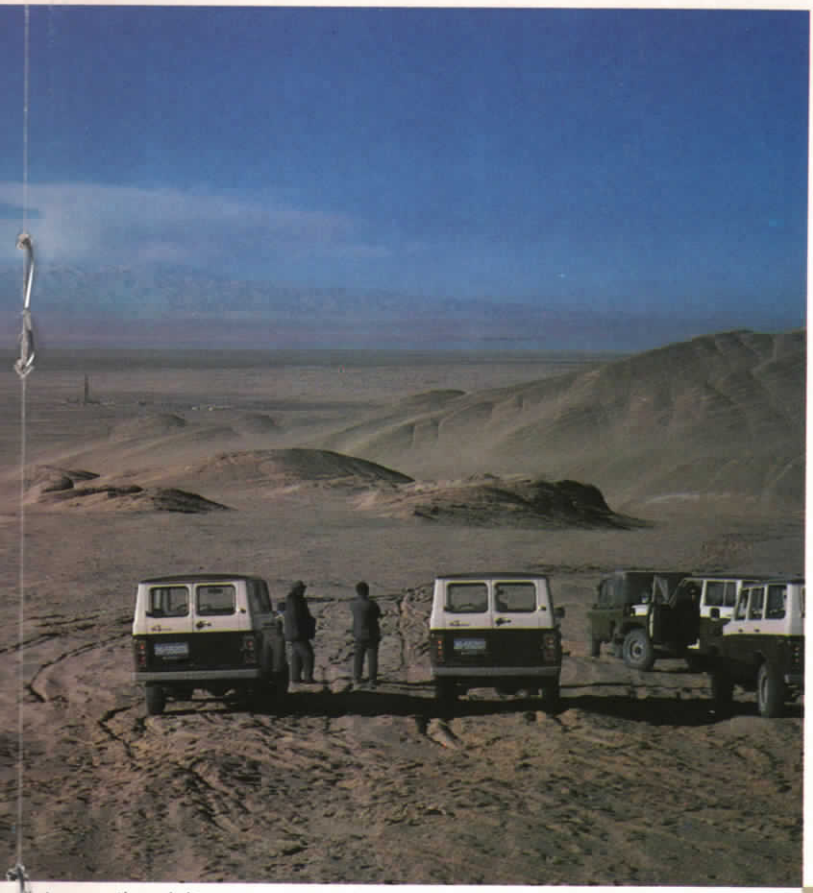


Driving to outcrops near Lenghu, with the Himalayas in the far dist

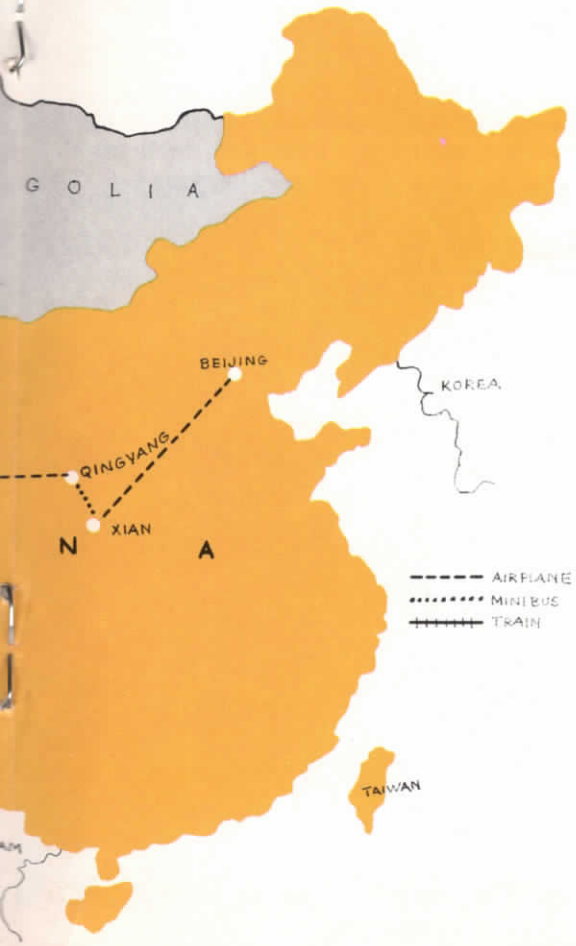
Traffic often slows as Chinese stop to see Americans.



were very polite and displayed a good sense of humor. Since they were working most of the time, the visitors had little time for sightseeing—unless it happened to coincide with their planned route. But they also pointed out they did not feel confined or as if they only were being taken to select tourist or industrial stops. "Our interpreters often went with us when we went for a walk," adds Sax, "for they said they were not sure how the people would react to seeing American foreigners for the first time." After the group left the major western cities they only met one other English speaking couple on the trip.



distance, the visitors were surprised at the flatness of the region.



Between Liuyuan and Lenghu the group stopped to explore the Caves of the Thousand Buddhas in Dunhuang. Once the eastern focus of trade and pilgrimage routes (called the Silk Route), the city had been a great staging center for China. Today the city is visited only by people wishing to see the Fifth Century rock sculptures in the honeycombed hillside.

"It was a highlight in the trip," says Yu. "The caves are in a remote area and it is difficult to get there. It just happened that they were on our route. Outside it looks like a city against the hillside, because every cave has its own external building-like facade. We entered one regular-sized doorway, to be confronted by a 10-story high Buddha."

Eating in a foreign country is always a new experience, and they found China to be no exception. "The meat was cut up into little pieces," says Krueger, "and was mixed with all sorts of vegetables. There were exotic dishes, too. Although sea cucumber, a kind of snail or slug, is a delicacy in China, I didn't care for it."

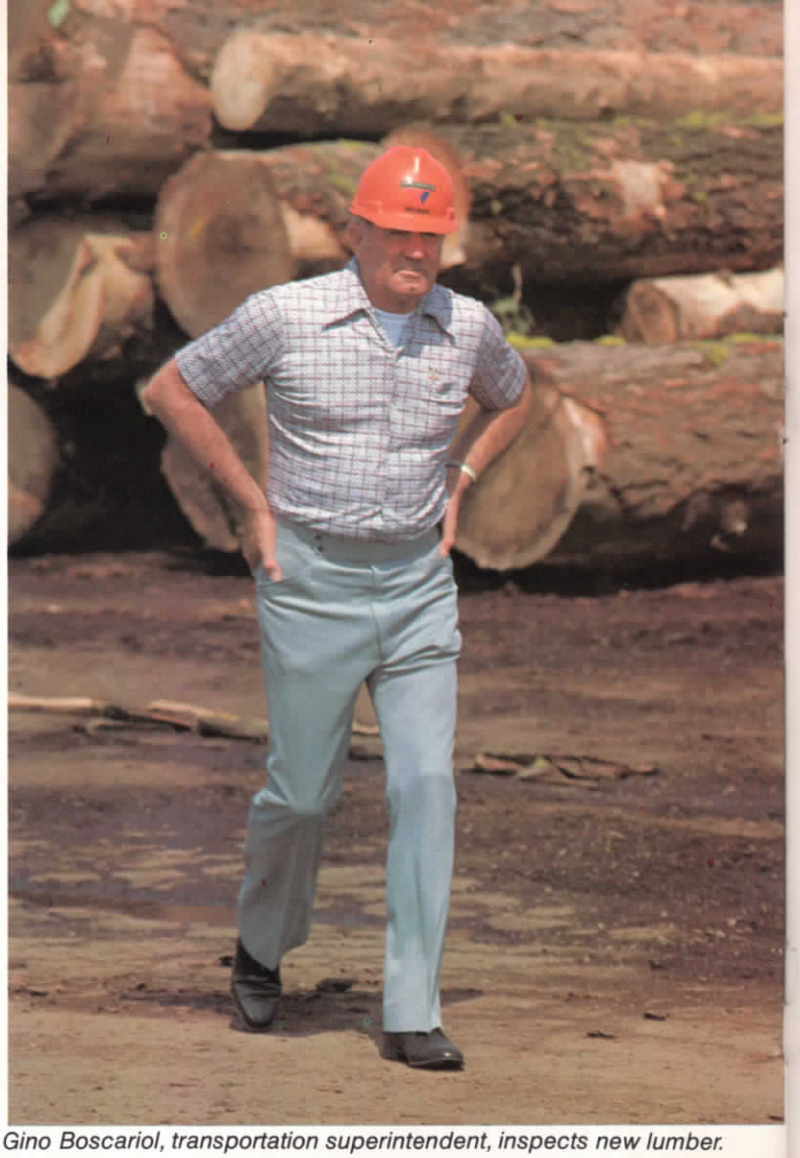
At the end of the trip, back in Beijing, the seven decided their visit with the Chinese had been a success when the Minister of Petroleum (similar to the Secretary of the Department of Energy) attended the dinner hosted by Union Oil. The minister rarely accepts dinner invitations.

The city of Ürümqi's population is a blend of 14 minorities.

"Apparently," says Yu, "he had received good reports about our constructive comments at the local offices we visited."

Yu, also adds, "I was interested by the drive the people showed to learn American technology. They went out of their way to try and help us during our trip." (76)

Several Union Oil employees and their spouses have had the opportunity to visit China in the last few months. Some have gone on business and others for vacations. These photographs were shot by: Roland Krueger, Doyle Paul, A. W. Sanborn, Bill Sax and Chung Yu.



Gino Boscariol, transportation superintendent, inspects new lumber.

DINUBA, CALIFORNIA, is a small town in the central part of the state that is more famous for its agricultural might than for anything else. Residents there think nothing of the vast acreage of lush farmlands which stretch to the horizon and which sprout the crops that feed America.

That part of the San Joaquin Valley is almost all agriculture-oriented and the only trees that impede the endless view of green crops are large peach and orange orchards and the occasional eucalyptus windbreaks.

On the outskirts of Dinuba, however, there is a forest of tremendous magnitude — a forest of felled, trimmed and neatly stacked logs destined to become boards, construction beams, chairs, walls and even picture frames. The forest consists of white fir, incense cedar, ponderosa

After milling the logs, workers pile freshly cut wood into various quality grades and prepare wood for shipping.

a chronoLOGy of lumber

A crushing machine turns scrap wood into sawdust.

and sugar pines and assorted other woods which require much care and maintenance, as evident in the dozens of workers who scurry in the lumbermill doing myriad chores. Once processed, this lumber will be shipped to all parts of the country and even to some foreign nations.

The lumber at Dinuba is owned by Wickes Forest Industries, a division of the Wickes Corporation, a large, multi-faceted operation that has expanded since its 1854 beginnings, when it opened as a machine shop servicing sawmills in Michigan, to a diversified international concern.

Its facility at Dinuba, some 20 miles north of Visalia, —where logs are processed with Swiss watch precision and care into more than two dozen products—is dependent to a large degree on the oil industry. It is there that

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So much lumber is processed at Dinuba that 17 saw blades are honed every two hours.

Giant mechanical logger piles logs in yard.

every year more than one million gallons of diesel and over 100,000 gallons of gasoline end their long trek from Union Oil refineries to quench the thirst of the powerful industrial vehicles which transport the lumber.

In addition, Wickes Forest Industries uses a considerable amount of lube oils and other petroleum products to keep its milling machines in operation.

Gino V. Boscariol, transportation superintendent at the Wickes Corporation's Dinuba division, is an experienced hand in the lumber industry. His office, like all the Dinuba main building, is paneled with a variety of wood. Interior designers reasoned that the best way to show the products of Wickes Forest Industries was to panel every wall with all the woods in which the company deals.

"Here in Dinuba we process logs which come from forests in the Sierra," Boscariol explains, the rumble of heavy machinery carrying logs into the mill from the piles of unprocessed lumber outside. "Most of the lumber we get is bought from lumber forests owned by the federal government. It comes mostly from the Sequoia, Sierra and Los Angeles National Forests, a good five-hour drive from where we process the lumber into any of the products we make."

The operation is impressive. The Wickes Forest Industries processes nearly 100 million feet of lumber per year in their Dinuba sawmill, one of two owned by the company in California.

"Our output is more or less evenly divided between the two sawmills," he continues, "It consists of two different categories of lumber."

The two categories are construction and shop lumber. Construction lumber is that wood destined for the manufacture of furniture, while shop lumber is used in the building and molding industries.

"The lumber industry, like any other large business in the country, is very complicated," Boscariol continues. "It's not so simple as to go to a forest and cut a given number of trees. The logs we use are sold by the federal government from its lumber lands and our company buys them through regulated bidding sales."

Once a firm makes a bid on an amount of lumber, it must follow all governmental regulations to the letter. For example, in some cases the company which has been awarded the contract must build roads which—after the lumber has been carried out — will either remain or be covered. In many areas, particularly in northern California, access to the lumber camps cannot be built, so lumber companies must hire helicopters to carry the lumber out of the area.

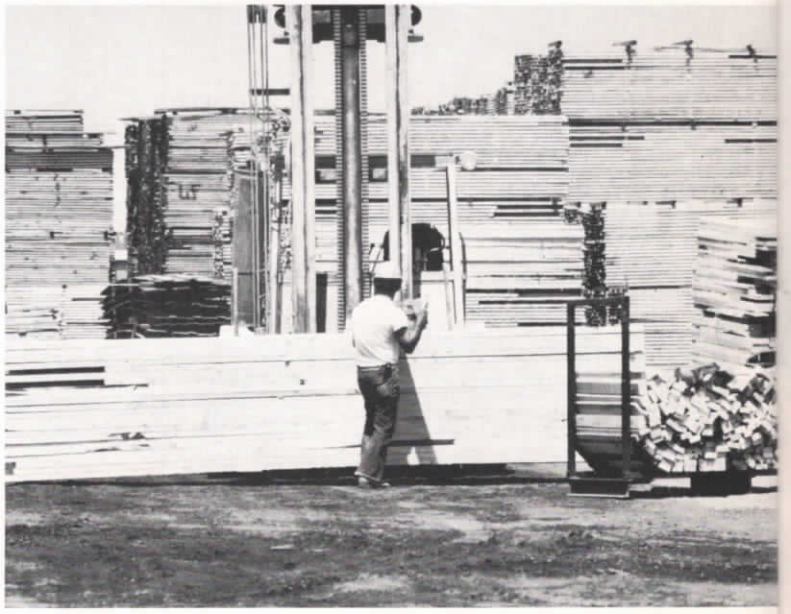
Over 75 million feet of lumber processed in the Dinuba area is carried out of the forests by Wickes Forest Industries' own trucks, but the biggest percentage is hauled by contracted local loggers who then transport it to the central California sawmill.

