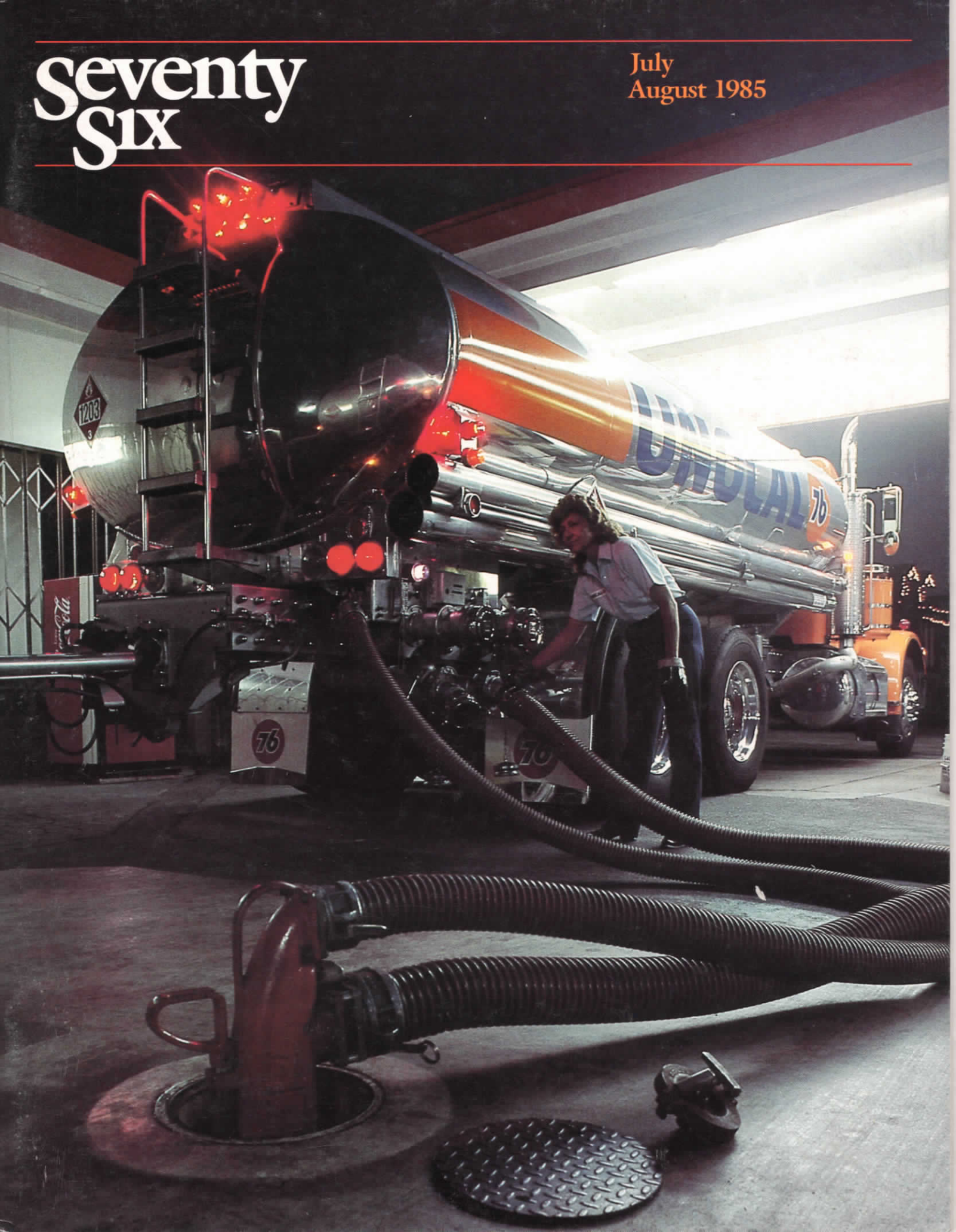
seventy six

July
August 1985



COMMEMORATING A TRIUMPH

The morning of June 21 dawned sunny and bright in the Gulf of Thailand. On board Union Oil of Thailand's Satun living quarters platform (SLQ), located in the middle of the Gulf 125 miles from shore, excitement was building.

Workers scurried everywhere: cleaning and polishing, setting up tables and chairs, making sure all was ready for the big day. The chefs in the galley were hard at work, preparing a sumptuous luncheon. On the bridge leading to Satun's central gas processing platform (CPP), workers were busy putting up flags and decorating the railings with orange and blue bunting. The CPP itself—a huge, high-tech marvel of pipes, valves and vessels, all freshly painted bright yellow and white—sparkled in the morning sun.

Up on the helideck atop the SLQ, several Satun workers and a contingent of reporters and photographers were scanning the skies. It was nearing 10 a.m., and any minute the first of three helicopters was due to arrive. Coming from Hat Yai and Songkhla, Union's staging area on the coast of southern Thailand, the choppers were carrying some very special guests. Among them: the Prime Minister of Thailand, H.E. General Prem Tinsulanonda; a contingent of senior executives from Unocal and its two partners in Thailand, SEAPEC (South East Asia Petroleum Exploration Co. Ltd.) and MOECO (Mitsui Oil Exploration Co. Ltd.); and nine Buddhist monks gathered from temples in Songkhla province.

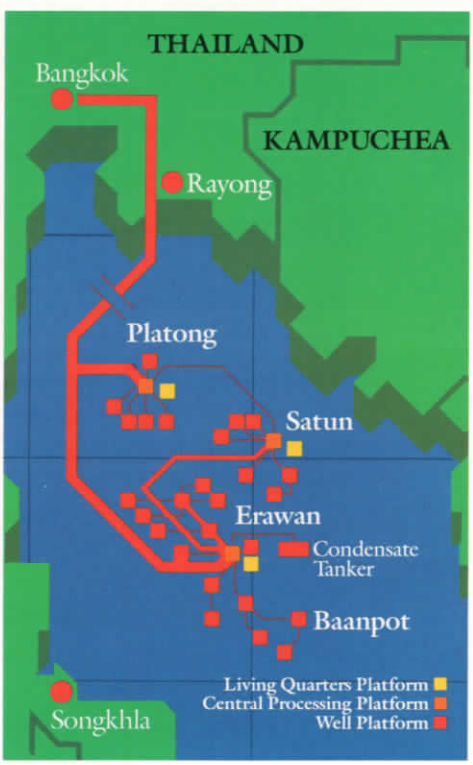
The occasion was the formal dedication of production from three natural gas fields (Baanpot, Satun and Platong) covered in the Second Gas Sales Agreement, signed in May of 1982, between Union Oil of Thailand (UOT), its co-venturers, and the Petroleum Authority of Thailand (PTT). But in fact, this was much more than just a dedication. This day marked both an important energy milestone for the nation of Thailand, and a technological and logistical triumph for Unocal—a triumph over problems that had seemed all but insurmountable only a few short years ago.

Just after 10:00, the three choppers landed in quick succession. The Prime Minister's group came in first, then the executives (including Unocal Chairman and President Fred L. Hartley; Ray A. Burke, chairman of UOT and senior vice president of Unocal; and Harold M. Lian, president of UOT). Finally came the nine saffron-robed monks, who would perform a religious ceremony to bless the new facilities.

After the monks had disembarked and proceeded downstairs, Mark Stephens, area production supervisor for Satun and Platong fields, took a moment to gaze out over the water before heading down himself. Stephens, who served as project manager during the development of the two fields, is one of several UOT employees who have been involved with the project from design to operation.

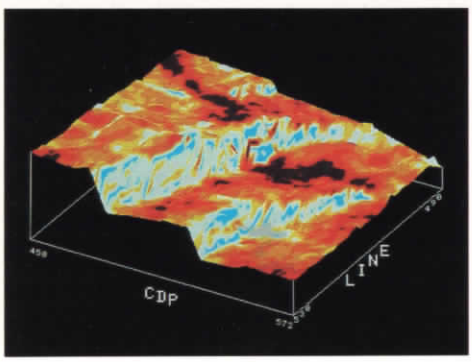
"Look at all those structures," he said, regarding a line of production platforms extending along the horizon. "I can remember when it was really lonely out here. Now it's like a small city. Sometimes it's hard to believe what's been accomplished. We've really turned the corner here in Thailand."

UOT's Mark Stephens (right) and Wayne Wheeler have worked on the Satun/Platong development project from design to operation. Above, a portion of Satun's central processing platform is installed.



"Unocal has been in Thailand for 23 years now. We made a major commitment to help the Kingdom develop its energy resources. We have never wavered from that commitment, and we are prepared to assume additional responsibilities in the future."

Ray A. Burke



Clockwise from top: The Satun central processing and living quarters platforms; the Buddhist monks arrive at Satun; Prime Minister Prem Tinsulanonda shares a light moment with Hal Lian and Fred L. Hartley; computer-generated display depicting a section of Satun field's gas-bearing sand deposits.

Indeed. UOT's offshore Thailand operations now extend over a distance of 55 miles. The company has drilled 200 wells in the four gas fields it is developing, and 35 offshore structures have been installed. Natural gas from the Gulf now supplies 30 percent of Thailand's total commercial energy requirements, and more than 1,100 people (including contract labor) work offshore on UOT operations. (UOT itself currently has 720 employees, more than 80 percent of whom are Thai nationals.)

"Turning the corner" to reach this point, however, was not a simple task. Beginning with Erawan, the first Gulf of Thailand gas field developed by UOT, the company's gas projects in Thailand have been beset by a series of difficult obstacles. Among them: unexpectedly complex geology, extremely high reservoir temperatures and pressures, and the logistical problems of coordinating and carrying out a major drilling and construction effort 125 miles offshore. Add to this tight contractual deadlines for delivering gas to PTT, and you have the makings of a formidable challenge.

Yet the company not only met, but exceeded that challenge in developing the new fields. In October of 1983, UOT brought Baanpot into production—14 months ahead of schedule—tied into the existing processing facilities of Erawan field. Satun began producing in January of this year, and Platong came on stream in March—both two months ahead of schedule and under budget.

The four fields can now produce a total of 450 million cubic feet of gas per day (Mmcfd) and 20,000 barrels of condensate—more than enough to meet the company's present commitments to the Thai government. PTT is currently taking an average of 370 Mmcfd and 16,000 barrels of condensate. (Most of the gas is used for electric power generation; a smaller portion goes to a cement factory and to an LPG plant which produces fuel for transportation and domestic uses.) Thailand's natural gas consumption should rise in the near future, however. Plans for fertilizer and petrochemical plants are now in the works, and the LPG plant is slated for expansion.

"Three years ago, we were in a shortfall situation," says Dr. Hal Lian, president and chief operating officer, UOT. "We brought together the best in people, equipment, and technology to meet the challenge—and our efforts paid off. We began to better understand the nature of the geology. We brought to Thailand the most sophisticated geophysical interpretation techniques. We reduced the time and cost of drilling by more than 50 percent, and we designed and built state-of-the-art facilities. The result was a dramatic turnaround."

The turnaround required a lot of hard work on the part of UOT and its contractors—not to mention speed. A total of 13 well platforms were fabricated and installed in the three new fields, plus living quarters and processing platforms at both Satun and Platong. As construction proceeded, 100 development wells were drilled in the three fields by six separate drilling rigs.

At the peak of drilling activity, a well was being completed every four to five days. In addition, 118 miles of in-field pipeline were laid by UOT contractors, and PTT's contractor laid a 29-mile tie line from Platong to the main PTT gas sales pipeline. (Since Satun lies only 16 miles northeast of Erawan, its gas enters the main pipeline at the Erawan CPP. Platong, northernmost of the producing fields, lies 40 miles north of Erawan.)

Contributing to the successful development of the new fields was the fact that many of those involved were veterans of the Erawan project.

"We learned a lot of lessons with Erawan," says Marty Miller, UOT's vice president for operations. "Being able to build on that experience was a great help in spurring along this project."

Perhaps most visibly advanced were the design and construction of the Satun and Platong central processing facilities. One reason is that the second gas sales contract required that gas from the two fields comform to more rigid product specifications than Erawan gas. In addition, it was decided that gas processing in the new fields would be more centralized than at Erawan due to the large number of wells being drilled. (At Erawan, gas from some wells is partially processed at smaller platforms before reaching the CPP.)

Each of the Satun and Platong processing platforms have state-of-the-art facilities for gas separation, compression, cooling, dehydration, hydrocarbon dewpoint control and condensate stabilization. The platforms process gas in two parallel systems, or "trains." Each train on the Satun platform can handle up to 90 million Mmcfd, while the Platong units each have a 60 Mmcfd capacity. Computers control the temperature, pressure, and flow rates of the sales gas.

The two new living quarters platforms, which are identical, are improved as well. "We got a lot of input from the people living and working at Erawan, and incorporated their ideas into the design of the new platforms," Stephens explains. As a result, the new LQs, each of which houses 120 persons, are as modern and spacious as any in the world. The platforms sport enlarged workshop and warehouse areas, improved materials handling equipment, and expanded dining and recreation space. A catering chef was even called in to help design the galleys.

"These LQs are really first-class," Stephens says. "They're excellent support structures for keeping the process plants on line."

Among dignitaries attending the June 21 ceremonies were Hal Lian and Ray Burke.

If anyone knows the nuts and bolts of the four new platforms, Stephens does. Assigned by construction manager R.A. "Bud" Nordquist to supervise the design, fabrication and hookup of the Platong and Satun facilities, Stephens spent more than three years on the project. His involvement began back in February of 1982, at the Tulsa, Oklahoma offices of a firm contracted by Unocal to design the offshore structures and equipment. Stephens spent 18 months there, then accompanied the finished blueprints to Korea, where fabrication took place. This phase lasted 13 months.

"We had a fixed date for getting the platforms to the Gulf, regardless of their state of completion," Stephens recalls. "There was a big effort to stay on schedule, because we didn't want to have to complete any onshore work offshore."

When the platforms were finished—ahead of schedule—each was loaded in sections on barges. In late September of 1984, the barges embarked for the Gulf of Thailand, a trip that took three weeks. For the next several months, Stephens and his assistant, project engineer Wayne Wheeler, worked almost continuously offshore. Stephens supervised installation of the Satun platforms, with Wheeler overseeing Platong. More than 150 laborers worked at each site. The platforms were set in October, with hookup taking place over the ensuing weeks.

"Development drilling in the fields had been going on for quite a while, of course," Wheeler recalls. "So the gas was there when we were ready to start up." Satun went on stream first, achieving a successful startup on January 17. Platong began production on March 5.

"We're very grateful for the support we've had throughout the project from the Thai government. Without that support, it would not have been possible to finish these highly complex operations ahead of schedule."

Harold M. Lian

Above, a close-up view of a section of Satun's CPP. Right, the chief monk makes a mark for prosperity on the platform's commemorative plaque.

"Not many engineers get the kind of opportunity I got—to start with a blank piece of paper and go all the way through to the very end of a job," Stephens says. "Unocal management deserves credit for allowing individuals to do that, and for accepting peoples' input along the way. Everyone involved worked hard and jelled as a team, and I think we've got the results to show for it. I am super, super proud of these facilities."