"The quantity of fuel we use depends on the number of the contracts at that time," Boscariol says. "In this sawmill we have 55 vehicles which are serviced from this plant."

Included in this figure are small and large trucks and piggy-back style loggers capable of carrying logs 40 feet in length.

Rumbling down the highway after an arduous drive from the lower Sierra forests to Dinuba, the logs are weighed before being dumped in the Wickes Forest Industries yard.

Once there, large log movers, which look like gigantic scarabs, pinch the logs with huge mechanical claws and stack them in the yard to await processing.



At Dinuba, a worker stacks some of the 100 million feet of lumber.

Wood inspectors check processed lumber for quality.

And quite a process it is.

According to Boscariol, "not a thing is lost from the logs here. Sawdust is used to make particle boards, the bark is bagged and sold for gardening products and decoration, small pieces are broken into wood chips for a variety of uses."

From the moment a log enters the conveyor belt to be de-barked, to the minute parts of it are deposited on a huge sawdust pile, its bark is bagged into garden decoration containers, its boards are stacked in the yard and its smaller pieces shredded into smaller chunks used for fertilizer, five minutes have elapsed.

Watching a log being processed at the Dinuba plant is quite an experience. Large mechanical loggers carry 40-foot long logs onto a conveyor belt where they are sawed into 16-foot commercial length pieces. These sections are then carried onto a huge lathe that removes all the bark. It falls onto another conveyor belt into a sieve-like machine that separates the sawdust from the bark. In turn, these products are taken to their respective processing plants.

Even tree bark is packaged and sold for decorative purposes.

Once the timber has been cleaned it is pushed through four screaming saws which square the logs. From there, in a matter of seconds, the logs are carried through a series of saws which slice them into boards of specific thickness.

Inside a shop to the side of this plant, Boscariol stops to talk to a man who is sharpening the teeth of a large saw with an electric honing machine.

"We sharpen about 17 of these blades every two hours," Boscariol explains. "With the type of work we do, our saw blades do not have a long life-span."

In another room below the main sawmill, conveyor belts carry finished boards to large warehouses where they await shipment to hundreds of destinations.

In an inspection room, workers inspect every board and mark it according to finish and type.

Watching these men work is akin to watching a connoisseur of fine wines at a vineyard. With a single stroke of their hands they can determine the type of wood they are working with and either let it pass through, or pull it out for another, lesser use.

The Dinuba sawmill, when working at full pace, is an example of orderly pandemonium. Saws screech, conveyor belts move at high speed, lights blink and sharpening machines make that unbearable shriek associated only with the sound of a dentist drill.

According to Floyd E. Pearson, area representative for Union Oil's 76 Division, Western Region, in Visalia, for an account such as Wickes Forest Industries it is necessary to have the best fuels and lubricants required for a sawmill's sophisticated equipment.

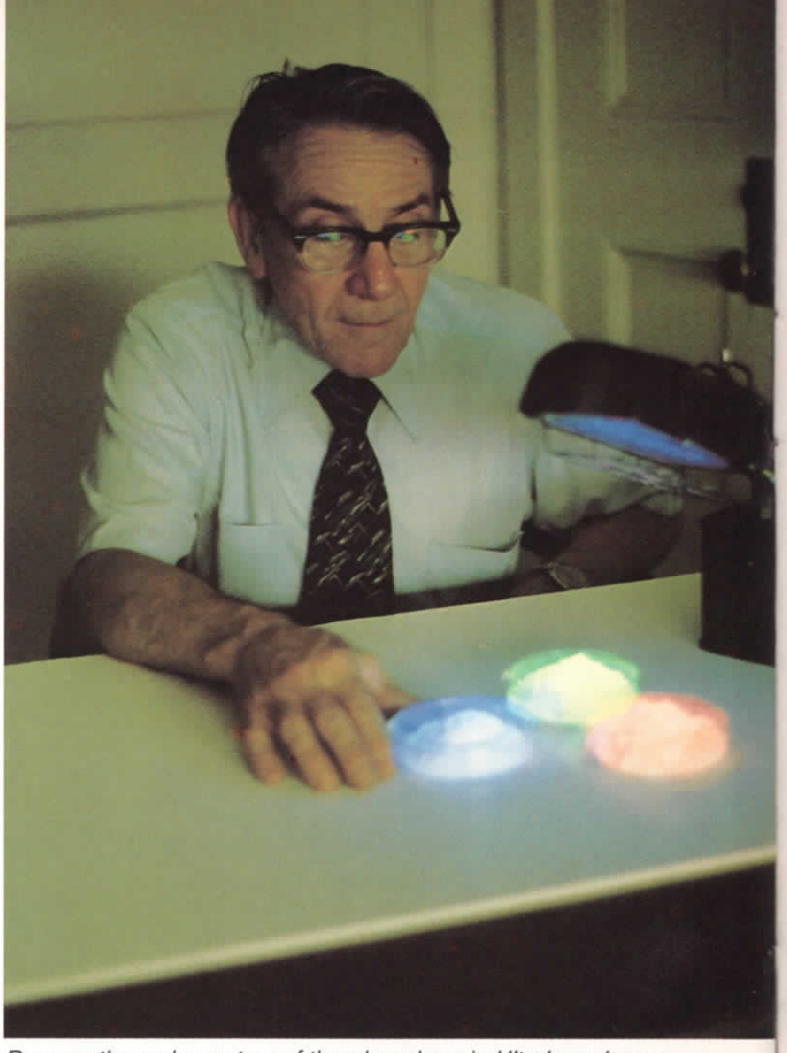
"The company uses an analytical laboratory in Oakland," Pearson says, "to determine what is the best fuel or lubricant available for that particular type of equipment.

"This is all part of preventive maintenance," he adds. "Once Wickes and we receive the report it's just a matter of ordering enough of what is best to keep the sawmill in operation."

J. L. "Jim" Ashlock, area manager in Bakersfield, Union 76 Division, Western Region, adds, "The reports are extremely detailed. With that type of analysis we know the appropriate Union Oil product for best performance."

Because Wickes Forest Industries relies on so much equipment, lubricants and fuels are a major concern. "For example," Boscariol says, "just to run the particle board plant, we have 27 different power units. Each of them has different lubricant and fuel needs. Union Oil provides them all." 76

The case of the un-rare earths



Rare earths make up two of the phosphors in Ultralume lamps.

WHEN HERBERT Woodward and a friend staked their mineral claims 65 miles west of Las Vegas, Nevada, just across the state line, they were jubilant over finding the world's largest body of ore for making lighter flints and glass polishes. In 1949, those were the only commercial applications for rare earths. But 31 years have proven what they had really found was a Noah's ark of minerals whose uses vary from refinery catalysts and steel strengthening alloys to making simulated gem stones. And it looks as if the innovative uses for rare earths have only just begun.

In reality rare earths are a little like a well-known carbonated drink manufacturer's product—they are *un*-rare earths since they are neither scarce nor earths. Existing as a group of 14 elements on the periodic table they are divided into two groups—light and heavy rare earths. Molycorp owns the world's largest and highest grade rare earth mine at Mountain Pass, California, the original claim identified by Woodward, who later became a metallurgist for the company. It is a wholly owned subsidiary of Union Oil and mines, processes and markets molybdenum as well as marketing columbium. It is the only fully integrated rare earth producer and it supplies 60 to 70 percent of the rare earths marketed in the world through its offices in Los Angeles, Pittsburgh, New York and Paris.

Molycorp's operations are in light rare earths: cerium, lanthanum, praseodymium, neodymium, samarium, gadolinium and europium. Each is a unique element, usually found in nature together with other rare earths, but they are difficult to chemically separate from one another. Earlier this year Molycorp started construction on a multi-million dollar program to increase the production of separated rare earths, including installing new solvent extraction circuits at Mountain Pass.

Tom Sleeman, president of Molycorp, says, "Rare earths have a good potential because they do so many different things. We have only just scratched the surface in finding out what they can do."

Today Molycorp plans to set up basic research programs at key universities across the United States, as well as specific grants at some European schools. "The purpose is two-fold," says Tom Wilson, vice president for Molycorp's Marketing. "One, because a school might discover a new application for rare earths and, secondly, so they begin to examine these elements for basic scientific information and become familiar with them."

One of the first big breakthroughs in the commercial use of rare earths was in 1962 when an oil company discovered that lanthanum made a catalyst which could be used in a refinery process converting crude oil to a higher yield of gasoline. Union's refineries use rare earths in the catalysis processes.

Three years later a television set manufacturer found that another of the light rare earths, europium, gave a much better red in color television. Today, every color television set utilizes europium.

In the following decades the applications for rare earths have mushroomed. Although the glass industry had used cerium to polish for years, it discovered it could also be used to economically decolorize glass—currently it is used extensively to maintain clarity in television faceplates and to tint optical lenses. Steel producers found that adding a tiny amount of rare earths to a ton of steel would make it stronger. Rare earth phosphors speed up the time needed to expose x-ray film, hence reducing diagnostic dosages up to 80 percent. Yttrium (often lumped with rare earths because of its similar characteristics) can be used to make simu-

Thornton (ctr) confers about light theory with other experts.

lated diamonds. The U.S. Air Force spearheaded the development of samarium cobalt magnets, the most powerful magnets ever developed. These miniature magnets are used to make electric motors for tape recorders and numerically controlled machine tools. Many 1981 car manufacturers have chosen a three-stage catalyst for auto exhaust. Up until now catalysts have been used to reduce carbon monoxide and hydrocarbons. Regulations for 1981 require a reduction of oxides of nitrogen, rare earths act to stabilize the catalysts.

One future use of rare earths is only just beginning to be investigated. "Hydrogen," explains Sleeman, "may be a primary energy source in the future. But one big problem is that it is very hard to store. Normally it must be kept under extreme pressure or temperature. But lanthanum, in combination with some other metals, has the ability to absorb and desorb hydrogen by a modest change in temperature or pressure. This may be the solution to the fixed storage problem." Today rare earths are mostly used in iron and steel production, catalysts and in glass and ceramics.

But rare earths also are standing on the frontier helping make *Star Wars*-type devices become reality. Two new rare earths applications—fluorescent lights and magnetic-bubble memories—have actually been in the making for the last decade. Only in the last few years have they begun to reach the marketplace. Recently SEVENTY SIX magazine interviewed two of the key researchers of these projects to learn more about them.

"People see most clearly in white light composed of three prime-color wavelengths," says Dr. William A. Thornton as he walks between racks of long fluorescent test lamps in Westinghouse's Bloomfield, New Jersey, laboratories. Dr. Thornton, a research engineering consultant in fluorescent and vapor lamps, received the inventor of the year award in 1979 from the Association for the Advancement of Invention and Innovation in Washington, D.C. For the last 15 years he has been investigating prime-color light sources.

"People expect certain objects to be particular, identifiable colors," he says, "they expect an orange, carrot, lemon or tomato to be a preconceived color." Studying the wavelengths that form light, Thornton discovered that the human eye perceives white light from three basic (prime) colors: blue-violet, green and orange-red. "The biggest surprise," he says, "was that a white light made up of these three precise prime color wavelengths allows the eye to see all colors."

After identifying the three precise wavelengths needed for the new light, the search for fluorescent phosphors to supply them began. The rare earth, "europium, is the backbone of this lamp," says Thornton, "contributing the blue-violet band and the orange-red band." The more conventional substance, manganese, supplies the green band.

Thornton terms the resulting Westinghouse Ultralume lamp "a genuine revolution in lighting." Although the initial cost of the light is high, it lasts longer and saves energy—the phosphors produce 30 percent more light than other fluorescent lamps that give good color rendition.

"Ultralume's energy savings were vividly demonstrated to us," says Gordon Barlow, manager of rare earth sales, "when we relamped the Molycorp marketing offices in White Plains, New York. We substituted the new lights on a one-to-one basis and everyone complained that it was too bright. We had to reduce the number of lamps."

Extensive tests have proven Ultralume's color rendi-

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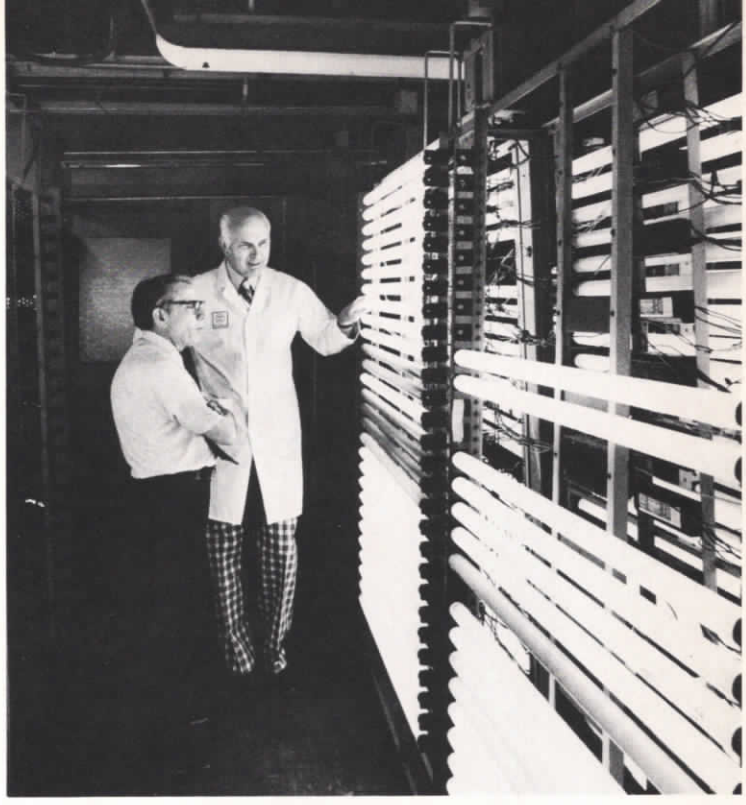


Joe Sausville (L) and Thornton study racks of lights.

Scientist makes final adjustments on a magnetic bubble chip.

tion pleasing, but unsolicited reactions have amused Dr. Thornton and his staff. Dorothy Rachko, his assistant, comments, "I have Ultralume lights in my kitchen. My daughter liked a kitchen plant and begged to move it up to her bedroom. The next day she looked at the plant in its new surroundings and carried it downstairs to me in the kitchen saying, 'Take it back, it's dying,' but the minute she entered the kitchen it looked its healthy green self again."

Prime-color lamps make viewed scenes brighter and colors more distinct. At least one major department store chain, well-known for its large staff of color experts and research of customer preference, chose to relamp their already well-illuminated store with Ultralumes. Why? Because the previous lights did not give them a red rendition and they had to add incandescent lamps to the fluorescent lighted store to achieve a proper color rendition. Changing to Ultralumes solved the problem. While converting one of the stores, customers walking from the old side into the newly lighted half remarked, "it is like coming from the subdued lighting of a mall into a fully lighted store."

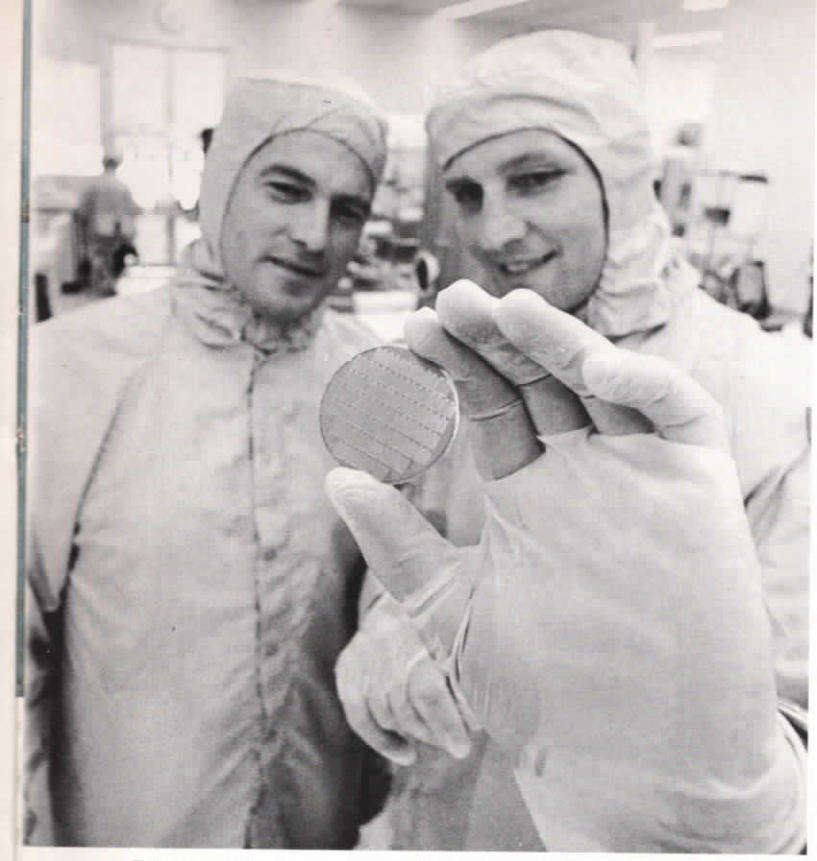
Thornton adds that a 22-story office building in New York City just converted to Ultralumes. He is pleased because the buildings employees are performing difficult visual tasks including financial work and check verifications. "And," he adds "for every four previous lights they only had to put two Ultralumes." Westinghouse's new lights are also being used by art museums because of their excellent color rendition.

And, in the future, Thornton sees "it will not only be possible, but inevitable that fluorescent lights will be made in smaller shapes to replace energy inefficient incandescent lamps."

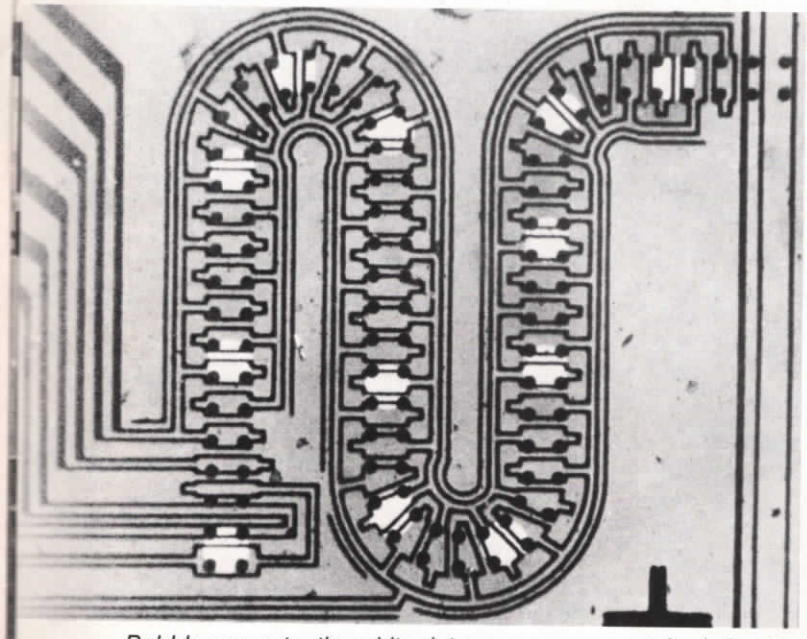
Jim Nielsen, working at Bell Labs administrative headquarters at Murray Hill, New Jersey, has been studying rare earths for an exciting new application.

"If you reach a recorded telephone announcement such as 'We're sorry, your call cannot be completed as dialed. Please check the number and dial again, or call your operator to help you. This is a recording.' chances are you are listening to a device utilizing a magnetic-bubble memory, he explains.

Magnetic-bubble memories were invented at Bell Labs in 1966. A few years ago computer manufacturing researchers noted that magnetic core and semiconductor memories offer fast data recovery, but at a high cost. Magnetic disc and tape memories were more cost efficient, but too slow. Magnetic-bubble memories filled the gap. And there are other advantages to the tiny units. Since there are no moving parts, there is nothing to wear out or require readjustment. They can store material in digital form while the quality of the recorded messages



Etched paths on a garnet slice are paths for bubble magnets.



Bubble magnets–the white dots–move over an etched circuit.

remains high. Each unit can record from one to eight messages, each different, and can be played—simultaneously—for up to 500 customers. In fact, one pack can store information equal to 27,000 telephone numbers.

The bubble memory packs are small units less than two inches long, one inch wide and less than half an inch deep. The idea is that tiny magnetic areas—"bubbles" only 1/16th the diameter of a human hair—can be created, moved or erased electronically to store and transport data in computers, mini-calculators, self-correcting typewriters and telephone switching devices. To function, the substrate, the wafer on which the bubble memory films are deposited, must be precisely cut and polished and free from impurities.

"We began looking at rare earths as a magnetic garnet material in 1955," says Nielsen. "We were searching for a magnetic material. We tried growing a rare earth crystalline garnet. The technician where the garnets are fired always carries tiny magnets to test new materials. He was startled when his pill-sized magnet jumped to the newly formed garnet."

One of the early problems in the late 1950's was trying different compounds to manufacture garnets which could be sliced and polished to form a wafer suitable for supporting the magnetic bubbles. Later Bell Labs developed a crystalline film to rest on the wafer in which the bubbles could be moved. Another problem was procuring extremely pure rare earths. The match between the rare earth wafer substrate and that of the magnetic-bubble film is critical. Therefore the garnets must be free from "discolorations" or tiny lines of discontinuity reaching the surface from mere one atom shifts between rows within the crystal. Less than five dislocations are allowed; using up to date processing facilities, today most rare earth-based wafers exhibit only three to zero.

Nielsen points out another advantage to magnetic bubble memories. One of the greatest problem areas in computer systems is if power is lost within a semiconductor memory, everything in the computer at that point is lost. "But if the power fails with a bubble memory, it still retains its memory."

Magnetic-bubble memories are only newcomers to the marketplace and Bell Labs is in the process of teaching people in the computer industry how their new memory works and its advantages.

If Herbert Woodward could see the many applications his orebody's discovery has spawned—from making more gasoline from a barrel of crude oil to putting the red in color television and from synthetic gems to a typewriter's memory—he'd have to laugh about his high hopes for owning the "world's largest lighter flint source." Un-rare earths are becoming a key part of advanced technology. ⑯

Reflections on a Refinery

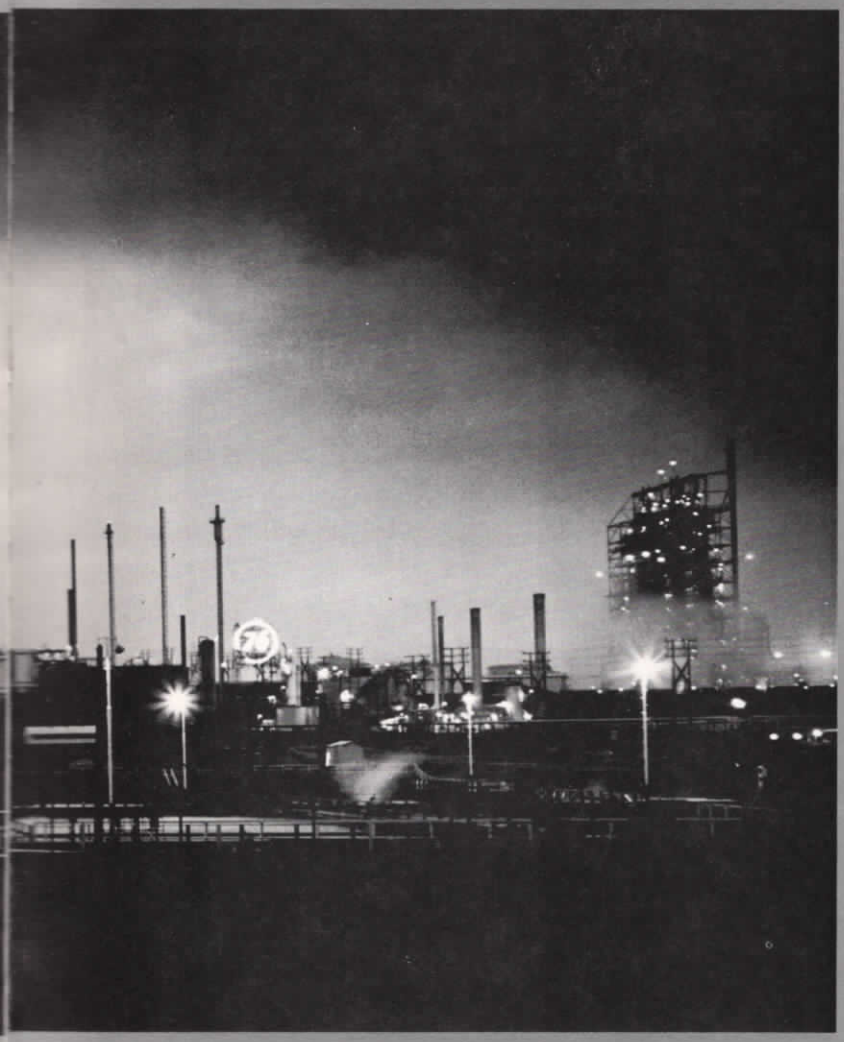
1916. The southern California oil business was booming. At a meeting of the Board of Directors of Union Oil Company a proposal was approved to sell 50,000 shares of treasury stock to provide funds for the acquisition of properties and improvements of existing plants.

The company purchased a 200-acre site at the Los Angeles Harbor where a new refinery was to be built.

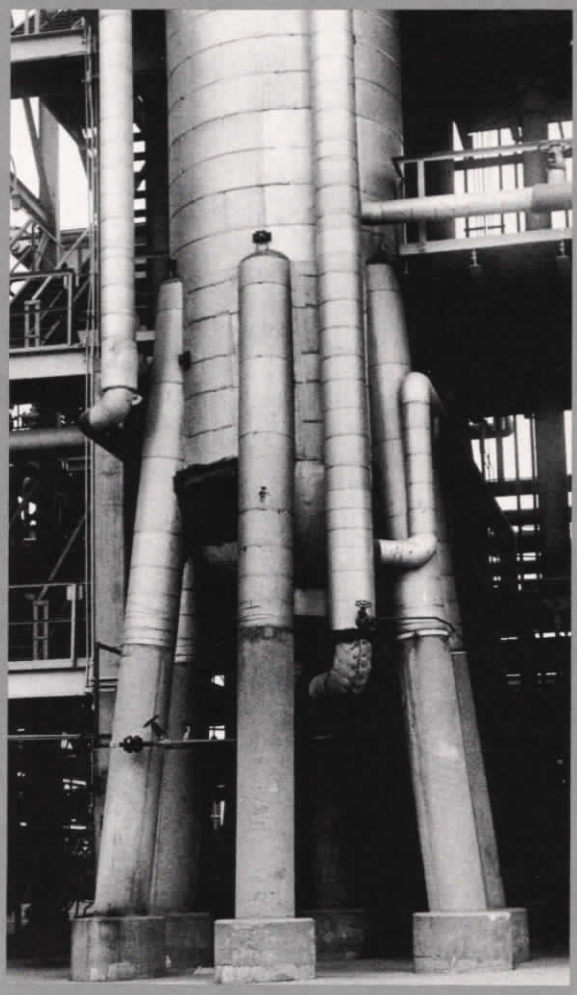
In 1919 the Union Oil Los Angeles refinery was inaugurated and in the 61 ensuing years it has grown at a rapid pace.