By 10:30 a.m. on dedication day, an overflow crowd had assembled in the SLQ recreation room. Along one wall of the room, a narrow stage was set up next to a small Buddhist shrine. The nine monks were seated on a row of cushions on the stage. Several rows of folding chairs, filled with guests and Satun staff, faced the stage. On the sidelines, two dozen reporters and photographers stood by to record the proceedings.

Following introductions by Dr. Lian and a brief welcoming address by Mr. Burke, Prime Minister Prem Tinsulanonda began the religious ceremony. Candles and incense were lit, followed by several minutes of chanting by the monks. The Prime Minister and guests then offered food and gifts to the monks. After another chant, the chief monk and most of the guests proceeded out to the CPP, where the Prime Minister unveiled a commemorative plaque to a round of cheers and applause. The chief monk made a mark for prosperity on the plaque, then sprinkled holy water on the guests and employees.

A tour of the CPP followed, including a visit to the platform's control room. There, Mr. Hartley and the Prime Minister talked with one of the platform operators, a Thai national who had recently earned his five-year UOT pin and purchased a new house. (This employee, along with more than 260 other Thai nationals on the UOT payroll, was a graduate of the company's Songkhla technical training center.)

"How many years does your mortgage run?" Hartley asked the operator.

"Five years," he replied.

"You're very lucky," Hartley said. "In my country it's usually 30 years."

"I'm glad I live here in Thailand," the operator said, smiling. Everyone in the room shared a laugh.

Back on board the SLQ, the group proceeded to the dining hall for a post-dedication luncheon. Among those making short speeches before the meal were Mr. S. Kumano, chairman of MOECO; Thailand Minister of Industry Mr. Ob Vasuratna; Prime Minister Prem Tinsulanonda; and Mr. Hartley.

"I wish to commend Union Oil Company of Thailand and its partners for their very fine efforts and achievements," the Prime Minister said. "We are grateful for your demonstration of confidence in the future of our country. We also commend you for the conscientious effort to discharge your responsibility in the area of technology transfer.

"The event we are celebrating today is an important milestone on Thailand's road to energy independence. It also is an event that augers well for the future. In the years to come, natural gas will occupy center stage in supplying our nation's growing energy needs."

In proposing a toast moments later, Mr. Hartley expressed similar sentiments.

"The dedication of the gas fields of the Second Gas Sales Agreement is equally important for the Kingdom of Thailand, and for our company," he said. "We have shared burdens together and we have shared benefits. Today we share mutual pride and satisfaction in dedicating three gas fields, whose output marks the beginning of a new era in Thailand's energy development."

A new era begins: shared pride, shared benefits, and shared satisfaction in having achieved an energy milestone.

Unocal:
a new name, a new look at where we are

Company installations worldwide are taking on the name "Unocal." While Union Oil Company of California will continue as the principal operating subsidiary of Unocal Corporation, the Delaware parent organization, it will now do business as "Unocal." The new name and logo, correctly and consistently applied, will clearly link all company operations and products to the parent organization, serving as a strong visual identity for our growing diversity of activities.

The Corporate Communications Department, in charge of administering the name-change program, is now producing a graphics standards manual to be distributed this fall. The manual will provide rules and examples of the proper use of the logo in all situations.

Efforts to implement the new name and logo were slowed by the events of the first part of this year when Mesa Partners II attempted a hostile takeover. With that episode closed, the conversion of signage, stationery, business cards and the like is now proceeding. Corporate identity coordinators have been appointed in each division, and schedules are being developed to achieve the conversion with appropriate speed and economy.

The new division names are:

Unocal Chemicals Division

Unocal Energy Mining Division

Unocal Geothermal Division

Unocal International Oil & Gas Division

Unocal Oil & Gas Division

Unocal Real Estate Division

Unocal Refining & Marketing Division
(formerly, Union 76 Division)

Unocal Science & Technology Division

Wholly owned U.S. subsidiaries that previously expressed an affiliation with Union will now be designated "A Unocal Company," as in:

Molycorp, Inc.
A Unocal Company

Poco Graphite, Inc.
A Unocal Company

Subsidiaries that have not before expressed an affiliation with the company will not do so now. The exception is Moreland Development Company, which will become Unocal Land & Development Company.

Foreign subsidiaries that used the "Union" designation will become "Unocal" followed by the country name:

Unocal U.K. Ltd.

Unocal Indonesia, Inc.

Unocal Norge A/S

Unocal Thailand, Inc.

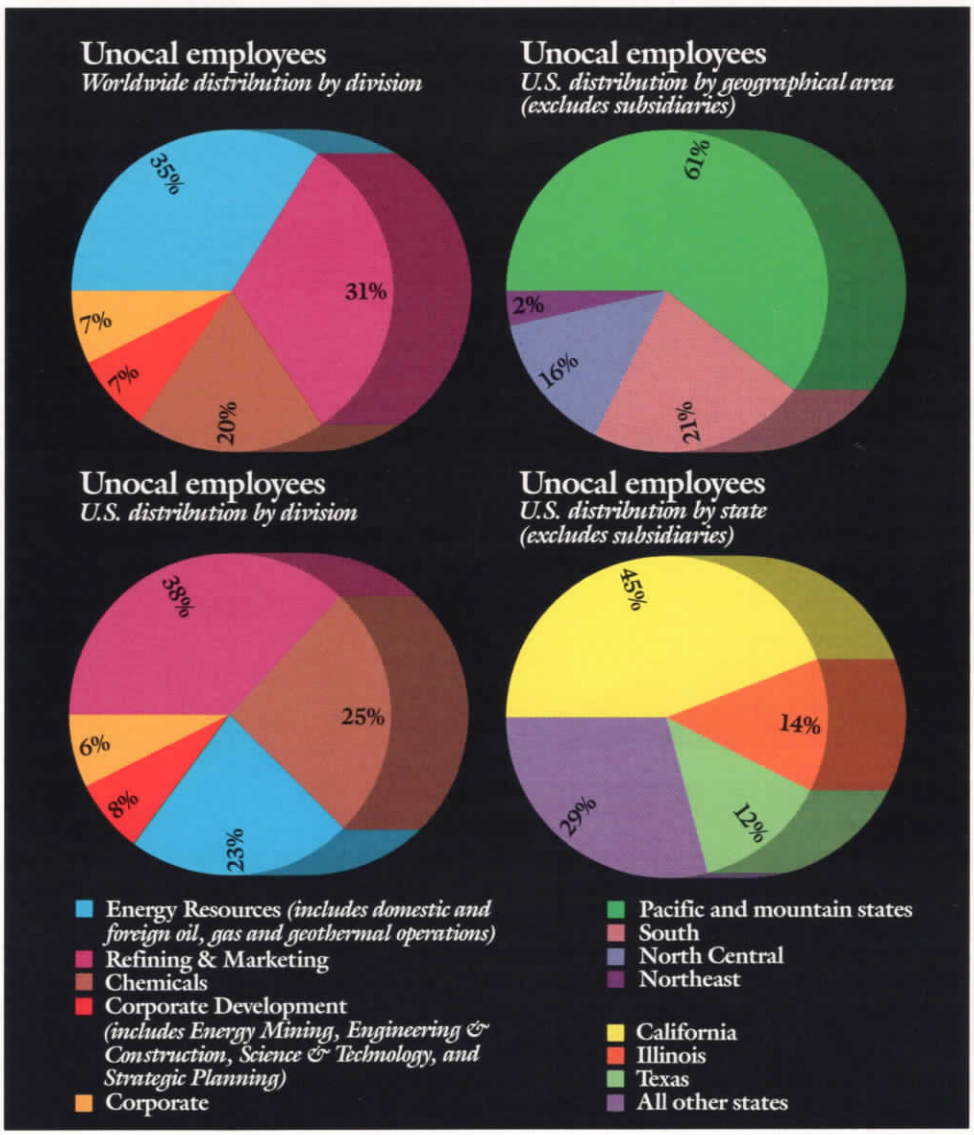
Corporate headquarters is now known as Unocal Center. The street address has changed: 1201 West 5th Street, Los Angeles 90017. The mailing address remains P.O. Box 7600, Los Angeles, California 90051.

Unocal Center is the largest of the company's offices with 1,297 employees. The Refining & Marketing Division's headquarters in Schaumburg, a suburb of Chicago, runs a close second with 1,093.

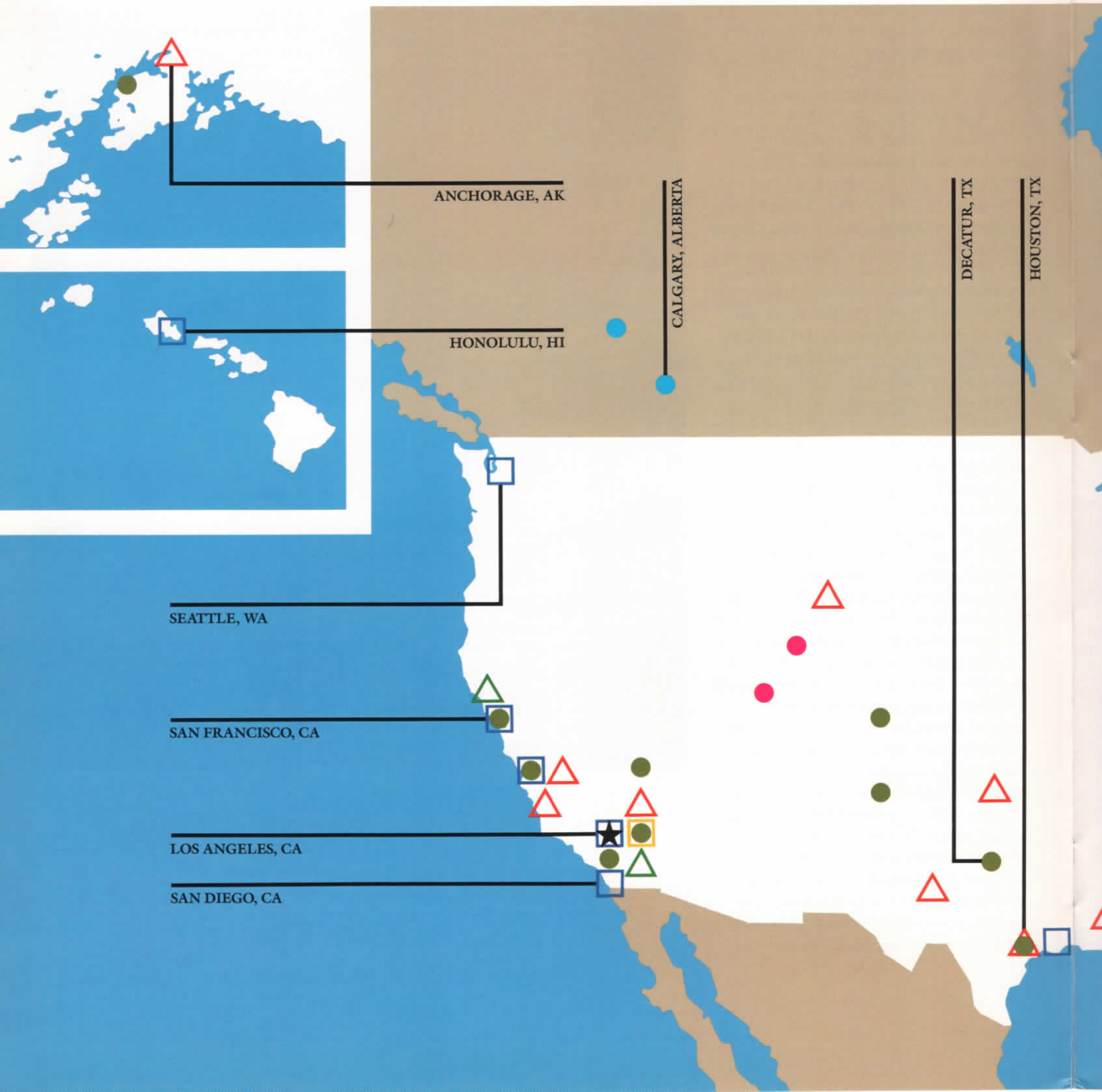
Worldwide, Unocal Corporation employs 20,986 people. Of these, 17,087 work in the United States—in 45 states and Washington, D.C. There are 3,899 employees stationed in 24 countries outside of the United States. These include 297 expatriate U.S. citizens, but the great majority—3,602—are citizens of the countries where we have operations.

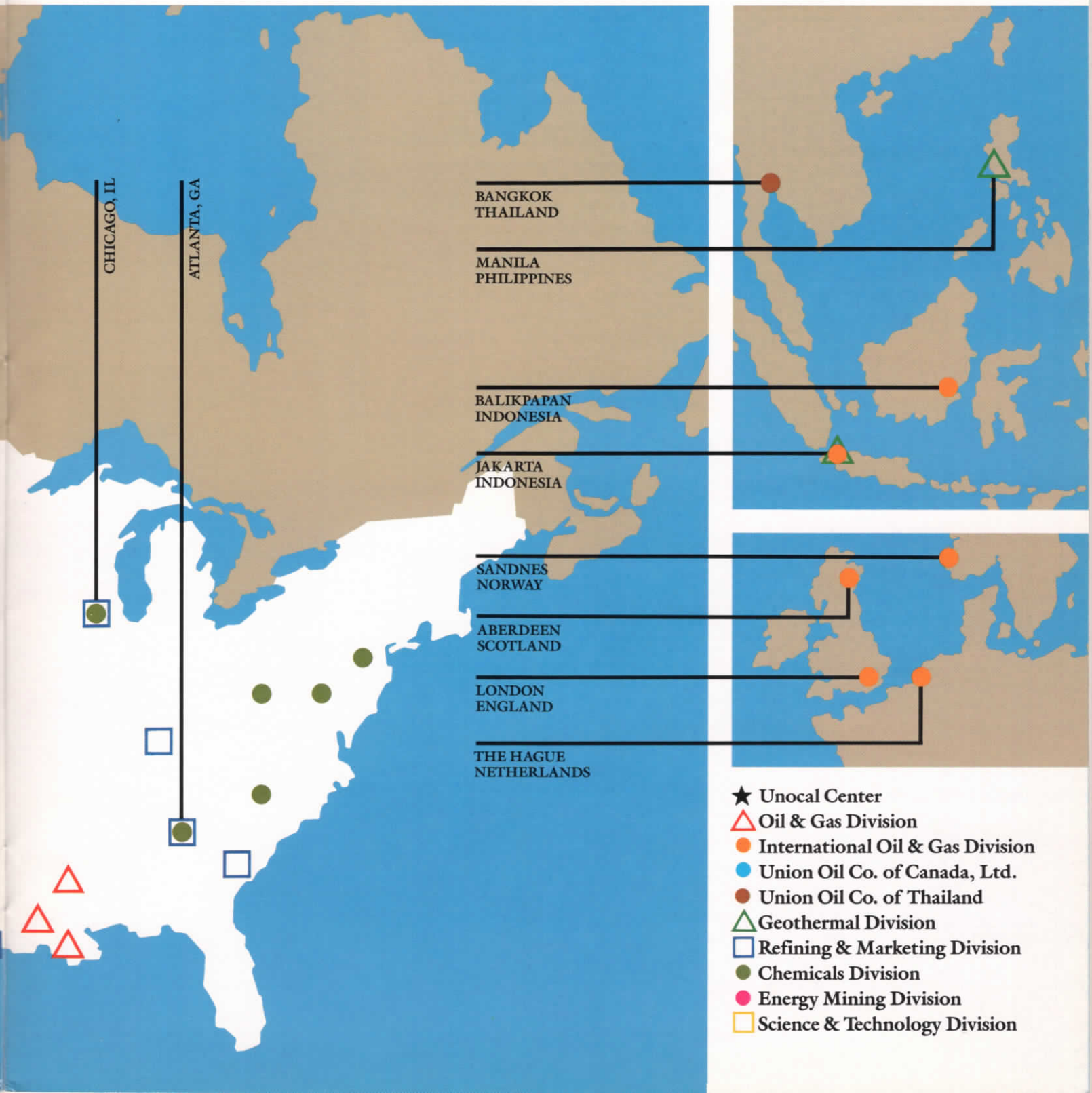
Seventy-one percent of the U.S. employees live in three states: California, where the company was founded in 1890, Texas and Illinois. Some 40 percent of the U.S. employees (including expats) have been with the company for more than 10 years. Median years of service is seven and median age is 37.