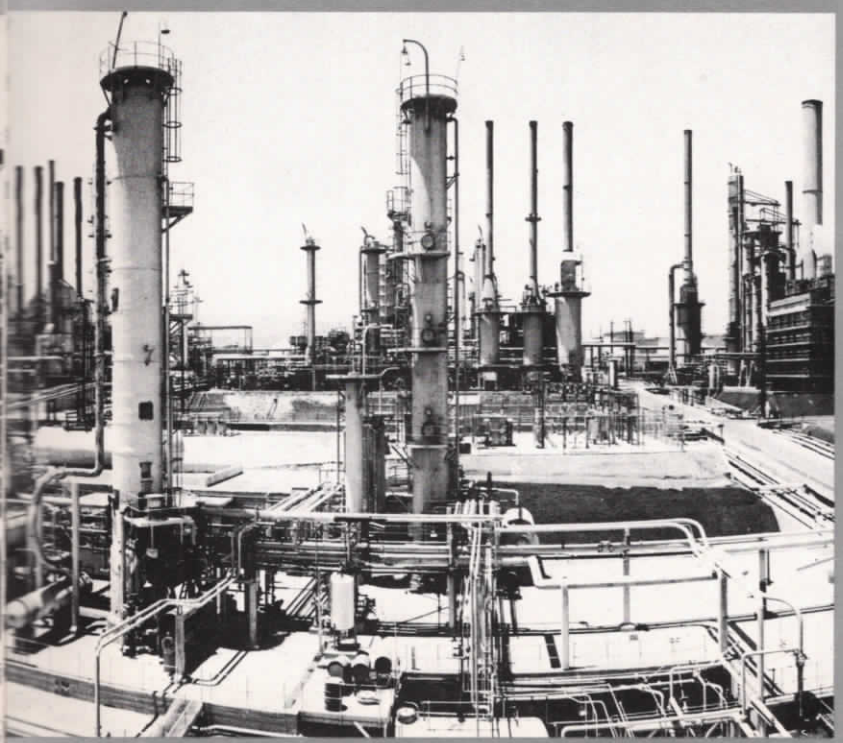
Today, the complex affords some of the best equipment available—much of it developed by Union Oil researchers and scientists—capable of processing some 108,000 barrels of crude oil every day of the year on its 424 acres.

The following photos were chosen because of unique pattern and composition while showing, at the same time, the delicate and sophisticated role of a refinery in today's energy world.



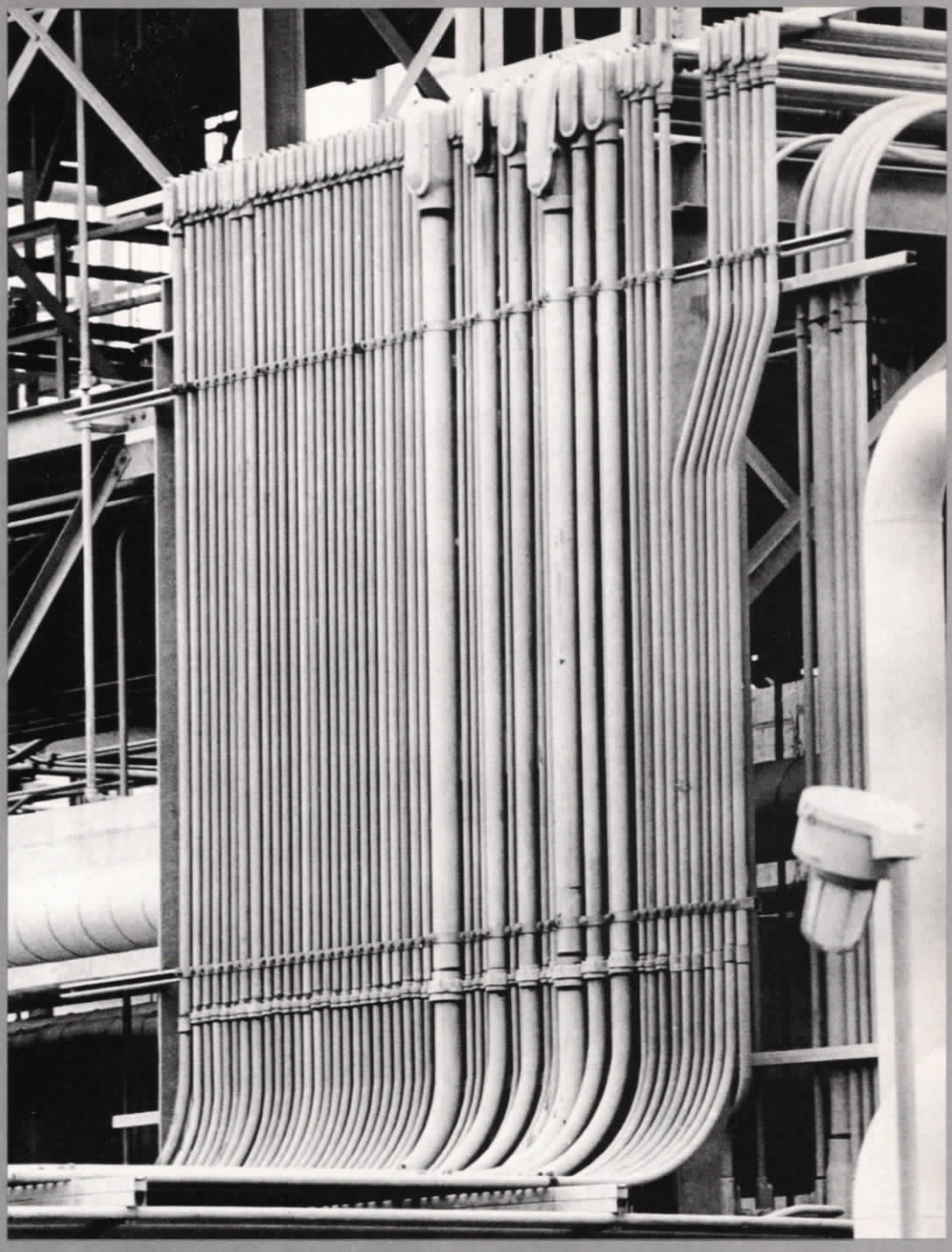
LEFT: A few years ago Union's Los Angeles refinery presented a well-lighted appearance during a tomcat gray southern California evening. Today, conservation methods have curbed any excess lighting—still maintaining a safe lighting standard—while the huge facility's energy efficiency has jumped.





ABOVE: A catalyst filled reactor in the LAR's Unicracking unit is a prime example of Union's innovative contributions to refining crude oil. This is part of the complex which converts midpoint materials into gasoline.

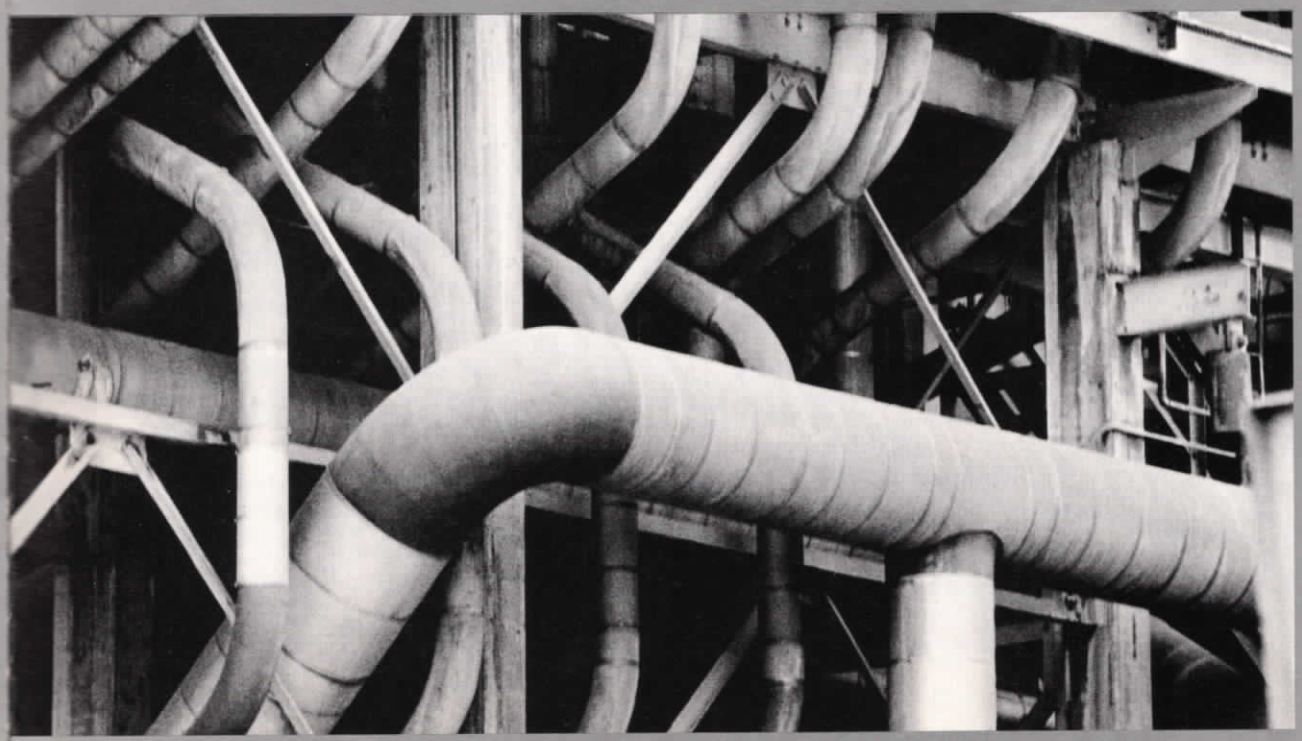
LEFT: The Unisol unit, removes mercaptan, a sulphur compound, from gasoline.



ABOVE: This complicated web of steel power conduits for the Los Angeles refinery's Unicracking unit No. 120, is an example of the advanced technology found in a refinery, a practical and almost artistic device to keep the Unicracker working.

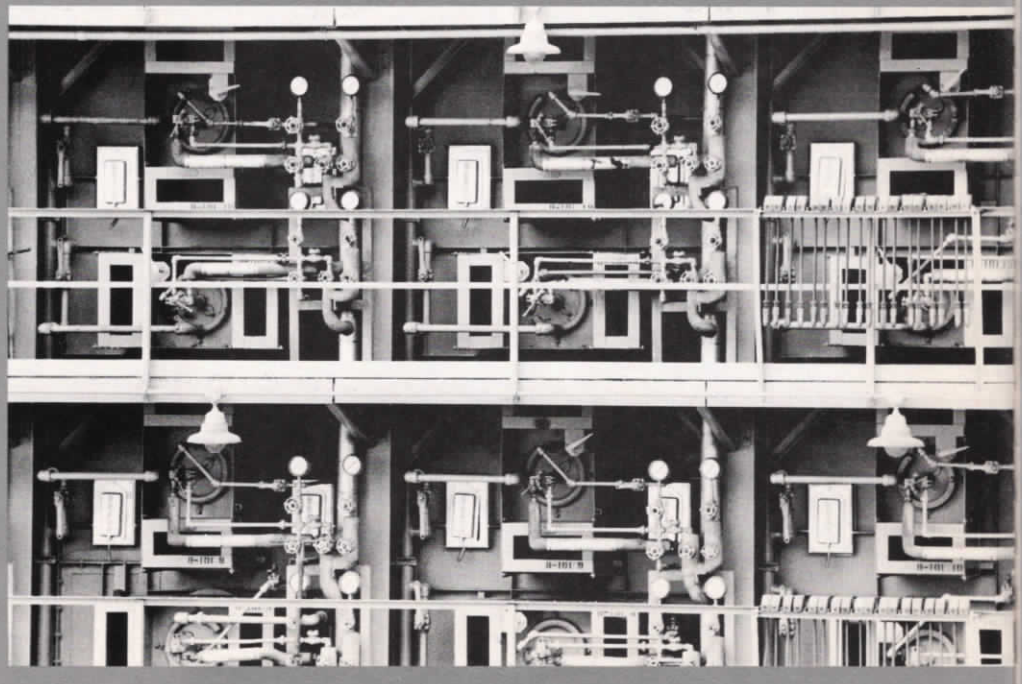
RIGHT: Pipes of various sizes, which seem to originate nowhere and end in infinity, may look like a colossal confusion of steel spaghetti to the uninitiated. A refinery engineer, however, will identify them as a section of a refinery's hydrogen heater.

LEFT: One of the many trained operators at the refinery positions a valve on a process unit. The Union Oil refinery employs 600 people who perform a variety of tasks such as maintenance, operations, engineering, clerical and production.



RIGHT: Inside the refinery's fluid cracking unit, Linwood Scott pauses to inspect maintenance work needed to keep the unit—and the refinery itself—on stream to produce energy. The sophisticated make up of a refinery is not confined to the production of gasoline alone. In the facility, Union produces a full line of motor fuels such as gasoline, diesel, aviation gasoline and jet fuel. At the same time, the refinery maintains a high standard of environmental and safety procedures.

BELOW: The burners of the reforming unit Number 80—a complex that produces high-octane gasoline stocks—form an intricate design pattern at the Los Angeles refinery.



LEFT: Stretching like huge tentacles from storage tanks to the refinery's units, this pipe trench houses many lines carrying refinery processing stocks, natural gas and water.

BELOW: Photographed from a long distance and blurred by heat waves, the tops of fractionating towers—units that separate gasoline from diesel, according to different boiling ranges—stand against a midday sky.

CORPORATE

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EARLE F. MEAD ..... Union Oil Center

35 YEARS

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KENNETH M. GORDON ..... Schaumburg, Il.

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NEAL A. THOMAS ..... Burbank, Ca.

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MARY A. KIMBALL ..... Union Oil Center

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GARY R. MILLER ..... Union Oil Center
MARY C. MYERS ..... Union Oil Center
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H. R. BROUSSARD ..... Union Oil Center

DECEMBER 1980

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JOHN M. REID ..... Union Oil Center

15 YEARS

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5 YEARS

CYNTHIA P. HOGAN ..... Union Oil Center
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35 YEARS

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MICHAEL L. SMITH ..... Brea, Ca.
ERNEST A. VAN ZILE ..... Brea, Ca.
WILLIAM C. WILLIAMSON ..... Brea, Ca.

5 YEARS

J. WAYNE MILLER ..... Brea, Ca.

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40 YEARS

MANFORD M. RALSTON ..... Brea, Ca.

35 YEARS

ARTHUR F. MAYS ..... Brea, Ca.
EARL J. ROSS ..... Brea, Ca.

30 YEARS

CARL R. ZYLSTRA ..... Brea, Ca.

20 YEARS

LAWRENCE F. WEIDNER, Jr. ..... Brea, Ca.

15 YEARS

J. C. CAMPBELL ..... Brea, Ca.
GARY L. ROQUET ..... Brea, Ca.

5 YEARS

PAULA W. MOYER ..... Brea, Ca.

NOVEMBER 1980

35 YEARS

ROBERT F. BUHL ..... Brea, Ca.

20 YEARS

ROBERT F. ARNOLD ..... Brea, Ca.

15 YEARS

DAVID E. MEARS ..... Brea, Ca.

10 YEARS

JAMES A. MILLER ..... Brea, Ca.

DECEMBER 1980

35 YEARS

ROBERT N. WHEATLEY ..... Brea, Ca.