The charts on this page and map on the following pages provide an overview of how Unocal people are distributed around the globe. What the drawings cannot show is that Unocal people are found in all kinds of terrain and weather—from the Arctic to steaming jungles, from dry desert plains to deep ocean waters. Yet all of Unocal's people share in the same effort: working to advance the company's search for and development of earth resources, and striving to develop better ways to use and market our products. (76)



Major Unocal Facilities

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SCOTLAND
LONDON
ENGLAND
THE HAGUE
NETHERLANDS
Unocal Center
Oil & Gas Division
International Oil & Gas Division
Union Oil Co. of Canada, Ltd.
Union Oil Co. of Thailand
Geothermal Division
Refining & Marketing Division
Chemicals Division
Energy Mining Division
Science & Technology Division

MAKING MILES

ON THE ROAD WITH NANCY MALM

It's nearing midnight on this crisp spring evening, and the Unocal Refining and Marketing Division's Los Angeles Terminal is humming. At LAT, biggest and busiest of the company's three major Western Region truck terminals, there's no such thing as slack time. Huge truck-and-trailer rigs rumble through the sprawling complex at all hours, pausing only long enough to refill their tanks with gasoline or diesel. It's a never-ending procession that continues 365 days a year.

Right: Unocal trucker Nancy Malm makes a fuel drop. "You don't have to be 6'4" and 200 pounds to do this job."

Inside the truck yard's lounge, a half dozen drivers take temporary refuge from the bustle outside. Talk among the drivers never varies much: road conditions, freeway geography and "bone-headed motorists" are standard fare. But the subject matter isn't really what's important. Driving a 65-foot-long truck-and-trailer rig—especially one that's loaded with 8,600 gallons of combustible fuel and weighs 80,000 pounds—is not an easy way to make a living. The work is both physically and mentally demanding, and largely solitary. Brief as it is, this "attitude adjustment time," as the drivers call it, helps them gear up for their 10-hour shifts and unwind after them.

Three of the drivers—all men—are seated at a table exchanging road tales when a petite, cheerful-looking woman strides into the room. Clad like the men in a pair of jeans and a pressed blue Unocal shirt, she looks to be in her early 40s.

"Hello, Nancy," one of the men chirps. "Where they got you headed this morning?"

"Up to Goleta first," she says, sitting down to scan a one-page computer printout. "Looks like I get to put some road time on today, Bob."

Meet Nancy Malm—wife, mother, grandmother, and one of 60 full-time Unocal truck drivers who haul product out of LAT.

To an outsider, the idea of a grandmother in this rugged line of work might seem, well, a bit incongruous. But around the L.A. Terminal, it's a different story. The first female driver ever hired by the Los Angeles Terminal (there are now six), Nancy is in her tenth year with Unocal. She recently picked up her ninth consecutive safe driving award—a coveted brass belt buckle given annually by the company to drivers who complete an accident-free year on the road.


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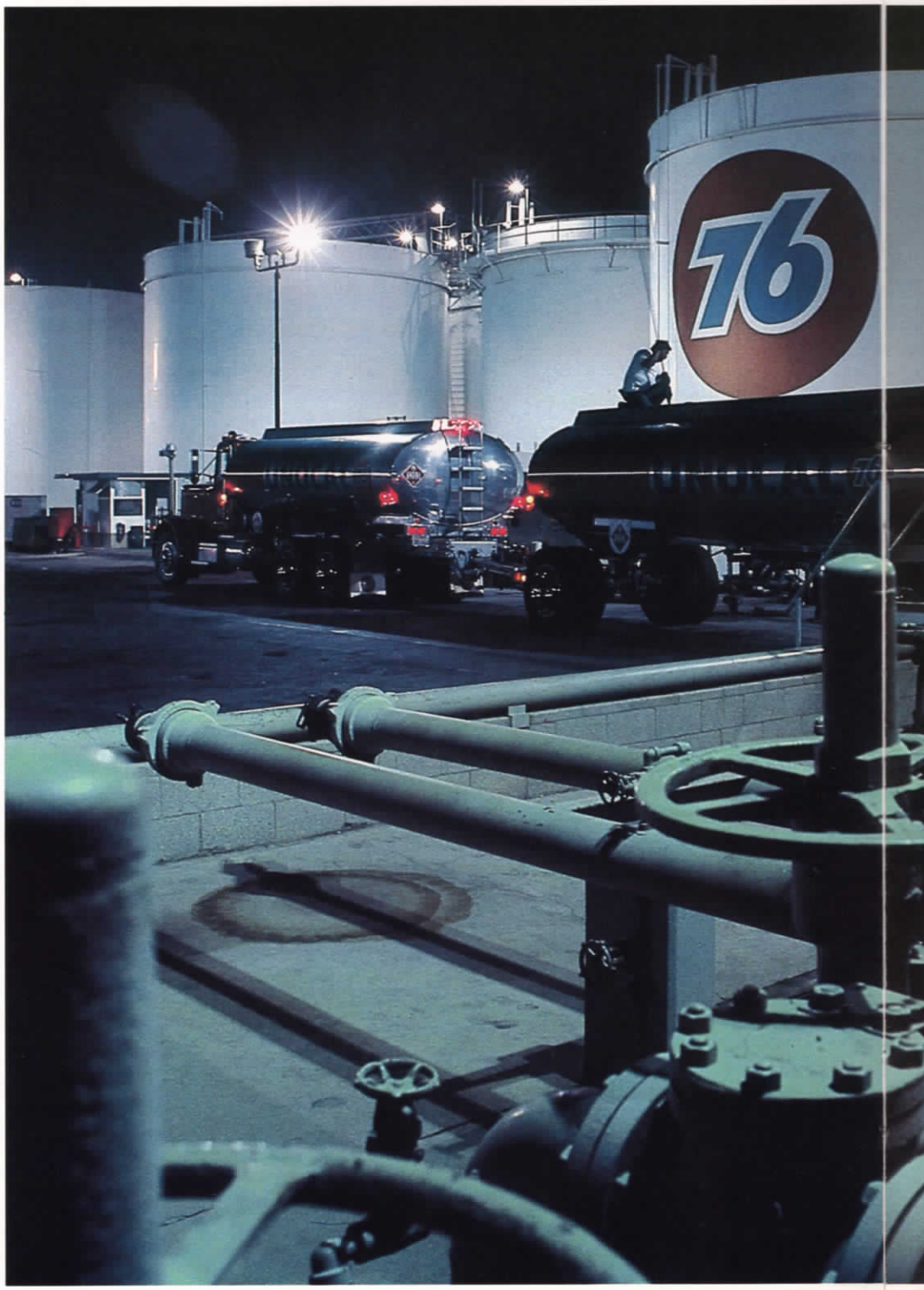
"Nancy really knows her stuff," says Wayne Lough, terminal supervisor at LAT. "She's simply one of the best, most conscientious drivers we've got."

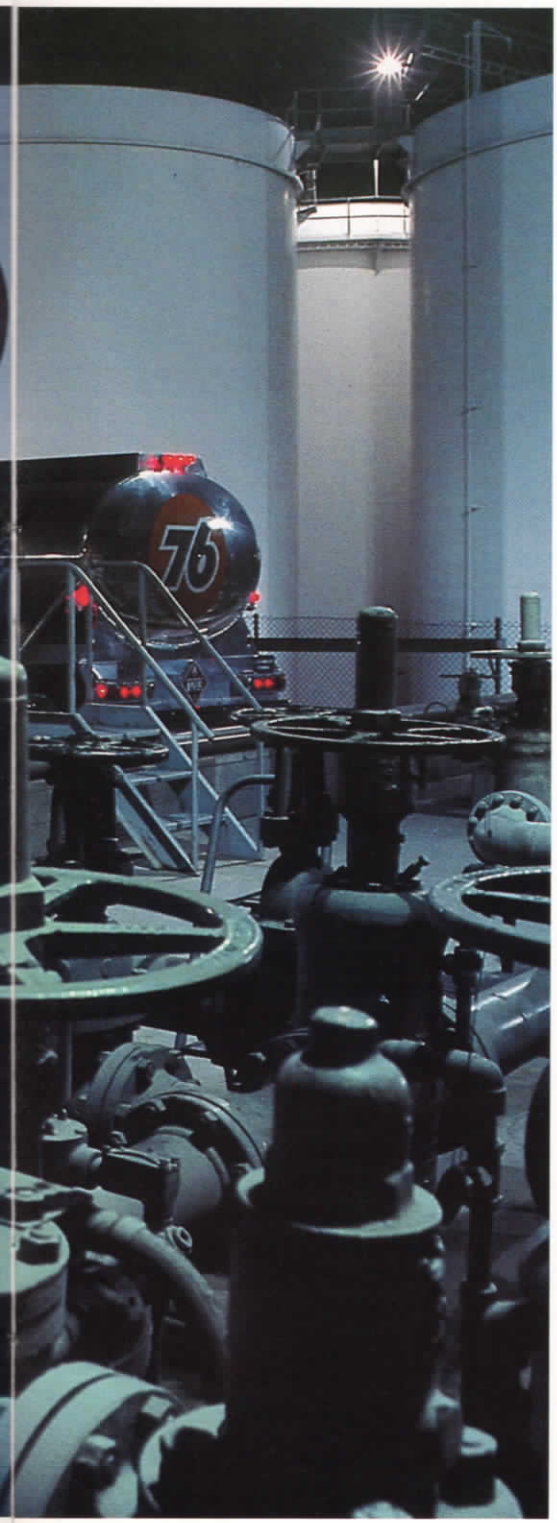
After a few minutes of small talk, Nancy heads next door to the terminal's control room. Outside, a pair of trucks is pulling into the brightly lit loading rack, where up to six rigs can take on cargo simultaneously. Pipelined to the terminal continuously from the company's Los Angeles Refinery, the products (unleaded and super grade gasolines, and diesel fuel) are trucked from LAT to roughly 1,000 Unocal stations (and several thousand commercial accounts) lying in the terminal's 8,000-square-mile delivery area. The territory stretches all the way from Goleta (near Santa Barbara) in the north to San Clemente in the south.

"It's a big piece of real estate—and believe me, I've covered most of it," Nancy says. The average station in the L.A. area needs a fill-up every three to four days, she explains, and destinations are assigned to drivers randomly by a computerized dispatching system.

"We work four 10-hour shifts per week, and usually have four or five deliveries to make each shift. The routes are never the same, so you really learn the geography."

At 12:15 a.m., Nancy bids goodbye to her cohorts and heads outside into the yard. Her truck, one of 16 large motor transports in the LAT Unocal fleet, sits patiently on the blacktop nearby. Already loaded by the previous shift's driver, the truck's two aluminum tanks sparkle in the moonlight. Up close, one gets a feel for the enormous dimensions of a rig like this. Even Kareem Abdul-Jabbar would be dwarfed.





Tossing her paperwork inside the cab, Nancy walks around the rig and makes the mandatory visual inspection. Springs, brake lines, tires, lugs, trailer hitch and product tags are checked, among other items. Satisfied that all is a-okay, Nancy climbs up behind the wheel, buckles in, and checks the truck's tacograph—an EKG-like mechanism which records speed, time and distance covered on a circular chart. That done, she reaches out and hits the starter. Instantly, the 350 horsepower diesel engine roars to life.

"Let's roll," she says, flicking on the truck's headlights and running lights. A half hour later we're passing the tall monoliths of downtown L.A., bound for the Ventura Freeway (Highway 101) which will take us all the way to Goleta. It's a 220-mile round-trip, one that Nancy makes two or three times a week. "Goleta is the furthest delivery point we have," she says. "But I like making miles. It's one way to escape city traffic."

Amazingly, traffic is still heavy at this hour—which doesn't surprise Nancy in the least. ("I've seen the San Diego Freeway bumper to bumper at 2 a.m.," she says.) But it's not just the volume of autos that annoys; it's their behavior. Cars zoom past us, cut in front of the truck, and dart across adjoining lanes. It feels like we're surrounded by a swarm of army ants.

"People in cars don't want to be near a truck," Nancy says. "All they want is to get away from you, and sometimes they'll do stupid things. That's why it's important to keep your eyes peeled, anticipate, and drive defensively."

Each of LAT's 16 large motor transports can haul up to 8,600 gallons of fuel. The delivery area stretches from Goleta to San Clemente.

Defensive driving is just one of the skills Nancy has mastered over her nine-plus years of piloting truck-and-trailer rigs. Learning to handle a vehicle that has 18 wheels, nine gears and two pivot points is no simple task. Add to this the extra challenge of being one of the first women to try for the job, and you've got some idea of what Nancy Malm has accomplished.

Nancy started driving for a very basic reason: her children had grown up and she itched to go back to work. (She has two sons, now in their 20s, and one grandson, age 3). Having worked previously in factories and as a waitress, Nancy wanted something "different." Her brother, a professional driver himself, suggested she give trucking a try. After he taught Nancy to drive a truck-and-trailer rig, she applied for work with several major oil companies.

"Unocal was the only one willing to give me a chance," she says. "The rest all said to forget it, that I couldn't handle the job. The feeling was, 'This is man's work. You've got to be 6′4″ and 200 pounds to do it.' Well, you don't."

After her interview, Nancy had to pass intensive driving and written safety tests. Several weeks of training with another driver followed, and finally she was ready for her first solo trip.

"My first shift alone was like Christmas morning," she recalls. "I didn't think I'd ever get through it, but I did."

For quite a while, Nancy was the only female driver in the Unocal fleet. Many of the male drivers were somewhat leery of her presence. "Most of them had a wait-and-see attitude," she recalls. "When they realized that I didn't want any special favors, and that I could do the work, they accepted me. In some ways I felt like a pioneer, but mainly I just wanted to prove that I could do the job and do it well."

Reactions of people when they learn what Nancy does vary from surprise to outright shock. "A lot of people who see me on the road do double takes," she admits. "And guys at the stations sometimes feel they have to help me with the hoses. That usually winds up slowing me down."

At 2:10 a.m., we pass through Ventura and proceed north up the coast. The glowing lights of several offshore oil rigs dot the horizon to the west, and overhead the jet black sky is bursting with stars. Very few cars are on the road here at this hour, and the driving is much more relaxed.

Nancy has been working this shift (Sunday through Wednesday nights) for four years. She likes it mainly because it affords weekends off, but she also enjoys the late-night solitude. "It gives you time to think," she says. "I get to see the other drivers between runs, so I don't get lonely."

Each of the 60 LAT drivers averages around 250 miles per shift. (An equal number of "common carrier" drivers are contracted by the company to deliver product in non-company trucks). Kept on the road virtually around the clock, the trucks rack up over 100,000 miles per year and are traded in after seven years. Nancy's rig, which she shares with another driver, is four years old and already has over 400,000 miles on it.

"The trucks are serviced once a month, unless problems come up," Nancy says. "Many times I can tell if something's wrong just by listening."

As you might expect, safety is a primary concern in this line of work. All Unocal drivers must be Department of Transportation (DOT) qualified, and each must undergo an annual physical exam and check-out ride.

LAT also has a full-time safety coordinator on staff (Grady Roberts), who holds regular safety meetings with company drivers. At the meetings, all accidents are reviewed and safety measures are thoroughly discussed. Because of the careful attention given to safety at LAT and the other Western Region terminals, the Unocal truck fleet currently boasts the best safety record in the oil industry.

"Unocal is an extremely safety-minded company," Nancy says. "We're taught to respect our cargo, be extra careful and never take chances. All of the drivers understand and appreciate that philosophy."

It's 3 a.m. when Nancy arrives at her destination: a Unocal service station on Hollister Street, Goleta's main drag. Pausing before pulling in, she surveys the scene to make sure no parked cars block her way in or out.

"Cars are our biggest problem," she explains. "People think they can park at a closed station, and just one car can foil my whole operation. Unless I'm able to locate the owner, sometimes I can't make the fuel drop."

On this night all is clear, so Nancy turns in, parks the truck, and quickly hops out. An eerie stillness pervades the deserted street, something Nancy has never quite grown accustomed to.

"One time I was making a delivery at a station near Thousand Oaks," she relates. "It was around 2 a.m., so quiet I could hear my watch ticking. Suddenly, there was this tremendous, unearthly scream from right behind the station's office. I mean, this wasn't human; I didn't know what it was. You never saw anyone dive into a truck cab so fast."

The mystery was solved back at the terminal. It seems the service station was located right behind an exotic wild animal park. What Nancy had heard was the protest of a startled camel. "I still take a lot of ribbing about that one," she says.

First order of business here in Goleta is to collect the payment (credit slips and a check) left by the dealer in the station's "lock box," accessible by key from outside the building. Depositing the envelope safely in the cab, Nancy steps over to a pair of small metal manhole covers which provide access to the station's two 10,000-gallon underground storage tanks. (One tank holds unleaded gasoline, the other super.)

After checking their levels with a dipstick to make sure they can take the load, Nancy pulls on her gloves and swings into action. Moving swiftly, she removes a pair of long, flexible hoses from aluminum tubes on the side of the truck. One hose will serve to unload the fuel; the other to direct the vapor that's forced out into the truck tank. (Back at the terminal, the process will be reversed: vapor enters a recovery system as the truck is reloaded.)

"It's a completely closed system at both ends," Nancy remarks. "You won't even smell any gasoline."

Although the hoses are not heavy, handling them can be tricky. But Nancy makes it look easy, quickly securing them to their proper fittings. Then she hits a valve to begin the fuel drop. Gravity does the rest, with only a slight hissing sound revealing that the transfer is in progress.

Each of the truck's tanks has two compartments, so the process is repeated three more times. By 3:25 a.m. the truck is completely drained. Nancy reseals the tanks, puts away the hoses, slips an invoice under the office door, and hops back up into the cab.

"We just dropped 8,600 gallons of gasoline in 25 minutes," she says, restarting the truck. "How long could you run your car on that?" A little fast calculation reveals a startling figure: something on the order of 14 years.

By 3:45 we're back on 101 heading south. Depending on their whereabouts and next destination, Unocal drivers can reload at LAT or at one of two smaller terminals located in the city of Orange and on Center Street in downtown L.A. Tonight, however, Nancy doesn't know her next destination. She's been designated a "gopher" for the remainder of her shift, meaning that she'll draw whatever deliveries are unassigned back at LAT.

"That's one of the best things about this job," she says. "You're going to different places every shift, so the work never gets routine."

Driving a 65-foot truck-and-trailer rig is not an easy way to make a living. "A lot of people do double takes when they see me on the road," Nancy says.

Top: Nancy goes over her delivery schedule with truck foreman Richard Pehrson. "The routes are never the same, so you really learn the geography," she says.

Sometimes, though, it can get a little frustrating. With over 1,000 stations in the territory, even veteran drivers often must go to outlets they haven't visited before. Some are only accessible to the trucks from a certain direction, while others can be difficult to find. "I once drove up three dead-end streets in a row looking for a station in Ventura," Nancy recalls. "And believe me, it's no fun backing up these rigs."

Helping each other avoid such situations is one way that drivers depend on one another. "Communication among the drivers is very important," Nancy says. "We draw on each other's experience, and that makes everyone's job a little easier."

As the hour nears 5:00, the sky abruptly lightens to a velvety blue, signaling that dawn is not far off. ("Sunrise is my favorite time on the road," Nancy says. "It's beautiful driving into the city on one of those clear spring mornings.") The approaching dawn also signals breakfast time, and Nancy happens to know just the place—an all-night diner near the freeway in Woodland Hills.

"Good all-night eating spots are hard to find," she says, "especially when you've got to consider the parking situation. We're always sure to tell each other about new places we run across."

Inside, Nancy orders coffee and a stack of pancakes. Within a half hour, she's back on the road. It's nearing 6 o'clock now, and daylight—the slate gray overcast typical of Southern California spring mornings—has swept away the night. On the Ventura Freeway, morning traffic is already building.

"From now until 9:00 is the 'fun' time," Nancy says, with a sigh. It's also the most dangerous time. Traffic not only builds, she explains, but people are in a hurry—a potentially deadly combination on the freeway. Nancy has seen her share of drivers tempt fate.

"A car in front of me once made a U-turn—from the fast lane—to get to a missed exit," she recalls. "I had to brake pretty hard to avoid hitting them. Sometimes you wonder how many lives you've saved because you're watching out for things like that."

It's 7:10 when we arrive back at LAT. Nancy immediately pulls into the loading rack and picks up a phone to talk with the dispatcher. He tells her that her next load—all unleaded—is destined for a station in Duarte, located up in the foothills 40 miles northeast of LAT.

"That ought to take care of the rest of my shift," she says, already connecting the hoses to begin reloading her truck. She pauses when asked a final question: what does she find most satisfying about her job?

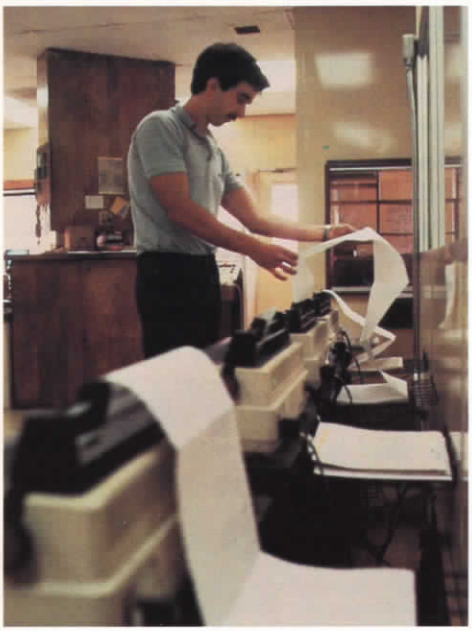
"I guess I'd have to say just doing the job," she says. "Knowing that I can pull my share and get this big piece of equipment around. That in itself is very satisfying. It's also taught me a lesson: if you have the desire to do something, you can find a way to do it."

Moments later, another driver pulls into the load rack. Hopping down from his cab, he ambles over to say hello.

"Hey, Nancy," he says. "You know any good places to eat up Simi way?" ⑯

When Tim Smight, associate editor of Seventy Six, *rode with Nancy Malm in late May, she was working the late shift. She has since switched to a day shift to spend more time with her family.*

LAT MOVES FUEL AND PRODUCTS



The Refining and Marketing Division's Los Angeles Terminal (LAT) opened in 1947 with its 24-hour Motor Transport operation. Whether it's 8 a.m. or 2 a.m., one word describes this place: busy. Motor Transport receives, stores and delivers vast quantities of gasoline and other products to more more than 1,000 service stations and several thousand commercial accounts.

After an 11-mile pipeline journey from the Torrance tank farm to LAT, the super, unleaded, leaded regular and diesel fuels produced by the Los Angeles Refinery are directly deposited in bulk storage tanks. They are then loaded on company trucks and common carriers for delivery. (The average station in L.A. needs filling every three to four days.) Sixty Unocal drivers cover 160,000 miles a month and make 4,000 deliveries. (See accompanying story.)

Above, clerk Ken Common checks a product loading printout in LAT's dispatch room.

When dealers call to request fuel, their orders are fed into computers. Sixty percent of Western Region deliveries are dispatched from the Southern Operations Area COE (Central Order Entry) Center located at LAT; 40 percent of the orders are actually delivered from the terminal.

LAT and its satellite terminals in Orange County and Los Angeles ship out an average of 250 loads, or 50,000 barrels, of gas and diesel fuel per day. That's more than two million gallons of refined product distributed every 24 hours. It's not surprising, then, that LAT provides 35 percent of all sales in the Western Region—an area encompassing 37 terminals in California, Washington, Oregon, Alaska, Hawaii and parts of Nevada. LAT, which spans 16 acres, is also the largest of the Western Region's three major terminals. The other two are in Richmond, California and Portland, Oregon.

In 1956, LAT built the "Westside" to expand into blending and shipping operations. Four major base stocks are mixed with about 25 various additives to form engine and lube oils, hydraulic fuels and other products. These stocks, not available from the Los Angeles Refinery, arrive from the San Francisco Refinery via tankers to Berth 150 in the Los Angeles Harbor. Trucked to LAT, they are then blended and shipped out in bulk, 55-gallon barrels, five-gallon pails and quart cans. Located across the street from Motor Transport, Westside also warehouses and ships some 1,500 accessory automotive items to Unocal service stations.

LAT was not always the bustling, fuel-moving metropolis it is today. Employees like Merv Hostetler, at the terminal when it first opened 38 years ago, remembers when nothing but "jackrabbits and oil wells" surrounded the site.

Although the terminal was quite isolated in the late '40s, working there then had its special advantages. As a delivery truck driver, Hostetler got a chance to meet and give rides to some pretty important people.

"One of the Stewarts (descendants of Unocal co-founder Lyman Stewart) even rode in my truck," he says.

Back in those days, however, LAT's trucks were not air-conditioned, which often made long-distance traveling less than comfortable. "But today the air-conditioned rigs are just like home," Hostetler says.

LAT itself has become home to some unlikely tenants—a family of owls. Bulk operator Billy Gregory says that generations of the nocturnal birds have nested in a hollow parking-lot pipe for the past 26 years. Gregory, with Motor Transport since 1956, has observed them regularly. He notes that even when the pipe was moved to another lot location, the family stayed put.

"The mother owl has her babies, they grow up, fly away—and come back."

The birds probably had an easier time getting to and from the terminal than many LAT drivers during the '40s and '50s. "There were few freeways then, and the roads were rougher and longer," recalls Wayne Lough, supervisor of terminal deliveries. "A trip to Santa Barbara and back took nine hours in those days. Today the same run takes only 5½ hours."

Refiners Rev Up To Meet Accelerated EPA Demands

Author Mike Thacher is manager of executive communications in Unocal's Corporate Communications Department.

"Some oil refiners are facing a formidable challenge over the next several months," says Wellman Branstrom, director of planning for Unocal's Refining & Marketing Division.

The challenge that Branstrom refers to is the stepped-up effort by the Environmental Protection Agency (EPA) to reduce the amount of lead in gasoline. In March 1985, EPA announced a new regulation requiring a 90-percent reduction in the amount of lead that can be added to leaded gasoline by January 1 of next year. And the agency has indicated that it may consider a ban on all lead in gasoline by 1988.

For the public, EPA believes its accelerated lead phasedown means cleaner air sooner, although lead makes up a very small part of atmospheric pollution.

For refiners, it certainly means higher production costs and, in some cases, an urgent need to build sophisticated new refining facilities in a very short period of time. Some refiners may even face an "octane bind," forcing them to cut back on their octane offerings.

For motorists, it probably means high prices at the pump, and some drivers of older cars could run the risk of engine damage if lead is phased out completely.

All these problems arise from a tiny bit of lead that refiners have long put in gasoline. Since 1927, in fact, a few grams of lead have been added to each gallon of certain gasolines as the most efficient way to increase the octane number of motor fuel and thus reduce engine "knock" (see sidebar on "Octane and Engine Knock"). Alternative techniques can cost five, 10 and even 15 times more than lead additives.

In gasoline, lead is a highly effective octane booster. In the human body, however, it can be a highly toxic substance. Apparently, all of us carry some natural level of lead in our bodies without harm. But 30 years ago, research studies began to turn up very high levels of lead in the bloodstreams of certain children, particularly those living in urban ghettos.

Lead in paint soon became the primary suspect. By the early 1970s, the paint industry had voluntarily phased out the use of lead in its products. Meanwhile, public and government concern about environmental pollution—including air pollution—had grown enormously. Lead in the atmosphere was one of the issues that received increasing scrutiny by EPA.

While not all researchers agreed that atmospheric lead posed a significant hazard to people, agency officials felt the potential dangers warranted a phasedown in the lead content of gasoline. In addition, EPA realized that the catalytic converters installed in auto exhaust lines to meet the agency's new emission standards would not function properly on leaded fuels. Even a small amount of lead deposited on their active surfaces would decrease their effectiveness.

Unocal took the lead in working with government to develop rational and orderly ways for the oil industry to reduce the lead content of gasoline. The company, for example, pioneered the concept of "low-lead" gasoline. Unocal Chairman and President Fred L. Hartley formally proposed the idea to the secretary of Health, Education and Welfare in the spring of 1970. A short time later, Unocal became one of the first companies to sell low-lead gasoline as its regular grade.

In 1972, Hartley proposed in a speech that EPA establish some average amount of lead per gallon that refineries could use. That way, refiners could choose to distribute different amounts of lead among various grades of gasoline, optimizing operational efficiency. EPA eventually adopted this idea.