20 YEARS

JAMES A. KLOTZ ..... Brea, Ca.

15 YEARS

CHARLES R. HOWE ..... Brea, Ca.

10 YEARS

LILLI HENSON ..... Brea, Ca.

UNION OIL AND GAS DIVISION

SEPTEMBER 1980

35 YEARS

CHARLES F. KONKEL ..... Ardmore, Ok.

30 YEARS

BOBBY H. ARNOLD ..... Midland, Tx.
WILLIAM J. BALL ..... Union Oil Center
RICHARD E. COOK ..... Van, Tx.
MARION A. PICKETT ..... Ardmore, Ok.
JERRY J. WASICEK ..... Union Oil Center

25 YEARS

JOSEPH A. LANKO ..... Coalinga, Ca.
JAMES W. LIVINGSTON ..... Ventura, Ca.
JACK A. MENEFEE ..... Houston, Tx.

20 YEARS

MARY E. McCARTY ..... Houston, Tx.
HERMAN L. PENALUNA ..... Andrews, Tx.
BAIRD E. STEPHENS ..... Oklahoma City, Ok.

15 YEARS

CHARLES E. AUGUSTUS ..... Orcutt, Ca.
GARY E. BOWEN ..... Santa Fe Springs, Ca.
DAVID M. COURTIS ..... Anchorage, Ak.
NORMAN M. EGGEBRECHT ..... Oklahoma City, Ok.
JAMES A. HENSLEY ..... Isleton, Ca.

10 YEARS

OSCAR L. AZCUA ..... Union Oil Center
ERIC J. BROUSSARD ..... Abbeville, La.
WILLIAM J. HOLDEN ..... Ventura, Ca.
LAWRENCE E. HUTCHINS ..... Orcutt, Ca.
GEORGE D. RICHARD ..... Lafayette, La.
FRANCIS A. VICTOR ..... Abbeville, Ca.

5 YEARS

OLIVIA L. AYALA ..... Union Oil Center
KEVIN R. BINNS ..... Anchorage, Ak.
R. TERENCE BUDDEN ..... Ventura, Ca.
AKBAR SHERIFF ..... Ventura, Ca.
JOHN G. TRAHAN ..... Abbeville, La.

OCTOBER 1980

40 YEARS

HARRY MANDEVILLE ..... Midland, Tx.

35 YEARS

MILTON W. BARRY ..... Santa Fe Springs, Ca.
WILLIAM V. BENNETT ..... Houston, Tx.
ERNEST M. GRAY ..... Orcutt, Ca.
EDWARD A. HALL ..... Ventura, Ca.
CECIL R. HAWTHORNE ..... Andrews, Tx.
QUENTEN C. HIGHFIELD ..... Woodward, Ok.
ALTON T. McNEIL ..... Orcutt, Ca.
JESSE C. MORGAN ..... Santa Fe Springs, Ca.
WILLIAM H. NOTT ..... Coalinga, Ca.
RITA I. SORK ..... Union Oil Center
JACK STOREY ..... Van, Tx.

30 YEARS

ROBERT F. CLEVENGER ..... Orcutt, Ca.
LESLIE J. FORD ..... Los Angeles, Ca.
GORDON E. OTTO ..... Union Oil Center
ROBERT W. PLUMB ..... Orcutt, Ca.

25 YEARS

MILTON A. MACLEAN, Jr. ..... Santa Fe Springs, Ca.
NORRIS W. PANNILL ..... Santa Fe Springs, Ca.
JAMES W. REDDING ..... Coalinga, Ca.
CHARLES K. ROSE ..... Coalinga, Ca.

15 YEARS

JEROME D. BOSEK ..... Santa Fe Springs, Ca.
ARCHIE A. CRADDUCK ..... Orcutt, Ca.

10 YEARS

CLAY L. CHIVERS ..... Kenai, Ak.
CYNTHIA L. EMBODY ..... Houston, Tx.
BUCK F. GIFFIN ..... Coalinga, Ca.
ROBERT G. HEBERT ..... Abbeville, La.
KENNETH P. LEBOEUF ..... Houma, La.
PAUL L. PHILIPPI ..... Mobile, Al.
GEORGE B. REED ..... Ventura, Ca.
GUY A. THIBODEAUX ..... Abbeville, La.
JOHN R. WATSON ..... Santa Fe Springs, Ca.

5 YEARS

JAMES D. ALLEN ..... Worland, Wy.
JULIA H. BATTLE ..... Lafayette, La.
JOHN S. HADLEY ..... Santa Fe Springs, Ca.
JOSEPH L. PILLETTE ..... Abbeville, La.
KURT P. SCHILLER ..... Fort Morgan, Co.

NOVEMBER 1980

45 YEARS

JACK L. STAIR ..... Union Oil Center

35 YEARS

ANNA M. COOLEY ..... Union Oil Center
WALTER J. DUMONTIER ..... Cutbank, Mt.
GEORGE T. GOLDEN ..... Coalinga, Ca.
MARVIN L. HOBBS ..... Van, Tx.
FRED NANINI ..... Cutbank, Mt.
WILLIAM A. SPEIGHTS ..... Van, Tx.
ELDEN L. SWEET ..... Orcutt, Ca.
HEWLETT N. WILLIAMS ..... Woodward, Ok.

30 YEARS

DALTON D. BROUSSARD ..... Lafayette, La.
LOUIS A. FALGOUT ..... Lafayette, La.
JOHN P. HILL, Jr. ..... Houston, Tx.
LARRY D. LANTRIP ..... Houma, La.
HARRIET E. McKINLEY ..... Oklahoma City, Ok.
FRED A. MONTGOMERY ..... Santa Fe Springs, Ca.
FLORIN V. MORRIS ..... Bakersfield, Ca.
LOUIS B. TRIMBLE ..... Ganado, Tx.
CLIFFORD VAUGHAN ..... Lafayette, La.
ERNEST R. ZOETER ..... Santa Fe Springs, Ca.

25 YEARS

JAMES A. ALLEN ..... Coalinga, Ca.
ALLEN B. CROCKETT ..... Midland, Tx.
DENNIS R. METT ..... Union Oil Center

20 YEARS

E. BERNARD BRAUER ..... Houston, Tx.
ROY E. KREPS ..... Orcutt, Ca.
A. B. McADOO ..... Odessa, Tx.

15 YEARS

BILLY LEE FREEMAN ..... Santa Fe Springs, Ca.
JOHN F. HOJNACKE ..... Orcutt, Ca.
ROBERT H. RAMSEY ..... Los Angeles, Ca.

10 YEARS

DARYL E. DAVIS ..... Ventura, Ca.
SUSIE D. NULL ..... Houma, La.
RAYMOND E. ORTIZ, Jr. ..... Santa Paula, Ca.

5 YEARS

GENE T. FORBES ..... Cutbank, Mt.
JOHN F. GAUDET ..... Houma, La.
RICHARD S. JOHNSTON ..... Bakersfield, Ca.
DONALD R. KILBOURNE ..... Houma, La.
RONALD L. KRIST ..... Moab, Ut.
TONY J. MARTINEZ ..... Santa Paula, Ca.
EVERETT McCORMICK, Jr. ..... W. Liberty, Il.

DECEMBER 1980

40 YEARS

CHARLES V. HICKS ..... Midland, Tx.

35 YEARS

JAMES K. FORRESTER ..... Orcutt, Ca.
LEON D. GRANBY ..... West Liberty, Il.
JAMES L. HARRIS ..... Van, Tx.
CHARLES R. TUCKER ..... Worland, Wy.
JOE F. WILKINSON ..... Midland, Tx.

30 YEARS

RICHARD B. ADAMS ..... Orcutt, Ca.
JIMMIE L. BOND ..... Andrews, Tx.
LAWRENCE W. LEWIS ..... Santa Paula, Ca.
BERNAL D. REYNOLDS, Jr. ..... Lafayette, La.

25 YEARS

WELDON BRICE ..... Midland, Tx.

20 YEARS

IRVING S. BROUSSARD ..... Abbeville, La.
JOHN H. KOSAREK ..... Abbeville, La.

15 YEARS

ESSIE INEZ MORRIS ..... Midland, Tx.

10 YEARS

ROY E. BRIGGS ..... Lafayette, La.
ROBERT L. HUNGATE ..... Houma, La.

5 YEARS

CHARLES ANCIRE ..... Houston, Tx.
KIRBY J. DOMINGUE, Jr. ..... Lafayette, La.
RICHARD HERSCHMAN ..... Cutbank, Mt.

UNION 76 DIVISION

JULY 1980

20 YEARS

LEE T. YOURMAN ..... Schaumburg, Il.

15 YEARS

DAVID H. DEWINDT ..... Los Angeles, Ca.
ANDRE F. VAN DER VALK ..... Los Angeles, Ca.

10 YEARS

THOMAS V. PEARSON ..... Chicago Refinery

SEPTEMBER 1980

45 YEARS

RICHARD E. PERRY ..... North Hollywood, Ca.

40 YEARS

LOREN F. GRANDEY ..... Los Angeles, Ca.
ROY E. McGEE ..... Schaumburg, Il.

35 YEARS

WARREN W. BOUSMAN ..... Los Angeles Refinery
BILLY E. COLE ..... San Francisco Refinery
EDWARD H. HANSON ..... San Francisco, Ca.
RAYMOND D. JOLICOEUR ..... Schaumburg, Il.
WILLIAM O. LACER ..... Tampa, Fl.
LEO G. RECCHI ..... San Francisco Refinery
DONALD L. SARGENT ..... Minneapolis, Mn.
EDWARD E. WALTON ..... Edmonds Terminal

30 YEARS

EDWARD J. BOWLAN ..... Chicago Refinery
HAROLD J. BREAUX ..... Beaumont Refinery
ROBERT J. CALLOWAY ..... San Francisco, Ca.
DAVID F. CHARLES ..... Union Oil Center
OLIVER F. CONREY ..... Pasadena, Ca.
FORREST B. CRITES ..... San Francisco Refinery
DOUGLAS W. GARNER ..... Beaumont Refinery
HERBERT H. HANSEN, Jr. ..... Los Angeles, Ca.
JOSEPH J. HYLEK ..... Chicago Refinery
MELVIN INGALLS ..... San Francisco Refinery
RICHARD M. JORDAN ..... Beaumont Refinery
LEWIS W. KAMINGA
W. H. Barber Co. ..... Chicago, Il.
HANS L. KOLFF VAN OOSTERWIJK ..... Chicago Refinery
DAN McINNIS, Jr. ..... Beaumont Refinery
ROBERT E. MONTGOMERY ..... Birmingham, Al.
CHANDLER H. NOERENBERG ..... Los Angeles, Ca.
HAROLD F. NORMAN ..... Minneapolis, Mn.
ANTHONY PALUMBO ..... San Francisco Refinery
MARION F. PERILONGO ..... Chicago Refinery
JOHN L. RENDE ..... Chicago Refinery
THELMA H. SHARPE ..... Birmingham, Al.
J. J. SNIDER ..... Los Angeles Terminal
HYMAN W. SWAIN ..... Beaumont Refinery
BARNEY B. TARVER ..... Beaumont Refinery
JOHN T. URONE ..... San Francisco Refinery
NORMAN B. WOODSIDE ..... Beaumont Refinery
ROBERT W. YOUNG ..... Chicago Refinery

25 YEARS

JOHN W. ANDERSON ..... Los Angeles Refinery
WENDELL R. GOTT ..... Los Angeles Refinery
CHARLES J. HOLLAND ..... San Luis Obispo, Ca.
DONALD L. HANLEY ..... Los Angeles, Ca.
DON H. JOHNSON ..... Rainy Lake, Mn.
KAREY E. MAYFIELD ..... Los Angeles Refinery
SAM MOLINARO
W. H. Barber Co. ..... Chicago, Il.
JOSEPH T. MYERS ..... Tallmadge, Oh.
DONALD O. NOAH ..... Schaumburg, Il.
JOSEPH D. ROSENBERGER ..... Tallmadge, Oh.
NORMAN C. SLOAN ..... Atlanta, Ga.

20 YEARS

RUTH M. BRACKMANN ..... Schaumburg, Il.
FREDERICK J. BUOB, Jr. ..... Hoffman Estates, Il.
DOUGLAS A. CAMPBELL ..... Los Angeles Terminal
GENEVIEVE L. CWYNAR ..... Schaumburg, Il.
THOMAS J. GORDON ..... Schaumburg, Il
VIVIAN N. HERMANN ..... Schaumburg, Il.
ROLAND C. SIMONSEN ..... Santa Rosa, Ca.
ROBERT A. WEBSTER ..... Schaumburg, Il.

15 YEARS

CHARLES W. COULTER ..... Orange Terminal
DONALD E. JORDAN ..... Columbus, Oh.
MICHAEL L. PERKINS ..... Avila Terminal
JAMES E. SHELTON ..... Schaumburg, Il.
MERLIN J. THIES ..... Romulus, Mi.
DUDLEY A. WELCH ..... Sacramento, Ca.

10 YEARS

LEE O. BELL ..... Los Angeles Refinery
JOHN A. BECKY ..... San Francisco Refinery
BESSIE C. DePALMA ..... Schaumburg, Il.
NORMAN R. ENGEN ..... Minneapolis, Mn.
JOHN H. GOOLSBY ..... Beaumont Refinery
LOUIS F. GUCKER ..... Los Angeles Terminal
NEUGENE HALL ..... Romulus, Mi.
BILLY D. HAUPT ..... Los Angeles Refinery
WESLEY E. HEINRICH ..... Richmond Terminal
WILLIE J. HOOKS ..... Wildwood, Fl.
JAMES A. HOPKINS ..... Richmond Terminal
MARGUERITE S. HUSE ..... Seattle, Wa.
DONALD L. JANES ..... Chicago Refinery
BETTIE JOHNSON ..... San Francisco Refinery
JOHN R. LANDRY ..... Edmonds Terminal
JOHN M. LAWSON ..... Chicago Refinery
LETICIA A. MALVAR ..... San Francisco, Ca.
RICHARD W. MEIFERDT ..... Chicago Refinery
ARTHUR S. MERZLOCK ..... Chicago Refinery
A. B. MOSES ..... Miami, Fl.
FRANK MUNOZ ..... Los Angeles Refinery
HILDA NORTH ..... Los Angeles, Ca.
ALAN J. ONCHAK ..... Chicago Refinery
DANUTA REGALADO ..... Schaumburg, Il.
RICHARD M. RITZ ..... San Francisco Refinery
ZELDA M. ROUSE ..... Wildwood, Fl.
LILA M. RUSSELL ..... San Francisco Refinery
RALPH A. SANDERCOCK, Jr. ..... Portland Terminal
BARBARA A. SCOTT ..... San Francisco, Ca.
CECIL H. SMITH
Arapahoe Pipe Line Co. ..... Brush, Co.
WILLIAM J. THOMAS ..... Beaumont Refinery
CALVIN W. WALKER ..... Chicago Refinery
ROBERT F. WALSH ..... Schaumburg, Il.
DALE J. WESTPHAL
W. H. Barber Co. ..... Minneapolis, Mn.

5 YEARS

JAMES E. ALSTON ..... Chicago Refinery
PHILLIP H. BARNES ..... Tucson, Az.
MICHAEL J. BAUER ..... Chicago Refinery
DENNIS C. BREAUX ..... Beaumont Refinery
BETTY A. CREDIT ..... Beaumont Refinery
REYNOLD C. DELES ..... Schaumburg, Il.
JAMES E. GOERS ..... Chicago Refinery
RUBEN GONZALES ..... Chicago Refinery
ISAAC GUNNER, Jr. ..... Beaumont Refinery
GAIL P. HADNOT ..... Beaumont Refinery
GREGORY J. HEIM ..... Hoffman Estates, Il.
FRED J. HOFFMAN ..... Chicago Refinery
EDWARD J. JAHN ..... Chicago Refinery
KOSTA LEONTARITIS ..... Chicago Refinery
LAURIE E. McQUEARY ..... Los Angeles, Ca.
UBALDO PACHECO ..... Chicago Refinery
RONALD G. RENTFRO
Pure Transportation Co. ..... Olney, Il.
ROBERT K. SHEPHARD ..... Richmond Terminal
GEORGE P. SILVA ..... Beaumont Refinery
AUBREY D. SOILEAU ..... Beaumont Refinery
RICHARD G. STAUSS ..... Chicago Refinery

HAROLD T. TAKARA ..... Honolulu, Hi.
RANDY M. TAYLOR ..... Portland Terminal
SAMUEL A. TURNEY ..... Chicago Refinery
STEVEN J. VEGA ..... Los Angeles Terminal
LAWRENCE R. VONCH ..... Chicago Refinery
BARBARA J. WILKINSON ..... Beaumont Refinery
RICHARD E. ZELAZNY ..... Los Angeles, Ca.

OCTOBER 1980

40 YEARS

CLAY ALBRIGHT ..... Birmingham, Al.

35 YEARS

FREDERICK F. BRAZ ..... Milwaukee, Wi.
ALBERT A. BRISSON ..... Schaumburg, Il.
JAMES W. BYRUM ..... Seattle, Wa.
T. A. DEMBOWSKI, Jr. ..... Los Angeles Refinery
JOHN R. HOLLAND ..... San Francisco Refinery
CHARLES A. JOHNSON ..... Beaumont Refinery
HENRY T. MOZELEY ..... Atlanta, Ga.
DONALD L. NIELSEN ..... Phoenix, Az.
WILLIAM PAPPAS ..... Richmond Terminal
EUGENE L. PHILLIPS ..... San Francisco Refinery
ROSEMARY RADICEK ..... Schaumburg, Il.
STANLEY W. WEINRICH ..... Colton, Ca.
EDMUND J. WUORIE ..... Los Angeles, Ca.

30 YEARS

CHARLES E. BLAIR ..... Taft, Ca.
JAMES M. HAGERTY ..... Chicago Refinery
EDWARD MAUEL ..... Schaumburg, Il.
MILTON O. MILLER
Pure Transportation Co. ..... Olney, Il.
BILLY G. MORAN ..... Beaumont Refinery
JAMES C. PETERSON ..... Superior, Wi.
ROY ROBINSON ..... Los Angeles, Ca.
EDWARD M. VANCURA ..... Los Angeles, Ca.

25 YEARS

PAUL D. CRITTON ..... San Francisco Refinery
WILLIAM I. GRAHAM ..... Portland Terminal
RUPERT C. HURT ..... Memphis, Tn.
RICHARD E. ITHAL ..... Anchorage, Ak.
DARRELL F. KEATING ..... Eureka, Ca.
JAMES A. LAHEY ..... North Hollywood, Ca.
E. E. PEASE, Jr. ..... Phoenix, Az.
O. W. SILLEMAN, Jr. ..... Los Angeles Terminal
LEA V. WILSON, Jr. ..... Richmond, Va.
VERN N. WELLER, Jr. ..... Avila Terminal

20 YEARS

DONNA M. BEARD ..... Schaumburg, Il.
CHARLEY D. ELLIS ..... San Francisco, Ca.
DAVID L. GREGORY ..... Richmond Terminal
ROY P. GILLIS, Jr. ..... Minneapolis, Mn.
PAUL A. INCAPREO ..... Schaumburg, Il.
RICHARD T. KETZA ..... Schaumburg, Il.
HOBERT L. SCHARFF ..... Fresno, Ca.
GUSTAV C. SEAVALL ..... Schaumburg, Il.
KEITH L. SHURTZ ..... Portland Terminal
MARION F. SMITH ..... Schaumburg, Il.
STEN H. WADIN ..... Schaumburg, Il.

15 YEARS

JOE A. BRYANT ..... Los Angeles Refinery
HARRY D. CHURCH ..... Norfolk, Va.
CHARLES W. COOPER, Jr. ..... San Francisco Refinery
ANNE H. ELSBERRY ..... Atlanta, Ga.
L. ENGELSGAARD ..... Los Angeles, Ca.
ROBERT HUNTER ..... San Francisco Refinery
DAVID R. McKINLEY ..... Los Angeles, Ca.
DONALD W. SCHMIDT ..... San Francisco, Ca.
JOANN WILLE ..... Schaumburg, Il.

10 YEARS

KEITH M. CURTIN ..... San Francisco Refinery
WILLIAM M. DIPPE ..... Schaumburg, Il.
SPENCER GREEN ..... Los Angeles, Ca.
GLORIA D. GUINTO ..... San Francisco, Ca.
BRUCE W. HALL ..... San Francisco Refinery
BARBARA A. HASBUN ..... San Francisco, Ca.
STEPHEN M. HORATH ..... Chicago Refinery
THOMAS M. KOTOWICZ ..... Chicago Refinery
EVELYN R. LASHER ..... Schaumburg, Il.
GEORGE LOPEZ ..... Los Angeles Refinery
DAVID L. LOVIN ..... Chicago Refinery
DENNIS J. SCHWARTZ ..... Cincinnati, Oh.
BARNEY D. STAGGS ..... Chicago Refinery
JAMES W. THOMPSON ..... San Jose, Ca.
LAMAR WHITE ..... Torrance, Ca.

5 YEARS

MARIA B. ALVARADO ..... Los Angeles, Ca.
NARDITO D. CALVERO ..... Los Angeles Refinery
PATRICIA A. CHINDERLE ..... Chicago Refinery
LINDA C. DELOATCH ..... South Holland, Il.
LAWRENCE F. GLINES ..... Hoffman Estates, Il.
TIMOTHY L. HARRISON ..... Cleveland, Oh.
LAURA HOLBAY ..... Schaumburg, Il.
FRANCISCO F. LEON ..... Los Angeles, Ca.
JAMES L. McLAIN ..... Nederland, Tx.
DENISE L. MUSHRO ..... Chicago Refinery
STEIN OHRSTROM ..... Schaumburg, Il.
RONALD J. PEARSON ..... Edmonds Terminal
FREDERICH ZACHARY ..... South Holland, Il.

NOVEMBER 1980

40 YEARS

GEORGE C. CRAMER ..... Toledo, Oh.
ELMER R. HOLLAND ..... Chicago Refinery
WILLIAM J. KRON ..... Wildwocd, Fl.
JOHN J. SANDSTROM ..... Schaumburg, Il.
JACK J. WEIDNER ..... Madison, Wi.

35 YEARS

ROSS W. BISHOP ..... Los Angeles Refinery
PAT C. CLARK ..... San Francisco, Ca.
DAVID E. GARBER ..... Orange Terminal
HARRY E. GREGG ..... Tampa, Fl.
FRANK K. LORD ..... Los Angeles Terminal
RALPH W. MILLER ..... San Francisco Refinery
FRANK LEE PERKINS ..... Los Angeles Refinery
RUBEN RAMOS ..... San Francisco Refinery
SIMON S. SEIFERT
W. H. Barber Co. ..... Minneapolis, Mn.
JOHNNY T. SMITH ..... Pensacola, Fl.
MORRIS C. TEITGEN ..... San Francisco Refinery
CHARLES L. THURMAN ..... Coalinga, Ca.

30 YEARS

WILLIAM L. BAKER ..... Los Angeles Refinery
GRACE I. CARROLL ..... Birmingham, Al.
GORDON M. CROSS ..... Beaumont Refinery
KING K. DUBOSE ..... Beaumont Refinery
WILLIAM E. DUTRO ..... Los Angeles Refinery
ROBERT F. FOUSHEE, Jr. ..... Sacramento, Ca.
JOSEPH B. KEENER ..... Wheeling, W.V.
DAVID W. McCANN ..... Tampa, Fl.
JOHN W. RATKOVICH ..... Chicago Refinery
RICHARD I. SULLIVAN ..... Minneapolis, Mn.

25 YEARS

JAMES E. HOOVEN ..... Los Angeles, Ca.
SAM P. SQUIBB ..... Van Nuys, Ca.

20 YEARS

CARL O. CARLSON ..... Omaha, Ne.
ARTHUR M. ELLIS, Jr. ..... Birmingham, Al.
BEVERLY C. HARTUNG ..... Schaumburg, Il.
JUDITH E. HARVEY ..... Schaumburg, Il.
EDWARD A. JEZIOR ..... Schaumburg, Il.
WALTER H. JEZIOR ..... Schaumburg, Il.
JOHN D. MURPHY, Jr. ..... Los Angeles, Ca.
FREDERICK T. MYERS ..... Detroit, Mi.
SAMUEL E. PEAVEY ..... Schaumburg, Il.
WILLIAM R. PTACK ..... Schaumburg, Il.
HELEN V. RAMM ..... Schaumburg, Il.
GARY O. THOMAS ..... Richmond Terminal

15 YEARS

EDWARD CARNEY, Jr. ..... Richmond Terminal
RODNEY R. PUPPE ..... Tacoma, Wa.

10 YEARS

BEN E. ANDREWS ..... Beaumont Refinery
JUNIUS W. BARKLEY ..... Wildwood, Fl.
MICHAEL A. CASEY ..... San Francisco, Ca.
KENNETH S. CASSON ..... Nederland, Tx.
EUGENE R. CHAVEZ ..... Avenal, Ca.
JAMES R. DIEDRICH ..... San Francisco Refinery
MICHAEL W. DRESSEL ..... San Francisco Refinery
PHYLLIS L. FLOWERS ..... Schaumburg, Il.
FRANK W. FRONEK, Jr. ..... Chicago Refinery
MARGUERITE R. GODZICKI ..... Schaumburg, Il.
ANNA ISAAC ..... San Francisco, Ca.
BILL R. KENDALL ..... Chicago Refinery
JUDITH A. KLOOG ..... Forest View, Il.
DOLORES A. KURTZ ..... Schaumburg, Il.
LARRY B. KWASNIEWSKI ..... Chicago Refinery
IRENE LANCE ..... Schaumburg, Il.
ALFRED E. LEWIS ..... Los Angeles Terminal
JAMES R. McQUEEN ..... Chicago Refinery
BOBBIE J. MORROW ..... Santa Maria Refinery
CHARLES S. MURCH ..... San Francisco Refinery
RICHARD A. PANNELL ..... San Francisco Refinery
OLIVER RENFRO ..... Beaumont Refinery
DENNIS K. VAIL
Pure Transportation Co. ..... Olney, Il.
AUSTIN H. VIVALDELLI ..... Chicago Refinery
JAMES E. WHITE, Jr. ..... Beaumont Refinery
WILFRID WHITE ..... Beaumont Refinery

5 YEARS

CHARLES F. ASTROUSKI ..... Los Angeles, Ca.
STEPHANIE L. CAPELLOS ..... Schaumburg, Il.
RONALD ESPAT ..... Torrance, Ca.
JOHN A. GININO
W. H. Barber Co. ..... Chicago, Il.
STEPHENIE J. HARRISON ..... San Diego, Ca.
RONALD H. LOPEZ ..... Santa Maria Refinery
NANCY A. MALM ..... Los Angeles, Ca.
WILLIAM E. PETERSON ..... Schaumburg, Il.
RICHARD A. STERN ..... Los Angeles Terminal
BONNIE L. VAN HAFTEN ..... Schaumburg, Il.

DECEMBER 1980

45 YEARS

HAROLD E. PAULUS ..... Detroit, Mi.

40 YEARS

SHELBY F. DEADERICK, Jr. ..... Los Angeles Refinery
JOHN HADDEN ..... Chicago Refinery

35 YEARS

JOHN A. CHRISTIANSEN ..... San Francisco Refinery
ERNEST J. GOULARTE ..... San Francisco Refinery
CLELL D. HANELY ..... Toledo, Oh.
CEILAN M. HULBIRT ..... Chicago Refinery
WILLIAM J. KEATING ..... San Francisco Refinery
C. F. LEWIS ..... Schaumburg, Il.
SIMMIE A. NIX ..... Santa Maria Refinery
GERALD H. O'LEARY ..... San Francisco, Ca.
GINO ORSI ..... San Francisco Refinery
DONALD G. RAMSTEAD ..... Los Angeles Terminal
FRANKIE F. SEARS ..... Atlanta, Ga.
CLARENCE WILLIAMS ..... San Francisco Refinery

30 YEARS

THOMAS H. BUSCH ..... Los Angeles Refinery
WILLIAM A. DEANE ..... Santa Maria Refinery
DONALD EICHMAN ..... Los Angeles Refinery
WILLIAM GRAFFENIUS, Jr. ..... Schaumburg, Il.
WILLIAM E. HERCHLINE ..... Atlanta, Ga.
WILBUR W. RASH ..... San Francisco Refinery
JACK M. SCOTT ..... Brisbane, Ca.
MARY ANNE SMITH ..... San Francisco Refinery
TOMMIE L. THOMPSON ..... Beaumont Refinery
WILLIAM D. NEWHALL ..... Los Angeles Refinery

25 YEARS

RAYMOND A. ASKEW ..... Norfolk, Va.
RICHARD R. COWAN ..... Los Angeles, Ca.
DONALD F. EVANS ..... Schaumburg, Il.
THOMAS J. JUSTICE ..... Birmingham, Al.
WILLIAM J. LEWIS ..... Los Angeles Refinery
JAMES L. MARKEY ..... Hoffman Estates, Il.