Lead use peaked in the late 1960s, when the average lead content in the total gasoline pool topped 2.4 grams per gallon. According to the American Petroleum Institute (API), leaded gasoline use has fallen from nearly seven million barrels a day in the early 1970s to 2.5 million barrels a day during the first few months of this year. About 37 percent of gasoline supplied in the first quarter of 1985 was leaded.

While the market for lead additives has sharply declined, the drop has been neither as deep nor as fast as EPA officials originally projected. For one thing, people have held on to their leaded-fuel cars longer than expected. One recent study indicates that at least 25 percent of the 135 million cars and trucks on the road in 1986 will still require leaded fuel. Boats, motorcycles and off-road vehicles like tractors and farm equipment also use leaded gasoline.

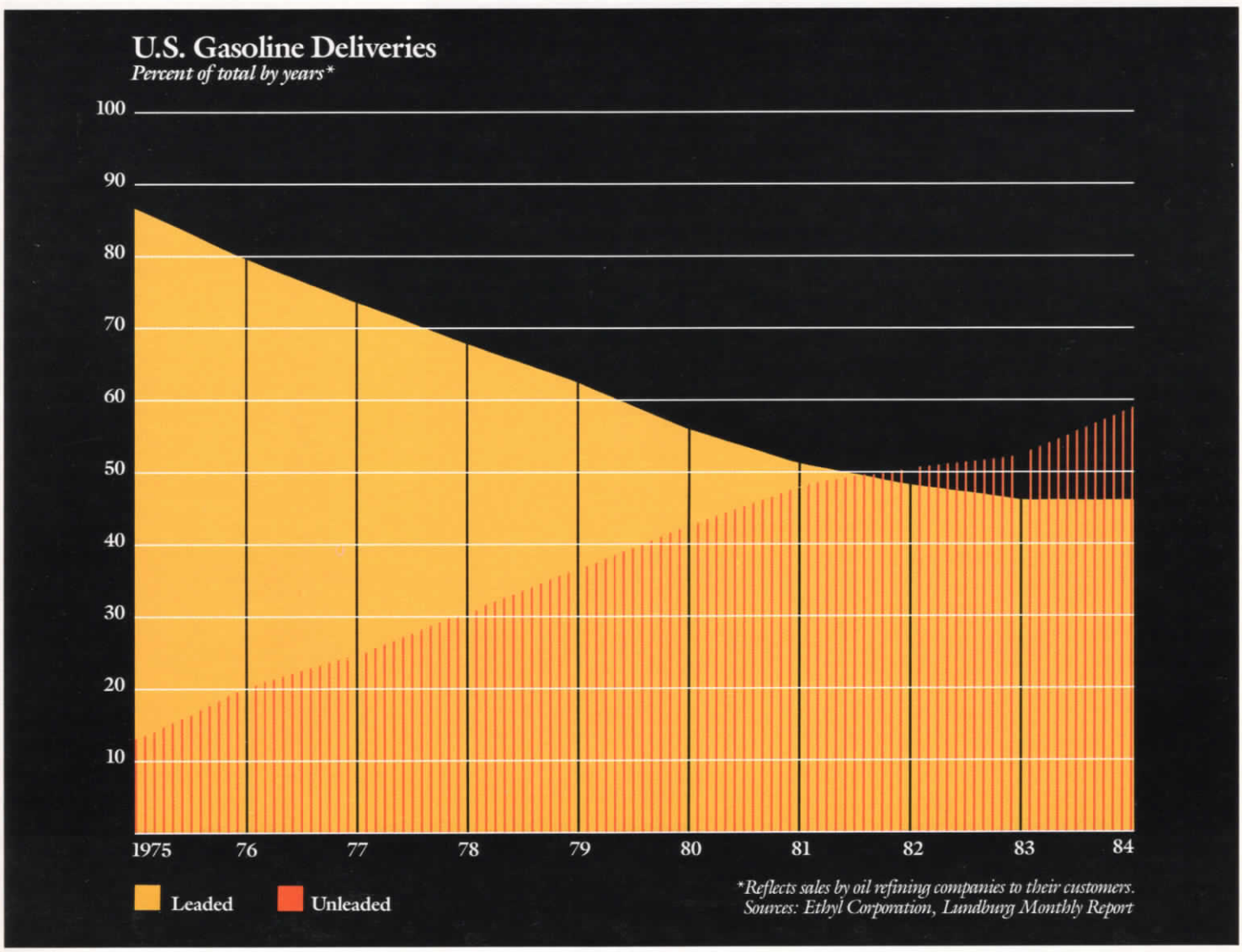
Furthermore, EPA's efforts to reduce leaded gasoline consumption have been stymied by the higher cost of most unleaded fuels. Some price-conscious motorists are willing to break the law by filling up with leaded, even though their cars have catalytic converters. Estimates vary, but more than 10 percent of all car owners could be "misfueling" their vehicles. (In California, this percentage is probably lower.)

Anxious to curtail misfueling and further reduce lead levels in the atmosphere, EPA in March of 1985 announced its accelerated lead phasedown schedule, catching many refiners by surprise. The two-step program requires refiners to reduce the lead content in their gasoline to 0.1 grams per gallon on January 1, 1986. A 0.5-gram-per-gallon-limit had to be met by July 1 of this year.

This rapid phasedown requires refiners to move quickly to replace the octane boost provided by lead. The previous lead level of 1.1 grams, for example, added about six octane numbers to a gallon of gasoline. A refinery, therefore, could transform an 83-octane gasoline blend into an 89-octane leaded regular by adding 1.1 grams of lead per gallon.

Under the new rule, the 0.1-gram-per-gallon limit will add only one octane number. Each refiner must now find a way to replace the other five octanes. "We don't oppose the need to reduce lead in gasoline, but we did expect more time for industry to make the adjustment," Branstrom observes.

Realizing that the industry would be hard pressed to meet its new standards on such short notice, EPA added a "lead banking" provision to the phasedown. Briefly stated, this provision allows refiners who use less than the permitted lead standard in 1985 to "bank" the difference as a credit. They can then draw against their lead credits to produce gasoline with higher-than-permitted levels of lead in 1986 and 1987. Ideally, these credits could last until new plants and equipment are installed; none, however, could be used after 1987.



California refiners are in a tougher situation. Instead of the EPA limit of 1.1 grams per gallon, the State of California had already established a separate lead standard of 0.8 grams of lead per gallon. EPA ruled that California refiners could only bank the difference between 0.8 and their actual usage during the first half of 1985, considerably less than the amount permitted their out-of-state competitors. Understandably, some California refiners, including Unocal, were unhappy about the ruling.

"The company found this provision highly discriminatory," recalls Tim Thomas, associate counsel for Unocal, "because it treats California refiners differently than those in the other 49 states." On June 3 of this year, Unocal filed a Petition for Review in the Court of Appeals for the District of Columbia.

"Our petition is narrowly drawn," says Thomas. "It simply challenges that part of the EPA regulation that prohibits California refiners from banking lead credits from the 1.1-gram-per-gallon level." He points out that EPA optimistically assumes that lead credits will be freely sold at reasonable prices by those refiners who bank more than they need. In reality, refiners may hoard their lead credits, keeping them as a safety factor.

Thomas does not expect a ruling on Unocal's petition until next year. In the meantime, the industry is trying to cope with EPA's accelerated phasedown while keeping its costs under control. EPA has predicted refiners' costs will increase about two cents per gallon. API believes that costs for some refiners will greatly exceed that figure.

The problem, concisely put, is to find ways to blend gasoline that use the least amount of lead. It is a demanding task, because a refinery is essentially a collection of separate processing units that "cook" crude oil with heat and pressure, and often catalysts. Each unit is designed to produce specific products or their building blocks, from light gases and gasoline to heavy tars and waxes, by altering the molecular structure of the feedstock.

"To the typical motorist, gasoline is just some liquid that flows out of the pump," observes Wayne Miller, manager of products research in Unocal's Science & Technology (S&T) Division. "At our refineries, gasoline is really a complex, high-quality blend of components that meets very strict specifications." And, depending on how these gasoline streams are blended, various grades of gasoline are produced.

Refiners have several ways to raise gasoline octane without lead; they are, however, more costly and usually more complex. One technique is to produce more high-octane blending stocks by operating catalytic reformers—units that literally re-form the hydrocarbon molecules—at maximum severities (temperatures). By "cooking" the molecules at higher temperatures, octane is raised, but gasoline yield is reduced. Also, the expensive platinum/rhenium catalysts must be regenerated more often, substantially shortening their working lives.

Another alternative is to use higher-octane-producing catalysts in "cat crackers," which also use catalysts and heat to promote desired reactions. Unocal is making this change at some of its refineries.

Refiners also have the option of importing—at a price—more blending stocks or finished gasoline in order to meet octane targets with less lead. They may also need to import more crude oil in order to make up for lower yields from operating catalytic reformers at higher severities. API expects total petroleum imports to increase at least 100,000 barrels a day as a result of the lead phasedown.

Some refiners are adding oxygenates (hydrocarbons containing oxygen) and other octane-boosters to their gasoline. Alcohols like methanol and ethanol, for example, are effective octane enhancers. Yet they lack widespread public acceptance, partly due to possible vehicle operating problems and incompatibility with fuel system components.

In addition, some alcohol/gasoline blends can separate if relatively small amounts of water get into the tank. For this reason, these blends require the use of co-solvents to prevent such phase separations.

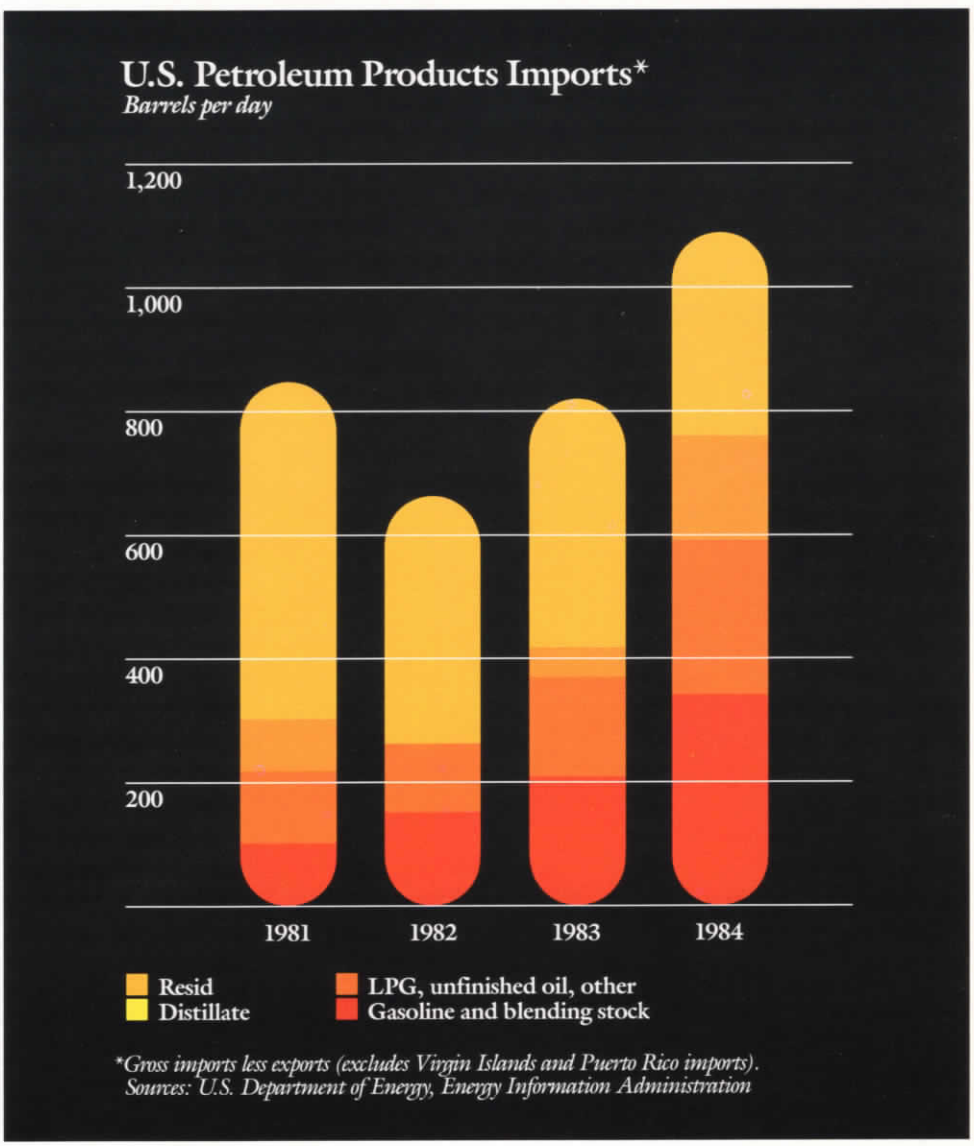
The chassis dynamometer at the S&T labs in Brea, California, provides information about octane requirements and exhaust emissions. The information helps in the formulation of gasoline. From left, Dave Schoen, Lee Nylander and Greg Brooks run a test.

In other cases, refiners will build additional processing units to produce high-octane blending stocks. But it takes time and large capital investments to construct these facilities. Obtaining permits for new processing units also is time-consuming.

Unocal, for example, plans to build two new isomerization facilities to raise the octane capability of its San Francisco and Chicago refineries. These sister units will boost low-octane gasoline stocks into the 85 to 90 octane range for blending into high-quality gasoline products.

In the meantime, the company has been banking lead credits since the beginning of the year. In California, the Los Angeles and San Francisco refineries have carefully coordinated their efforts. Unocal's refineries in Chicago and Beaumont, Texas, have exerted similar efforts.

"We're not doing anything really different," says Dick Miller, manager of the Los Angeles Refinery. "We're just operating at higher severity (which entails higher operating costs) in order to bank more lead credits and help out San Francisco." Currently, the L.A. Refinery has greater octane capability, so by minimizing lead usage, it can share its credits with San Francisco. Beginning in 1986, the company will start drawing on those credits in an attempt to bridge the revised lead standards until the new isomerization facilities at San Francisco and Chicago can be completed.



The S&T Division has been studying ways to optimize octane both in refining processes and through nonlead additives. Company researchers have determined that a manganese additive (MMT) when combined with small amounts of lead can be very effective in boosting octane. The L.A. Refinery is now using MMT in Unocal's 76 Super leaded premium gasoline, which is marketed in the West.

Eventually, leaded gasoline in the United States will almost certainly disappear. EPA seems committed to banning all lead additives within the next few years. Even before EPA's most recent announcement, however, Unocal's S&T Division had begun exploring ways to produce high-quality, high-performance gasolines without lead at an acceptable cost.

Car engines built before 1971 (and many others built between 1971 and 1975) were designed for gasolines with relatively high levels of lead—up to four grams per gallon. When operated on unleaded fuels at high speeds, especially with heavy loads for substantial periods of time, the valve seats of these engines can be severely damaged. Under normal use—stop-and-go driving and moderate freeway speeds—these pre-1971 engines will probably operate satisfactorily on unleaded gasoline. But the evidence so far is preliminary.