20 YEARS

DOUGLAS E. AKAU ..... Honolulu, Hi.
ARTHUR CLARK ..... Savannah, Ga.
EDWARD H. GARCIA ..... Richmond Terminal
VICTORIA M. STACH ..... Schaumburg, Il.

15 YEARS

LARRY J. BEALMEAR ..... Southfield, Mi.
GERHARD D. BREITLING ..... San Francisco Refinery
ARNIE G. SASSER ..... Tampa, Fl.

10 YEARS

ADYJAIR P. CAVALCANTI ..... North Hollywood, Ca.
GLENN R. EBERLE ..... Schaumburg, Il.
STANLEY KIRCHGESSNER ..... San Francisco Refinery
IRENE W. KOEPKE ..... Schaumburg, Il.
DANNY L. M. LECCE ..... San Francisco Refinery
ROBERT D. LEEDY ..... Brisbane, Ca.
ANDREW W. LOJO ..... San Francisco Refinery
JAMES D. McDANIEL ..... San Francisco Refinery
SUSAN J. PERDUE ..... San Francisco, Ca.
KATHY J. SCHURR ..... Schaumburg, Il.
JAMES M. SMITH ..... Tampa, Fl.
JEANETTE M. VOYDA ..... Schaumburg, Il.
JAMES E. WARD ..... Los Angeles Refinery
GEORGE S. WILCOX ..... Minneapolis, Mn.
GARY L. WOODS ..... Chicago Refinery
ROBERT L. WOODSON ..... San Francisco Refinery
THOMAS F. WYLIE ..... Chicago Refinery

5 YEARS

JOSEPHINE ALVAREZ ..... North Hollywood, Ca.
RICHARD G. BINGHAM ..... Nederland, Tx.
EDWARD BRUMMETT ..... Los Angeles Refinery
WILLIAM F. BURCHAM ..... Chicago Refinery
DANIEL J. CONNER ..... Chicago Refinery
ROBERT H. ERICKSEN ..... Chicago Refinery
JESUS FLORES ..... Schaumburg, Il.
THOMAS N. FRENZEL ..... Chicago Refinery
HARRISON GREENWOOD ..... Los Angeles Refinery
ARTHUR W. HARRISON ..... Wildwood, Fl.
ROBERT W. JACKSON
Pure Transportation Co. ..... Olney, Il.
KENNETH A. JOHNSON ..... Richmond Terminal
LAURA J. LOBOCKI ..... Schaumburg, Il.
JERRY L. LUCAS ..... Chicago Refinery
GEORGE J. NOVOTNY ..... Chicago Refinery
THOMAS J. NOVOTNY ..... Schaumburg, Il.
NANCY M. PECK ..... Richmond Terminal
GARY C. PETERSON ..... Chicago Refinery
CORNELIUS R. PLUG ..... Chicago Refinery
GREGORY E. QUID ..... Des Plaines, Il.
WALTER ROBINSON ..... Chicago Refinery
RANDAL C. STUDE ..... Los Angeles, Ca.
RONALD S. SUNDA ..... Phoenix, Az.
LARRY F. TAYLOR
Pure Transportation Co. ..... Olney, Il.
RAYMOND F. TERZICK ..... Chicago Refinery
HARRY W. VASELS ..... Schaumburg, Il.
CHRIS I. WATKINS, Sr. ..... Chicago Refinery
DUWELL WELCOME ..... Wildwood, Fl.
BARBARA J. WILLIAMS ..... Chicago Refinery
MARK B. WIRTH ..... Chicago Refinery

UNION ENERGY MINING DIVISION

SEPTEMBER 1980

10 YEARS

GERALD E. MARRALL ..... Union Oil Center

OCTOBER 1980

5 YEARS

DOMINIC T. ARRIETA ..... Tucson, Az.
STEPHEN J. PAVLAK ..... Casper, Wy.

NOVEMBER 1980

10 YEARS

CLEO THEIN ..... Casper, Wy.

5 YEARS

MARGARETA KAULISCH ..... Grand Junction, Co.

UNION GEOTHERMAL DIVISION

SEPTEMBER 1980

5 YEARS

GREGORY D. RAASCH ..... Manila, Philippines

OCTOBER 1980

30 YEARS

DELBERT E. PYLE ..... Union Oil Center

NOVEMBER 1980

5 YEARS

DAVID G. CRAYFORD ..... Big Geysers, Ca.

DECEMBER 1980

10 YEARS

GARTH M. LYON ..... Manila, Philippines

5 YEARS

DENNIS W. LAWRENCE ..... Big Geysers, Ca.
CALVIN J. STROBEL ..... Manila, Philippines

UNION REAL ESTATE DIVISION

NOVEMBER 1980

25 YEARS

WILBUR H. COTREL ..... Union Oil Center

UNION INTERNATIONAL DIVISION

OCTOBER 1980

25 YEARS

WILLIAM A. SAX ..... Union Oil Center

5 YEARS

ANA E. ROSALES ..... Union Oil Center

UNION CHEMICALS DIVISION

SEPTEMBER 1980

25 YEARS

ANDREW R. BRENNAN ..... Houston, Tx.
LYLE L. BURNETT ..... Carteret, N.J.
FRANK EMETERIO ..... Brea, Ca.
JEROME J. RAYMOND ..... La Mirada, Ca.
JAMES ROGERS ..... Brea, Ca.

20 YEARS

CHARLES WAUGH ..... Brea, Ca.

10 YEARS

DAVID W. BARTHELMEH ..... La Mirada, Ca.
KENT H. DODGE ..... Carteret, N.J.
RALPH J. KONESKI ..... Carteret, N.J.
BASIL L. MACK, Jr. ..... Lemont, Il.
PETER F. TRAVERS, III ..... Atlanta, Ga.
RICHARD WALKER ..... Brea, Ca.
IRENE M. WESTON ..... Schaumburg, Il.

5 YEARS

JOEY L. CLARK ..... Charlotte, N.C.
DANIEL A. HARRIS ..... Charlotte, N.C.
HOWARD JAIDINGER ..... Kenai, Ak.
JAMES JUSTICE ..... Arroyo Grande, Ca.
CLIFFORD McELREA ..... Kenai, Ak.
MARTIN SHEARER ..... Kenai, Ak.

OCTOBER 1980

30 YEARS

STEPHEN HNEYDA ..... Carteret, N.J.

25 YEARS

JACK CANADAY ..... Brea, Ca.
ROBERT DAVIS ..... Brea, Ca.
DAVID H. LINDSAY ..... Kearny, N.J.

20 YEARS

BENNY CARRUTH ..... Brea, Ca.
MILDRED B. MURPHY ..... Baltimore, Md.
WAYNE REIDY ..... Brea, Ca.

15 YEARS

ALBERT T. OLIVER ..... La Mirada, Ca.
DOROTHY A. SCHMIDT ..... La Mirada, Ca.

5 YEARS

DANIEL G. BROWN ..... Schaumburg, Il.
LAURA M. CONSTANTINO ..... Schaumburg, Il.
HARRY A. DIERKS ..... LaMirada, Ca.
ROBERT FLAGER ..... Brea, Ca.
JOSEPH HARDY ..... Kenai, Ak.
MARK HOWARD ..... Portland, Or.
LINDA KENNEDY ..... Arroyo Grande, Ca.
JOHN R. WRIGHT ..... Charlotte, N.C.
RICHARD J. ZLATOS ..... Lemont, Il.

NOVEMBER 1980

25 YEARS

W. B. VANDERBURG ..... Brea, Ca.

20 YEARS

ROBERT C. BRISCOE ..... Kansas City, Mo.
CHARLES S. DUNN ..... Arroyo Grande, Ca.

15 YEARS

WILLIAM C. BOHANNON ..... Nashville, Tn.

10 YEARS

MILDRED M. BAYNES ..... Carteret, N.J.
BOBBY JOHNSON ..... Charlotte, N.C.
PERRY MURATA ..... Union Oil Center

5 YEARS

GERARD V. CURRAN ..... Conshohocken, Pa.
DONALD ST. JOHN ..... Kenai, Ak.

DECEMBER 1980

35 YEARS

C. E. ARMSTRONG ..... Providence, R.I.
JOSEPH B. RABA ..... Cleveland, Oh.

15 YEARS

JACK HUTCHINS ..... Charlotte, N.C.

10 YEARS

JOE R. McCAULEY ..... Charlotte, N.C.

5 YEARS

JEAN ALLEN ..... Union Oil Center
BRIAN CHRISTENSEN ..... Kenai, Ak.
MERLIN CRUMPACKER ..... Kenai, Ak.
ROBERT DENT ..... Kenai, Ak.
GREGORY KNORR ..... Kenai, Ak.
GREGORY NIBLER ..... Kenai, Ak.
FRANK J. VLK ..... Lemont, Il.

POCO GRAPHITE

SEPTEMBER 1980

10 YEARS

VERNON LEE ..... Decatur, Tx.

OCTOBER 1980

10 YEARS

TOMMY CLOWER ..... Decatur, Tx.
JIMMY SHERMAN ..... Decatur, Tx.

UNION OIL COMPANY OF CANADA LIMITED

SEPTEMBER 1980

25 YEARS

GRANT VOURI ..... Calgary, Alberta

NOVEMBER 1980

25 YEARS

BRUCE GARDNER FREEBORN ..... Calgary, Alberta

DECEMBER 1980

JOHN JOSEPH GRAHAM ..... Calgary, Alberta

MOLYCORP

SEPTEMBER 1980

25 YEARS

JACK BEECHAM ..... Washington, Pa.
ELMER NICHOL ..... Washington, Pa.
HAROLD RAINEY ..... Union Oil Center

10 YEARS

JOE ARELLANO ..... Questa, N.M.
AMADOR RAEL ..... Questa, N.M.
J. EDWARD WENDEL ..... Nipton, Ca.

OCTOBER 1980

25 YEARS

LEW HELLMANN ..... Washington, Pa.
ARTHUR JEFFERS ..... Washington, Pa.
CHARLES MILLER ..... Washington, Pa.
RICHARD SPELLMAN ..... Washington, Pa.

15 YEARS

MERLE COOPER ..... Nipton, Ca.
DAVID DENSON ..... Washington, Pa.
JACK LOAR ..... Washington, Pa.
DONALD STERNER ..... Nipton, Ca.
DAVID WALKER ..... Washington, Pa.
CLARENCE WILSON ..... Washington, Pa.
EDWARD WISZCZOR ..... Washington, Pa.
JON YOUNG ..... Washington, Pa.

10 YEARS

EUGENE LINDSEY ..... Union Oil Center
ROBERT WIGGLESWORTH ..... Nipton, Ca.

5 YEARS

ELI SUAZO ..... Questa, N.M.
JAMES VAN OSTEN ..... Questa, N.M.

NOVEMBER 1980

30 YEARS

ROBERT SUNDAY ..... York, Pa.

15 YEARS

NORMAN BAKER ..... Washington, Pa.
DAVID BUCHANAN ..... Washington, Pa.
CHARLES CHURCH ..... Questa, N.M.
GUY DESMOND ..... Washington, Pa.
JOHN ROGERS ..... Washington, Pa.
MARCELLO VIALPANDO ..... Questa, N.M.
JEAN WILKINSON ..... Nipton, Ca.

DECEMBER 1980

15 YEARS

ELIAS CHAVEZ ..... Questa, N.M.
DAVID SANTISTEVAN ..... Questa, N.M.
CHARLES VELASQUEZ ..... Questa, N.M.
BURTON WHITNEY ..... Nipton, Ca.

5 YEARS

MARY ANN JENKINS ..... Washington, Pa.

JOBBERS AND DISTRIBUTORS

AUGUST 1980

30 YEARS

N. S. BUVICK ..... Santa Maria, Ca.

SEPTEMBER 1980

50 YEARS

ESPIE WATTS LITTLE, INC. ..... Taylorsville, N.C.

30 YEARS

BRIGHTON OIL CO. ..... New Brighton, Mn.
R. E. COX ..... Chelan, Wa.

25 YEARS

GENE BRADLEY ..... Holbrook, Az.

15 YEARS

RICHARD OIL, INC. ..... McClure, Oh.

10 YEARS

JIM JONAS, INC. ..... Lower Lake, Ca.
PRAIRIE OIL CO. ..... Waukesha, Wi.

5 YEARS

HAWKEYE OIL CO. ..... Cedar Rapids, Ia.
QUICK STOP FOOD MART, INC. ..... Fayetteville, N.C.

OCTOBER 1980

45 YEARS

CARTER OIL CO. ..... Walhalla, S.C.
J. C. PELLASCIO ..... Point Arena, Ca.

30 YEARS

M. M. BAILEY ..... Redmond, Or.
WINDWARD PETROLEUM CO., INC. ..... Kaneohe, Hi.

25 YEARS

J. W. EARLEY ..... Port Angeles, Wa.
CHARLES L. BRYANT ..... Modesto, Ca.

20 YEARS

JOHN HODGES ..... Westley, Ca.
YOUNG OIL & SUPPLY CO. ..... Shelbyville, In.

15 YEARS

BELL OIL CO. ..... Augusta, Ga.

10 YEARS

BILLY ESPEY OIL CO. ..... Huntington, Tn.
HOME OIL CO. ..... Ashford, Al.
K. E. EDGMON ..... Madras, Or.
M. VUKSANOVICH ..... Miami, Az.
R. C. BROWN ..... Halfway, Or.

5 YEARS

ELY INVESTMENT CO., INC. ..... East Ely, Nv.
INLAND TRANSPORTATION ..... Cedar Rapids, Ia.
250 BUILDING CORP. ..... Cedar Rapids, Ia.

NOVEMBER 1980

45 YEARS

ADAMS DISTRIBUTING COMPANY ..... Casa Grande, Az.

35 YEARS

J. H. WILLIAMS OIL CO. ..... Tampa, Fl.

30 YEARS

POTEAT OIL CO., INC. ..... Kingsport, Tn.
S. H. DAVIS ..... Toledo, Or.

25 YEARS

BUDDY NE SMITH OIL CO. ..... Hawkinsville, Ga.

20 YEARS

GEORGE MARINER ..... Pocomoke City, Md.

15 YEARS

HAROLD J. CARRON ..... Virginia, Mn.

10 YEARS

ERWIN D. ALVES ..... Half Moon Bay, Ca.
K & L CAR WASH ..... Oak Lawn, Il.
RETTINGER BROS. OIL CO. ..... Long Lake, Mn.

5 YEARS

WOODBURY OIL CO. ..... Woodbury, Ga.

DECEMBER 1980

25 YEARS

DANIELS OIL CO. ..... Elberton, Ga.

15 YEARS

TRI-COUNTY OIL CO. ..... Fredericksburg, Va.

5 YEARS

JOHN BOSMAN ..... Bellingham, Wa.

RETIREMENTS

JUNE 1980

WILLARD C. STUHLFAUT, Union Chemicals
Wayzata, Mn. ..... January 1, 1952

AUGUST 1980

WILLIAM BREMKAMP, Oil and Gas
Casper, Wy. ..... March 6, 1961
RICHARD E. BROWN, Union 76 Division
San Diego, Ca. ..... December 27, 1948
ROBERT D. DOWD, Union 76 Division
N. St. Paul, Mn. ..... November 20, 1950
PAUL D. JONES, Union 76 Division
Arlington Heights, Il. ..... July 28, 1936
CHARLES H. KIRCHNER, Union 76 Division
Gurnee, Il. ..... April 4, 1941

KENTON L. LUDIKER, Oil and Gas
Casper, Wy. ..... September 1, 1946
EDWARD J. MOLLOY, Jr., Union 76 Division
Lafayette, Ca. ..... August 1, 1946

SEPTEMBER 1980

DONALD L. ALLISON, Union 76 Division
Lockport, Il. ..... March 31, 1949
RICHARD T. BURGESS, Union 76 Division
Lucerne Valley, Ca. ..... February 18, 1955
JOSEPH BOBENCHIK, Union Chemicals
Perth Amboy, N.J. ..... June 1, 1955
VIVIAN S. CLARK, Union Chemicals
Antioch, Ca. ..... January 22, 1962
RICHARD S. CROG, Science and Technology
Villa Park, Ca. ..... September 12, 1941
FRANK I. DAVIES, Union 76 Division
Long Beach, Ca. ..... December 15, 1952
EDWARD H. HANSON, Union 76 Division
Menlo Park, Ca. ..... September 6, 1945
PAUL R. HOWARD, Molycorp
Washington, Pa. ..... May 6, 1936
MELVIN S. HURST, Oil and Gas
Midland, Tx. ..... December 10, 1952
JOE E. JONES, Union 76 Division
Newton, Tx. ..... September 12, 1946
ROBERT L. LUCKHARDT, Union Chemicals
Costa Mesa, Ca. ..... November 2, 1953
CHARLES J. MALLOY, Union 76 Division
Walnut Creek, Ca. ..... July 21, 1950
RICHARD PHILLIPS, Union 76 Division
Silsbee, Tx. ..... March 17, 1947
DAVID W. SALMON, Oil and Gas
Coalinga, Ca. ..... December 1, 1942
GEORGIEREE H. SMITH, Union 76 Division
Savannah, Ga. ..... October 14, 1957
ALBERT C. TARR, Union 76 Division
Torrance, Ca. ..... July 11, 1952
RAYMOND L. TURNER, Jr., Union 76 Division
Beaumont, Tx. ..... August 24, 1948
WILLIAM R. WHITFIELD, Union 76 Division
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PHENLY W. BAHAM, Union 76 Division
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SAM D. BLACKWELL, Poco Graphite
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RAYNOR B. BRADSHAW, Union 76 Division
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PAUL K. COSS, Union 76 Division
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JAMES R. DABNEY, Oil and Gas
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JOHN A. DEMPSEY, Union 76 Division
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BESSIE C. DePALMA, Union 76 Division
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HARRY L. FOWLER, Union 76 Division
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ROBERT F. GLEASON, Union 76 Division
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WILLIAM E. HAM, Jr., Science and Technology
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WOODROW W. JELKS, Oil and Gas
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WILLIAM KARLAK, Union 76 Division
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VERLE D. MASON, Union 76 Division
Mira Loma, Ca. ..... March 23, 1953
JOSEPH M. MURPHY, Union 76 Division
Rodeo, Ca. ..... April 8, 1946
PHILLIP M. SEATON, Oil and Gas
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HENRY A. SHREVE, Union 76 Division
St. Albans, W.V. ..... June 24, 1946

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HAROLD G. AYERS, Sr., Union 76 Division
Lockport, Il. ..... November 16, 1938
NELLIE N. BEAUCHAMP, Oil and Gas
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ROBERT R. COOPER, Union 76 Division
Beaumont, Tx. ..... May 3, 1948
CHARLES J. FERRY, Union 76 Division
Lockport, Il. ..... May 1, 1940
LOUIS A. HAJEK, Union 76 Division
Lemont, Il. ..... January 6, 1947
JAMES L. HESTER, Union 76 Division
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LOUIS L. HESTER, Union 76 Division
Nederland, Tx. ..... November 18, 1946
LEROY HOLLAND, Union 76 Division
Robeline, La. ..... August 12, 1952
THOMAS E. HOWELL, Union 76 Division
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WILLIAM F. ISABELL, Union 76 Division
Call, Tx. ..... July 28, 1953
JAMES C. MEEKS, Union 76 Division
Nederland, Tx. ..... September 13, 1950
CHARLES R. MERRILL, Oil and Gas
Midland, Tx. ..... November 4, 1946
LEROY G. NAGEL, Union 76 Division
Lockport, Il. ..... February 13, 1940
WILLIAM H. NOTT, Oil and Gas
Coalinga, Ca. ..... October 26, 1945
JAMES C. PETERSON, Union 76 Division
Superior, Wi. ..... October 16, 1950
STANLEY J. PIRC, Union 76 Division
Joliet, Il. ..... August 20, 1951
GENEVIEVE M. SALLINE, Union 76 Division
Arlington Heights, Il. ..... March 3, 1949
EDWARD D. SANDS, Jr., Oil and Gas
Houston, Tx. ..... August 16, 1945
BERTON S. SARIS, Union 76 Division
Las Vegas, Nv. ..... August 29, 1952
PAUL H. WERFELMANN, Union 76 Division
Brooksville, Fl. ..... July 18, 1960

IN MEMORIAM

EMPLOYEES

SIMEONE ADDIEGO, Union 76 Division
So. San Francisco, Ca. ..... September 22, 1980
ALAN A. AMUNDSEN, Union 76 Division
Schaumburg, Il. ..... August 1, 1980
PAIGE R. ASHMAN, Molycorp
Questa, N.M. ..... August 16, 1980
GEORGE H. BARNES, Union 76 Division
Clearwater, Fl. ..... August 30, 1980
CLAYTON H. BLACK, Union 76 Division
Spartanburg, S.C. ..... September 4, 1980
GEORGE H. CASEY, Oil and Gas
Edmond, Ok. ..... September 10, 1980
LESLIE JACK CLAYTON, Union Chemicals
Buena Park, Ca. ..... September 26, 1980
DONALD H. FERR
Fullerton, Ca. ..... September 13, 1980
DONALD LINDROS, Corporate
Cypress, Ca. ..... September 2, 1980
JOHN McGEE, Oil and Gas
Ojai, Ca. ..... June 27, 1980
NOLAN D. MOORE, Union 76 Division
Port Arthur, Tx. ..... September 4, 1980
CHARLES B. NOBLETT, Union Chemicals
Santa Fe Springs, Ca. ..... September 26, 1980
JOSEPH H. PAAUHAU, Union 76 Division
Mountlake Terrace, Wa. ..... July 13, 1980
JOSE A. PEREY, Union 76 Division
Fairfield, Ca. ..... September 5, 1980
RICHARD PHILLIPS, Union 76 Division
Silsbee, Tx. ..... August 21, 1980
LEO G. RECCHI, Union 76 Division
Rodeo, Ca. ..... August 19, 1980
LEE A. ROGERS, Oil and Gas
Missouri City, Tx. ..... August 30, 1980
BELTON M. SPARKS, Union 76 Division
Nederland, Tx. ..... August 15, 1980
PAUL F. STROMGREN, Corporate
Glendale, Ca. ..... August 18, 1980
IVONA F. TROFKA, Union 76 Division
Glendale, Ca. ..... July 14, 1980
L. R. WILLIAMS, Union 76 Division
Park Ridge, Il. ..... September 3, 1980
GREGORY B. WYANT, Oil and Gas
Midland, Tx. ..... August 21, 1980

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JOE C. AKIN, Union 76 Division
Birmingham, Al. ..... September 3, 1980
JOHN ARNOLD, Oil and Gas
Sarasota, Fl. ..... June 23, 1980
SAMUEL D. ASHLEY, Union 76 Division
Austell, Ga. ..... July 16, 1980
LUCILLE HORTON ASKEW, Corporate
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HENRY F. BARNES, Oil and Gas
Taft, Ca. ..... July 7, 1980
HAROLD F. BELL, Union 76 Division
Columbus, Oh. ..... September 27, 1980
CHARLES BLEDSOE, Oil and Gas
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WALTER BOAZ, Oil and Gas
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PHILLIP A. BRENO, Union 76 Division
Crossville, Tn. ..... September 3, 1980
CLYDE BRUST, Union 76 Division
Brookland, Ar. ..... August 1, 1980
EVERETT BULLARD, Oil and Gas
Flora, Il. ..... July 3, 1980
ALBERT B. CLARK, Oil and Gas
Van, Tx. ..... July 19, 1980
FRED L. CLUTTER, Oil and Gas
Cisne, Il. ..... August 30, 1980
LOUIS L. COSTA, Union 76 Division
San Pablo, Ca. ..... September 12, 1980
WAYNE H. DENNING, United Geophysical Co., Inc.
Morro Bay, Ca. ..... June 13, 1980
EDWIN G. DUKE, Union 76 Division
Jacksonville, Fl. ..... July 13, 1980
HERBERT C. DUNN, Union 76 Division
Anaheim, Ca. ..... July 21, 1980
JAMES W. FLANIGAN, Oil and Gas
Fullerton, Ca. ..... July 24, 1980
GEORGE W. GIBBS, Oil and Gas
Tulsa, Ok. ..... September 28, 1980
CHARLES K. GREEN, Oil and Gas
Santa Maria, Ca. ..... August 20, 1980
WILLIAM M. HARRISON, Oil and Gas
Sapulpa, Ok. ..... July 17, 1980
WAYNE HAW, Union 76 Division
Grants Pass, Or. ..... July 2, 1980
FRANCES E. HOWELL, Union 76 Division
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ROBERT M. JACKSON, Union 76 Division
Delray Beach, Fl. ..... September 12, 1980
AUBREY N. KNIGHT, Union 76 Division
Norfolk, Va. ..... June 24, 1980
TED R. LAIDLAW, Union 76 Division
Glendale, Ca. ..... July 18, 1980
ARTHUR L. LAMAR, Union 76 Division
Lakewood, Ca. ..... September 13, 1980
WILLIAM H. LASATER, Arapahoe Pipeline
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JENNINGS L. LIGHT, Oil and Gas
Dawes, W.V. ..... September 23, 1980
LYMAN E. LIMBOCKER, Union 76 Division
Huntington Beach, Ca. ..... July 21, 1980
STEPHEN J. LINTNER, Union 76 Division
Toledo, Oh. ..... August 26, 1980
HOMER V. MARTIN, Oil and Gas
Sapulpa, Ok. ..... August 17, 1980
MAURICE H. MAXWELL, Union 76 Division
Dana Point, Ca. ..... September 10, 1980
JAMES H. MILLER, Union 76 Division
Banning, Ca. ..... July 7, 1980
FREDERICK NEVINS, Marine
Long Beach, Ca. ..... June 10, 1980
NORAH A. O'RORKE, Union 76 Division
Dublin, Ireland ..... August 2, 1980
DELBERT OSTERMAN, Union 76 Division
Fort Wayne, In. ..... June 27, 1980
ANTONIO L. PIRES, Union 76 Division
Rodeo, Ca. ..... September 25, 1980
EMORY L. PULLEN, Union 76 Division
Byron, Ca. ..... September 2, 1980
THEROLD RAMSEY, Oil and Gas
Morro Bay, Ca. ..... June 25, 1980
GEORGE C. ROESS, Union 76 Division
Ballwin, Mo. ..... August 19, 1980
VICTOR H. ROOD, Union 76 Division
Palatine, Il. ..... September 18, 1980
BERNIE R. SCARBOROUGH, Union 76 Division
New Port Richey, Fl. ..... July 10, 1980
JOHN D. SHAFER, Oil and Gas
Noble, Il. ..... September 27, 1980
GARLAND H. SHEATS, Union 76 Division
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LLOYD N. SLUYTER, Union 76 Division
Buena Park, Ca. ..... August 7, 1980
GOLDMAN SMITH, Oil and Gas
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ORLAN LUTZ SNYDER, Union 76 Division
Tampa, Fl. ..... June 6, 1980
DAVID J. TIERNEY, Union 76 Division
Long Beach, Ca. ..... July 9, 1980
EDITH OLMSTED TIMMSEN, Union 76 Division
San Francisco, Ca. ..... March 16, 1980
NELLE L. UNDERWOOD, Union 76 Division
Indianapolis, In. ..... May 6, 1980
WALT VOLLMER, Union 76 Division
Napa, Ca. ..... June 26, 1980
JAMES PRESTLEY WAITS, Union 76 Division
Trusville, Al. ..... June 13, 1980
CLARENCE D. WALTERS, Oil and Gas
Clay City, Il. ..... July 20, 1980
EARL WINCHESTER, Oil and Gas
Flora, Il. ..... September 6, 1980

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COVER: The Christmas card beauty of the wild Snake River outside Yellowstone Park in Wyoming, might be one choice in SEVENTY SIX magazine's photography contest featuring energy efficiency. Photo by Karen Saunders. Story on page 8.

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