Apparently, EPA wants to test this hypothesis on a much wider scale. In 1988, when the agency hopes to ban leaded gasolines entirely, several million cars with pre-1971 engines will still be on the road. Their drivers will have no choice but to fill up with unleaded. Today, most farm equipment and heavy trucks also need leaded fuel.

As older vehicles disappear, demand for leaded gasoline will decline to the point where it will no longer be economical for major oil companies to distribute it. Given time, a natural phase-out would make EPA's ban unnecessary, and the transition to lead-free gasolines would be more efficient.

At any rate, if refiners cannot adjust quickly enough, some motorists may find it more difficult to purchase high-octane fuels in the near future. "We expect that refiners will use a number of alternatives to handle the problem in the short term, but nobody really knows yet how the situation will shake out," says Branstrom. "We've never objected to EPA's goal of removing lead from gasoline. All we've asked is that EPA establish a planned, equitable, long-term objective to give the industry enough time to do the job right." ⑯

Octane and Engine Knock

Engine "knock" is not just an irritating, metallic-sounding ping in car engines that are running on the wrong quality of gasoline. It is also a wasteful and potentially damaging problem that can cost unwary motorists money.

Knock occurs when gasoline vapors do not burn evenly in the engine cylinders. Instead, part of the fuel ignites prematurely. The pistons are given hard, sudden raps at the wrong time, causing them to work against the crankshaft, not with it. This abrupt energy release sounds like a sharp metallic ping or knock. Knocking engines, then, burn gasoline inefficiently. And prolonged knocking can overheat valves, spark plugs and pistons, making them wear out more quickly.

This annoying phenomenon has been studied since the days when Henry Ford's "Tin Lizzies" were cruising down the Main Streets of America. Researchers soon realized that the chemical structure of different gasolines was the culprit.

Crude oil is composed of a virtual kaleidoscope of hydrocarbon molecules—complex assemblages of hydrogen and carbon atoms. In the mystery of engine knock, carbon atoms, which can be arranged in straight chains, branched chains or rings, proved to be the key. In general, straight-chain hydrocarbons seem less stable and most prone to produce engine knock. Certain of the branched-chain and ring hydrocarbons are much more knock resistant. Unfortunately, crude oil consists mostly of hydrocarbons that are more prone to knock.

In 1919, researchers demonstrated that knock could be held in check if certain chemical additives were put in gasoline. In particular, research chemist Thomas Midgley discovered that tetraethyl lead had remarkably effective antiknock action when added to fuel in small amounts. In 1923, Midgley received the prestigious Nichols medal from the American Chemical Society for this discovery. During the next six decades, more than 100 other knock suppressors were tested; none proved as cost effective as lead.

Meanwhile, in 1926, Graham Edgar of Ethyl Corporation devised the so-called octane scale that is now the world standard for measuring the antiknock quality of motor fuels.

Basically, Edgar took one hydrocarbon that burns with a lot of knock and assigned it a value "0." He then chose a nonknocking hydrocarbon and assigned it a value of "100." By blending these two hydrocarbons together in various percentages, Edgar created basic reference fuels with various octane numbers that could be used to compare the knock resistance of any type of gasoline.

A fuel's octane number is simply a measure of its resistance to engine knock. Gasoline with an octane rating of 65 has the same resistance to knock as a reference fuel composed of 65 percent knock-resistant and 35 percent knock-prone hydrocarbons. Today, most refiners produce gasolines ranging from 87 to 92 octane. (76)

Left, a refinery is a complex collection of processing units— like the Unicracker at the Los Angeles Refinery—that produces specific products or their building blocks from crude oil. Right, Doug McCorkell makes an adjustment as he tests an engine on the dynamometer at S&T in Brea.

MOLYCORP IN NEW MEXICO:

working to keep the mountains beautiful

A molybdenum mine in the high country of northern New Mexico may seem an unlikely spot for a gardening job, but not to John Stribling. To him, planting, transplanting and tending his plots are all in a day's work.

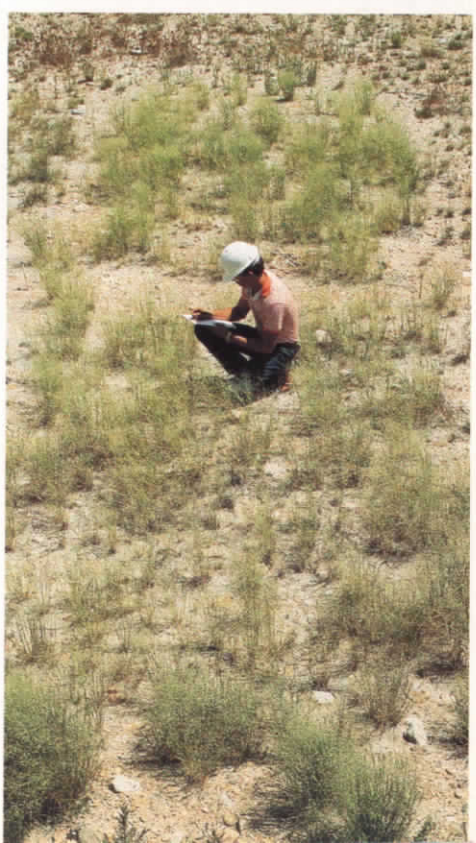
Stribling is an environmental technician for Molycorp, Inc., a division of Unocal Chemicals. His job is to direct Molycorp's program of reclaiming land it disturbs in its mining and milling operations just outside of Questa, about 30 miles north of Taos.

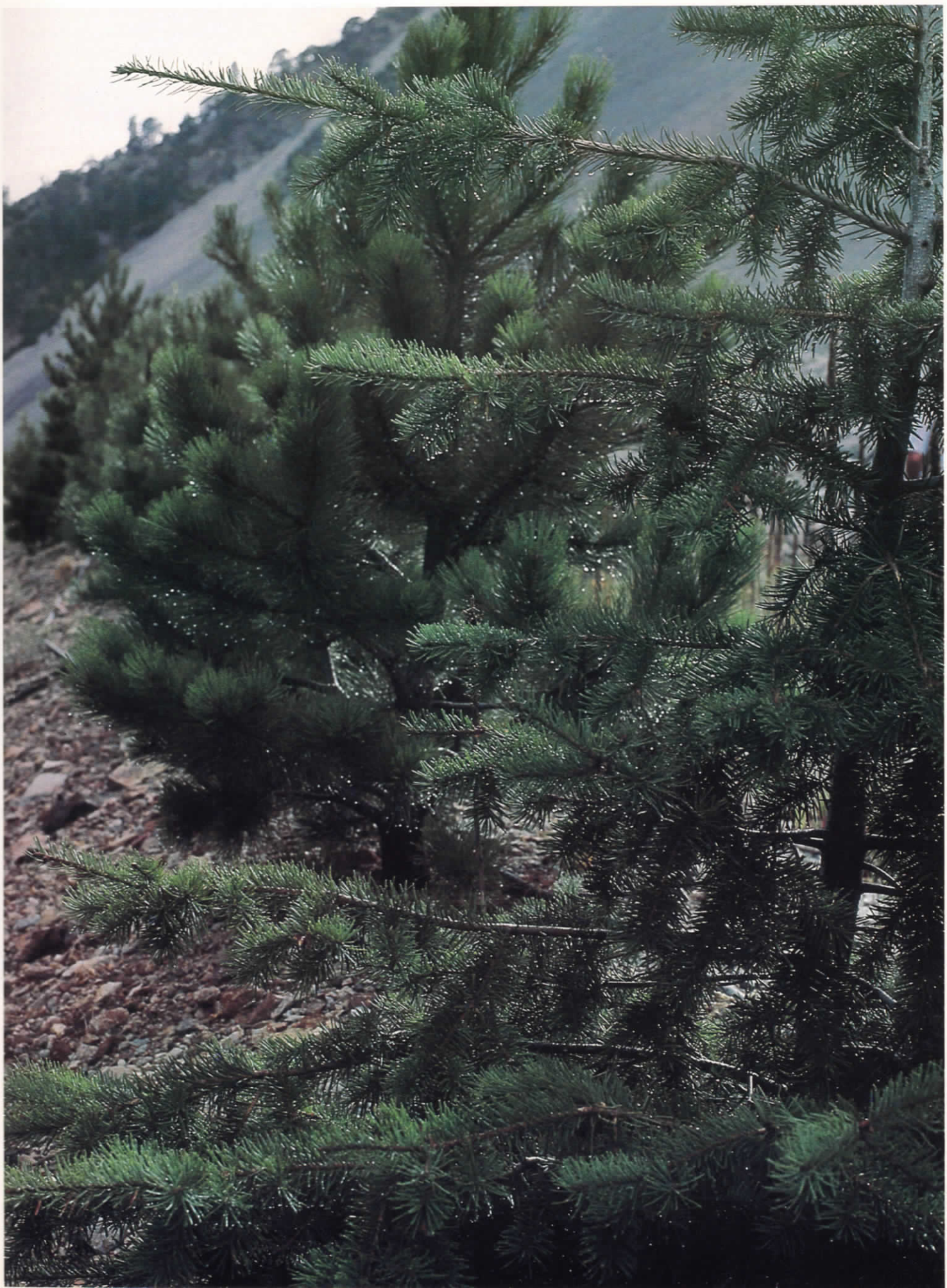
"I was born and raised in Taos, so I'm just as concerned about preserving the environment here as anyone else," says Stribling, who joined Molycorp in 1982 after earning a degree in range management from New Mexico State University. "I may be even more concerned, because I'm working in the biggest industry in Taos County."

With more than 800 workers on the payroll, Molycorp is the largest private employer in northern New Mexico. The company mines an important mineral. Used as an alloy in steel, molybdenum inhibits corrosion and increases resistance to extreme temperatures. In the oil industry, moly-alloy steels are essential for heavy section pipe such as that used in undersea and arctic pipelines, and in high-pressure natural gas pipelines.

Molycorp's operations are vital to New Mexico's economy, but so is tourism. "We recognize that we have an impact on visual quality," says Stribling, "and we want to approach that problem in an organized and scientific way."

Molycorp's reclamation program involves two distinct ecosystems: the high mountain slopes near the mine and mill and the grassy, rolling hills and valleys around Questa. Below, a view of the tailings area and the Sangre de Cristo Mountains. Opposite, five- to seven-year-old pines and firs are thriving in the overburden reclamation area.





John Stribling regularly checks his experimental plots to evaluate which grasses do best in the tailings area.

While molybdenum mining is not subject to the stringent regulation of the coal industry, Molycorp management has long recognized its environmental responsibility. "We are an ecologically minded company," says R. Gene Dewey, president of Molycorp. "We are located in the Kit Carson National Forest. It is beautiful, high mountain country. If we want to continue to operate there, we have to be out front in minimizing our impact on the environment."

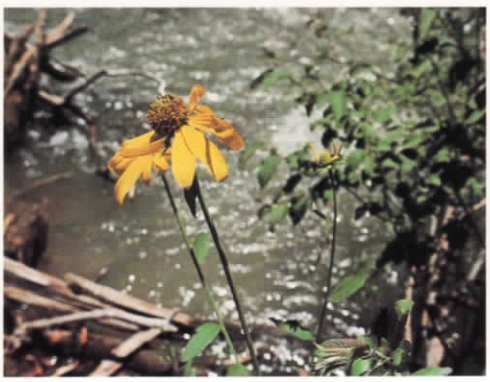
In the early 1970s, Molycorp began a voluntary program of reclamation and reforestation when 55 acres of land were planted with native species of trees and shrubs. Today, the program encompasses more than 350 acres. In addition, the company has planted approximately 12,000 tree seedlings in and around the mine. Species include ponderosa and pinon pine, Douglas fir, blue spruce and Rocky Mountain juniper.

Costs of reclaiming areas disturbed by mining range from $500 to more than $3,500 per acre. The company spends about $100,000 per year on reclamation. "The most important part of our reclamation program is the active research we are doing," Stribling says.

Since 1979, Molycorp has combined its efforts with the U.S. Soil Conservation Service. Working with researchers from the Plant Materials Center in Los Lunas, New Mexico, Stribling has set up research plots at the two major reclamation areas on Molycorp's property.

Reclamation involves a lot more than spreading a few seeds around. Stribling must cope with two separate and distinct ecosystems. Differing climates and varying soil and surface conditions require that a wide range of plant species, seeding techniques and maintenance methods be used.

Two of the most successful grasses in the test plots are Mammoth wildrye (right) and Indian rice grass (far right). Wildflowers spring up anywhere, in tailings (below) and along the banks of the Red River flowing past Molycorp's operations (center).



A good example of the challenges inherent in reclamation is the treatment of tailings—the crushed rock left over from the milling process. Mined ore is crushed fine and mixed with water to remove the molybdenum. The remaining slurry, about 40 percent solids and 60 percent water, is piped to a disposal area (located eight miles from the mine and one mile west of Questa) where the tailings settle out. The water, after treatment in Molycorp's ion exchange plant, is returned to the Red River in compliance with all federal and state water quality standards.

Tailings have the consistency of fine sand and, for a time, Molycorp faced a considerable problem with blowing dust from the disposal area. A stabilizer resembling synthetic rubber has solved it. The material, which is periodically sprayed on the tailings, was developed by Unocal Chemicals Polymer Group.

Plants can also help stabilize tailings. "Technically not soil, tailings lack the nutrients to support plants," says Stribling. But studies have shown that some grasses will grow directly on molybdenum tailings if they are fertilized. As these plants take hold and nature takes its course, they will become self-sustaining. The most successful species include blue grama, western wheatgrass, Indian ricegrass, Russian wildtye, thickspike wheatgrass and mammoth wildrye. Current experiments also include planting fast-growing reeds in areas of the disposal site with fairly consistent water levels.

Once the tailings area is filled, Molycorp will cover it with topsoil and revegetate it with the plants proved most successful in the research plots. The reclaimed sites will then provide meadows for wildlife habitat. The tailings disposal site is at an elevation of 7,500 feet, placing it in the pinion-juniper zone, which receives 11 to 13 inches of rain annually.

The second major reclamation area is much higher, ranging in elevation from 8,200 to 10,500 feet. It receives from 18 to 23 inches of precipitation annually. This area is covered with overburden—rock that was blasted out during surface mining operations which ceased in 1981.

U.S. Soils Conservation staffers Teresa Hemann, Wendall Oaks and Helen Wolfe rush to plant rhizomes (rootstocks) of shoreline reed in the tailings area before an afternoon thunderstorm breaks.

(Molycorp, a primary producer of molybdenum, closed its surface mining operations in Questa in 1981. It retained all of its workforce to construct and operate a new underground operation which opened in late 1983. This was during a period of decline in mining operations, and subsequent heavy layoffs throughout the United States.)

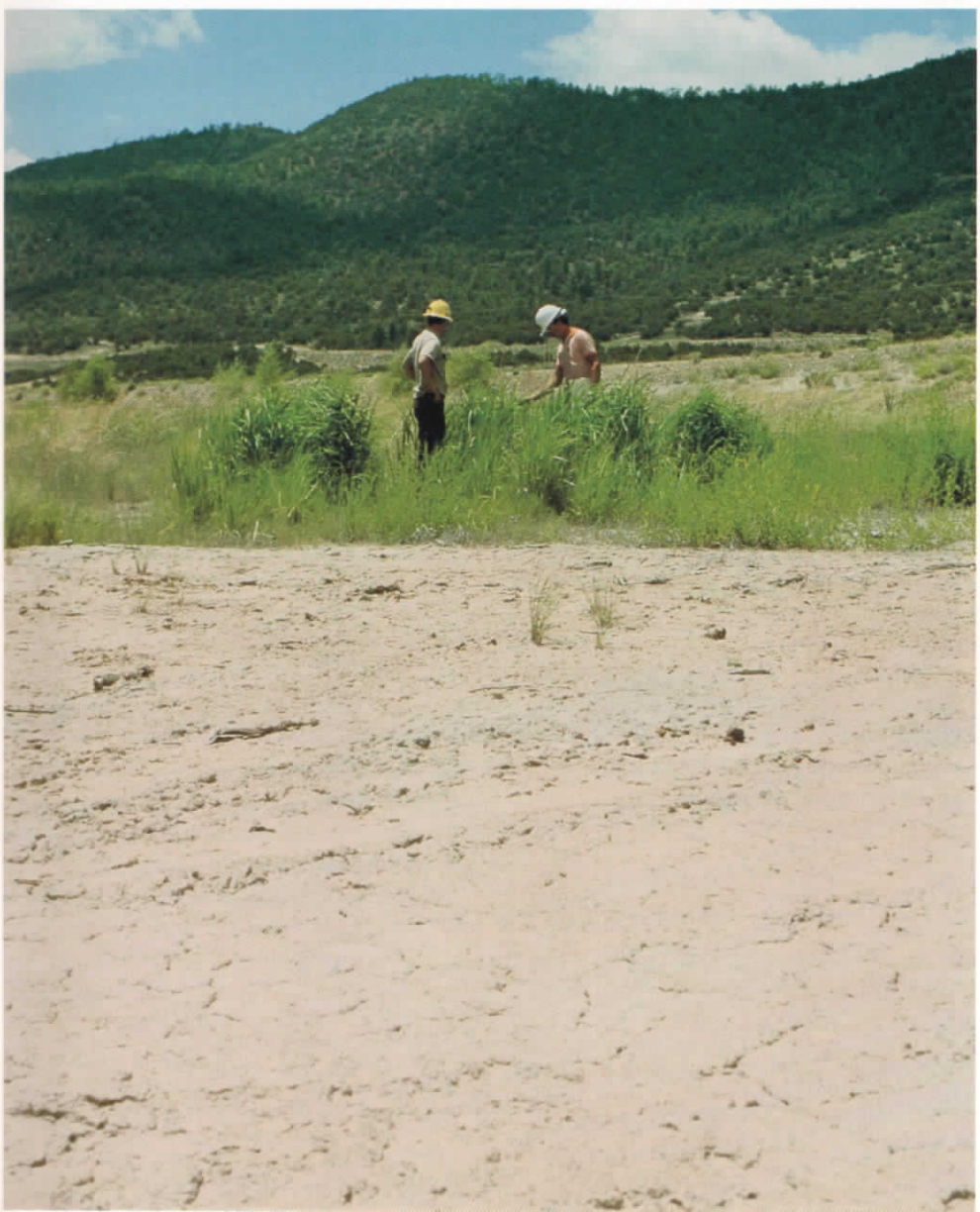
The overburden lacks natural soil and contains an excess of coarse rock fragments. Where soil exists, it is acidic, not conducive to supporting many plants. Steep slopes make access difficult, and the high altitudes limit plant species. Arid conditions on slopes with a southern exposure compound the difficulties.

"We have just completed a soil survey and mapping of the overburden area to identify the spots with the highest potential for reclamation," says Stribling. Current experiments include the investigation of some non-native, high-altitude plant species.

Much of the recent planting has been done by hydromulching, a reclamation method in which a mixture of seed, water, mulch, fertilizer and tackifiers are sprayed onto disturbed areas. "The tackifier acts to glue everything to the soil," says Stribling, "and it holds firmly even in rain and wind." Many trees have been planted in the overburden area.

"We are very pleased with the progress of our research and reclamation program," Stribling says. "We were fortunate to receive national recognition in 1983." That year, the National Arbor Day Foundation cited the excellence of Molycorp's reclamation activities. The purpose of the award was to recognize the initiation by a corporation or institution of a successful ecological or environmental program.

"I think the foundation was particularly impressed with the fact that our reclamation program is entirely voluntary," says Stribling, "and with the quality of our research." ⑯



Stribling (right) and William Devine, mill and surface superintendent, are pleased with the success of the experimental plantings. These experiments will guide the eventual establishment of a diverse plant community to return the tailings area to wildlife habitat.

CLEANING INDUSTRIAL WASTEWATER WITH AN "IRON GRIP"

"If employees aren't encouraged by a company to come up with new ideas, eventually their creative instincts will wither and die."
Dr. Doug Walker, inventor of UNIPURE technology

Imagine an industrial wastewater pure enough to drink. It may not sound appetizing, but it is possible. A new technology can treat water containing toxic heavy metals—and leave it clean enough to pass the Environmental Protection Agency's primary drinking water standards! That technology is called the UNIPURE* process and it is revolutionizing the standards of wastewater treatment.

Not long ago, metal finishers, iron and steel producers and others in the metals industry were required to do nothing more than neutralize acidic wastewaters before releasing them to the local sewage system. The waters, however, still contained toxic metals like lead, zinc, nickel and cadmium which are harmful to human and aquatic life. Growing environmental concern prompted legislation like the Clean Water Act, which imposes rigorous restrictions on the amount of contaminants left in treated wastewater. The act requires industries not only to remove acids from their wastewaters, but eliminate toxic metals as well.

Many manufacturers have had trouble complying with these governmental standards because eliminating metal contaminants from wastewater is not easy using conventional methods. That's where UNIPURE technology comes in. It approaches this problem like no other technology ever has.

How does the process work? It first might be helpful to examine a conventional wastewater treatment process in simplified terms.

Typical metals industry wastewater is highly acidic, containing toxic heavy metals in their solution form. The basic steps in eliminating heavy metals are segregation (separating different types of wastes), precipitation (causing metal particles to solidify and separate from the liquid) and clarification (where metal particles agglomerate and are sifted from the water).

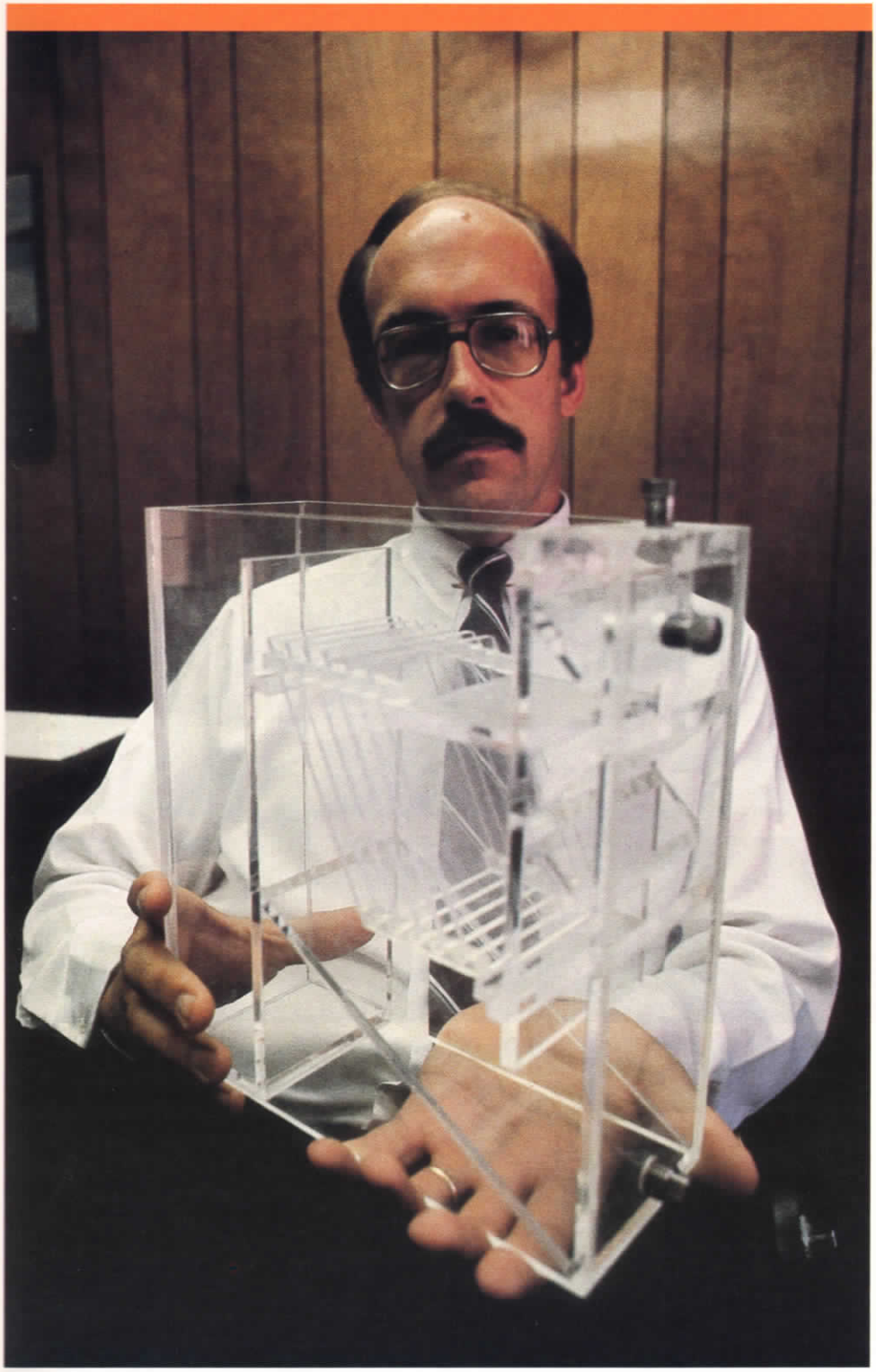
Usually, wastewaters from manufacturing processes are segregated and pre-treated either physically or chemically as necessary. Next, the waste flows to a treatment tank. Here, a base such as ammonia or caustic soda is added to raise the pH, increasing the alkalinity. This causes most metals to precipitate in the form of solid particles. The waste then flows to another vessel, where a polymer is added to make the smaller particles gather together. This enables more effective separation of liquid and solids in the next step, clarification.

Conventional methods worked well enough to neutralize the acid in wastewater. But a problem developed for those manufacturers using ammonia as a precipitation base. Ammonia is capable of functioning as a complexing agent, thereby preventing the metals from precipitating. Treatment plant operators realized that the use of ammonia as a material for effective treatment of metals industry wastewater was limited. As a result, the market for ammonia in wastewater treatment virtually disappeared overnight.

This presented a dilemma for the company's Chemicals Division (UCD), since a healthy chunk of Nitrogen Group customers were manufacturers who purchased ammonia to neutralize their acidic wastes. So in the early 1980s, Luis Cervantes of the Nitrogen Group asked the Science & Technology Division to investigate the matter and devise an alternate wastewater treatment technology. The project was assigned to Dr. Doug Walker, an S&T research chemist.

"It was my feeling that we could develop such a process, and still maintain ammonia's economical edge," recalls Walker. "I felt it was possible to use elements already present in wastewater—to, in effect, have it treat itself."

**a service mark of Union Oil Company of California*



Dr. Doug Walker uses a lucite model of a clarifier to explain how it separates metal sludge from treated wastewater. With the UNIPURE process, the metal solids produced are denser and therefore easier to separate.

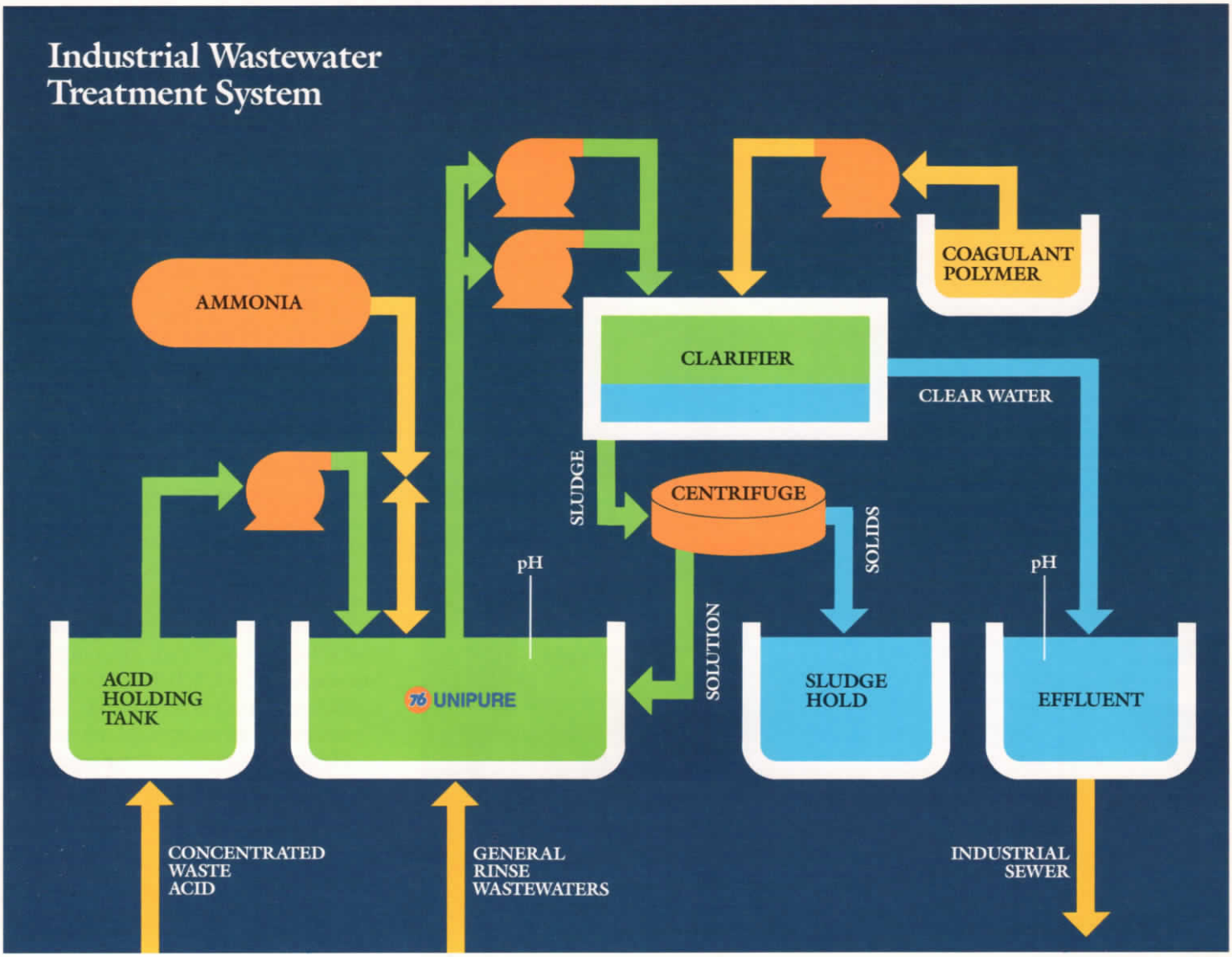
Walker, who has a Ph.D. in chemistry, began the project with his attention on iron. "It's one of the most ubiquitous metals, and is present as a contaminant in wastewaters from a wide variety of industries," he says. Based on a series of laboratory experiments—and his initial hunch—Walker turned iron into the foundation for a new technology.

Dr. Jeff Dagdigian, an applications engineer involved in the project, explains the differences between the UNIPURE process and conventional technology: "Soluble metals are removed from wastewater by forming insoluble metal hydroxides. This is accomplished by increasing the pH of the wastewater by adding an alkaline material such as lime, caustic or ammonia. In the end, each metal is precipitated as its own metal hydroxide.

"The UNIPURE process, however, doesn't rely on traditional soluble chemistry. It works by removing otherwise soluble toxic metals in an iron-based solid. The UNIPURE process, unlike conventional technology, is not bound by the limitations of solubility."

He notes that manufacturers are limited by conventional wastewater technology in two important areas.

"First the conditions required to remove the metals are different for every metal. Most all manufacturers have problems removing several different metals from solution simultaneously. They can't achieve optimum conditions for every metal and thus must compromise for the best overall condition. With the new Environmental Protection Agency guidelines, conventional technology just isn't effective enough."



This simplified diagram shows how an industrial wastewater treatment system using the UNIPURE process works. Wastewater travels through the UNIPURE reactor and clarifier (arrows). Excess water from the metal sludge is extracted and routed back to the treatment tank. The sludge is compacted by a filter press, then hauled away and deposited in a toxic waste landfill.

Analytical chemist Ann Amii gauges heavy metal content, precipitation time and other important aspects of industrial wastewater samples. The information helps APTECH staff determine the size and cost of building or modifying a treatment facility to use UNIPURE technology (right).

To Walker, the word "flexibility" best describes how the UNIPURE process and conventional methods differ. UNIPURE technology can usually be introduced to conventional treatment facilities at a minimal cost, since it revolves around chemistry, not expensive new equipment or chemicals. UNIPURE technology eliminates the need for segregated treatment of all conventional wastes except for cyanide. The metals sludge produced contains less water, which makes it easier to compact and dispose of the contaminants. And ammonia can be used effectively as a base with the UNIPURE process.

One aspect of the process most significant to industry, however, is its ability to keep the level of toxic heavy metals in accordance with regulations. "Our basic message is that we can enable clients to consistently comply with wastewater standards," Walker states.

A short time after development of UNIPURE technology began, Doug Walker and his research came to the attention of Nick Lynam, senior vice president, UCD Petrochemical Group. Lynam has always been interested in the vast resources available through the S&T Division, and keeps abreast of the latest developments in chemical research.

He considered UNIPURE technology a significant discovery, and was interested in assessing its potential. So naturally, he was pleased when the process was installed at a wire galvanizing firm in Los Angeles and performed better than anyone expected. Plant officials were quite satisfied with the results as well.

The creative, pioneering attitude surrounding the birth of UNIPURE technology impressed Lynam so much that he got the support of UCD President Craig Henderson to investigate its market potential. With the assistance of Walter Talley, manager, Corporate Consulting & Acquisition, and the approval of the Executive Committee, a new business venture called APTECH was launched in April 1984. Herb Pomerantz, then manager of manufacturing, Petrochemical Group, was appointed general manager.

APTECH, an acronym for Applied Technology, is part of the Petrochemical Group. Its purpose is to find applications for company-developed technology that doesn't fit into an established business unit.

Pomerantz regarded the UNIPURE process as a good candidate. "I thought it could represent the opportunity for a new business area," he says.

UNIPURE technology became APTECH's premier project. Walker and Pomerantz recruited staff members from within and outside the company who had scientific and sales backgrounds. Besides themselves, there are nine other APTECH members: John Norder, sales manager; two sales engineers; two applications engineers; an analytical chemist; a computer technician and design expert; and two office administrators.

Part of the staff is based with the Petrochemical Group in Schaumburg, Illinois; the rest are located at the Science & Technology Division in Brea, California. They communicate daily, and meet every two months to share experiences, problems and suggestions.

"These are up-and-coming professionals who were willing to take a chance on a 'start-up' business," explains Pomerantz. "They wanted to use their technical backgrounds, and accepted the challenge of getting involved in a new venture."

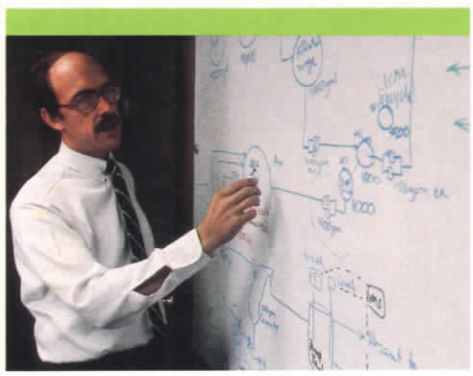
That's why Ritchie Pickens, who used to sell chemicals for the Petrochemical Group in Michigan, joined APTECH. "I saw a lot of opportunities. Since I had a chemical engineering education and enjoyed working in sales, this was the best of both worlds for me," he says.

Currently, APTECH is studying new projects which include a portable UNIPURE system and a sludgeless waste treatment process where metals could be reused.

Pomerantz views UNIPURE technology as a unique and different approach to a problem. It is so different, in fact, that some potential customers are a little skeptical. They find it hard to believe the technology uses chemistry—not additional equipment or chemicals—to obtain successful results. Many times UNIPURE technology can be applied with only slight modifications to a customer's existing equipment.

"Telling manufacturers they can comply with regulations 100 percent of the time without building a newer, bigger treatment facility is like telling someone you can make his car get 100 miles per gallon of gasoline," Walker points out.

APTECH applications engineer Joe Burquist, above, tests a manufacturer's wastewater sample in the UNIPURE process pilot plant at Brea. Walker, right, wants APTECH to become known as a leader in wastewater technology.



But once customers see results from the UNIPURE process, their initial hesitancy vanishes. Just ask people at a manufacturing firm which was having problems meeting wastewater regulations. Now, with its specially designed UNIPURE facility, the firm's plant is in consistent compliance with discharge limits. Its treated wastewater is even of drinking-water quality.

Although no hardware or chemicals are sold for the UNIPURE process, the technology does come with extended services to ensure customer satisfaction. First, APTECH staff members conduct a thorough evaluation of the metal-bearing wastes of a potential client's plant. Then, after extensive laboratory analysis, staff applications engineers will recommend the best way to apply UNIPURE technology to new or existing equipment. Often in this stage of appraisal, the analysts spot ways manufacturers can reduce wastes simply by altering their operations.

APTECH also works with its customers in designing plans to implement the UNIPURE process, and provides consultation, quarterly quality-assurance visits and training services.

Pomerantz wants to see APTECH's customer base continue to expand. All signs portend that it will. UNIPURE technology is being installed in an Illinois metal fabrication plant, and giant firms in steel, automotive battery and other industries may soon follow suit.

"The UNIPURE process has innovation in the form of technology," adds Pomerantz, "and innovation equals customers. We have a lot of talented people in APTECH, which makes for quality performance. And that lets us help people in industry efficiently comply with wastewater regulations." ⑯

Service Awards

UNOCAL 76

CORPORATE

July 1985

35 YEARS — **Robert O. Hedley,** Unocal Center
N. Malte Molin, Burbank, Ca.
Albert A. Totten, Unocal Center

30 YEARS — **John M. Abel,** Unocal Center
Samuel A. Snyder, Unocal Center

20 YEARS — **Margaret Mallen,** Unocal Center

10 YEARS — **Diane Duncan,** Unocal Center
Michael W. Roach, Santa Fe Springs, Ca.
Karen Sikkema, Unocal Center
Jacquelyn I. Woodhouse, Los Angeles, Ca.

5 YEARS — **Richard W. Brown,** Bremer, Ca.
Michael L. Kinworthy, Unocal Center
Anna Krupa, Pasadena, Ca.
Aida L. Ngan, Unocal Center
Johni M. Van Winkle, Pasadena, Ca.

August 1985

20 YEARS — **C. E. Bernasconi,** Burbank, Ca.
Sally A. Cheng, Unocal Center

10 YEARS — **Gary Najdowski,** Schaumburg, Il.

5 YEARS — **George C. Beck,** Los Angeles, Ca.
Wayne W. Chen, Unocal Center
Gary E. Davie, Unocal Center
Lilia Fausto, Unocal Center
Gilbert Karsenty, Unocal Center
Patricia Londono, Unocal Center
Elsa B. Molinas, Unocal Center
Christopher A. Robinson, Unocal Center
Stella I. Sheleretis, Unocal Center

CORPORATE DEVELOPMENT

ENERGY MINING

July 1985

30 YEARS — **Dale C. Mooney,** Parachute, Co.

20 YEARS — **Allen C. Randle,** Parachute, Co.

15 YEARS — **Geoffrey W. Nason,** Rawlins, Wy.

5 YEARS — **Darlene M. Depinho,** Parachute, Co.
Donald A. Ortiz, Parachute, Co.
Earl W. Phillips, Parachute, Co.
Dennis A. Murray, Parachute, Co.
Gregory S. Nisely, Parachute, Co.
Thomas P. Sabo, Parachute, Co.
Robert E. Swenson, Parachute, Co.
Richard H. Weems, Parachute, Co.

August 1985

5 YEARS — **David L. Bell Sr.,** Parachute, Co.
David E. Gilchrest, Parachute, Co.
Robert L. Mitten, Parachute, Co.
Jeffrey H. Noland, Parachute, Co.
Elizabeth A. Smith, Parachute, Co.

ENGINEERING & CONSTRUCTION

July 1985

40 YEARS — **Henry K. Pfirrmann,** Unocal Center

20 YEARS — **Sanford S. Burke,** Unocal Center

15 YEARS — **Darcel L. Hulse,** Unocal Center

5 YEARS — **Norman S. E. Richardson,** Unocal Center

SCIENCE & TECHNOLOGY

July 1985

30 YEARS — **Reinold E. Fett,** Brea, Ca.

25 YEARS — **Kenneth L. Olivier,** Brea, Ca.

20 YEARS — **Guenter J. Hinck,** Brea, Ca.

15 YEARS — **David M. Breen,** Brea, Ca.
Antolin Garcia-Pizarro, Brea, Ca.
Otis Tolbert Jr., Brea, Ca.

5 YEARS — **Laurence T. Blades,** Brea, Ca.
Jean M. Henderson, Brea, Ca.
Amy H. Liao, Brea, Ca.
Martha A. Nickus, Brea, Ca.
Rajanikant H. Patel, Brea, Ca.
Stephen A. Soeller, Brea, Ca.
Robert E. Sweeney, Brea, Ca.
Donna W. Winder, Brea, Ca.

August 1985

30 YEARS — **George W. Lassel,** Brea, Ca.
C. Ray Mitchell, Brea, Ca.

15 YEARS — **Richard E. Goudie,** Brea, Ca.

10 YEARS — **Walter Albertson,** Brea, Ca.
Josefina M. Dumdum, Brea, Ca.
Steven D. Light, Brea, Ca.
Steven D. Robertson, Brea, Ca.
Rossann D. Sandoval, Brea, Ca.
Charles F. Wong, Brea, Ca.

5 YEARS — **Samuel R. Aragon,** Brea, Ca.
Pamela J. Bobo, Brea, Ca.
Teresa I. Carranza, Brea, Ca.
Hoai T. Dovan, Brea, Ca.
Michael G. Grecco, Brea, Ca.
David R. Griffith, Brea, Ca.
Frank G. Martens, Brea, Ca.
William A. Minner, Brea, Ca.
Laura L. Nesbit, Brea, Ca.
Roberto Ortiz, Brea, Ca.
Brian M. Smith, Brea, Ca.
Alan H. Thompson, Brea, Ca.
Jon C. Wood, Brea, Ca.

ENERGY RESOURCES

OIL & GAS

July 1985

40 YEARS — **Donald L. Redfern,** Santa Fe Springs, Ca.

35 YEARS — **George W. Coombes Jr.,** Midland, Tx.
J. D. Norman, Oklahoma City, Ok.
Thomas W. Stoy Jr., Houston, Tx.

30 YEARS — **John F. Hansen,** Midland, Tx.
Doris A. Hebert, Lafayette, La.
Thomas R. Miller, Midland, Tx.
Manuel J. Plocheck, Van, Tx.
Clayton G. Wailes, Mobile, Al.

25 YEARS — **David L. Burkett,** Snyder, Tx.
Billie J. Morris, Coalinga, Ca.
Jack J. Norris, Lovington, N.M.
Maxell Porter, Andrews, Tx.

20 YEARS — **Donald H. Davis,** Brea, Ca.
John A. Moody, Orcutt, Ca.
Billie L. McFarland, Ventura, Ca.
Roland A. Naquin, Houma, La.
Ernest A. Newell Jr., Orcutt, Ca.
Gilbert A. Reinemann, Santa Fe Springs, Ca.

15 YEARS — **James R. Byer,** Unocal Center

10 YEARS — **Thomas G. Browning,** Houma, La.
Charles T. Burwell, Santa Paula, Ca.
Earl Coxen Jr., Houma, La.
M. Josette B. Hebert, Lafayette, La.
Neil B. Horn, Ardmore, Ok.
Claude D. Kitchens, Snyder, Tx.
John J. Matthews, Midland, Tx.
Garry L. Nolph, Olney, Il.
Michael D. Rairdan, Santa Paula, Ca.
David V. Wilson, Unocal Center

5 YEARS	**Thomas Nick Adams,** Bakersfield, Ca. **Lawrence F. Bader,** Orcutt, Ca. **Micheal D. Buswell,** Lafayette, La. **Jeffery L. Dronsky,** Santa Paula, Ca. **Jimmy T. Fernandez-Lopez,** Taft, Ca. **Larry W. Garrard,** Olney, Il. **Jeffery E. Grant,** Houston, Tx. **Patricia A. Hiatt,** Ventura, Ca. **Dennis E. Lehman,** Orcutt, Ca. **Joseph L. Marquez,** Orcutt, Ca. **Richard H. McKay,** Oklahoma City, Ok. **Gwendolyn Mills,** Pasadena, Ca. **Ronald J. Morris,** Houston, Tx. **Billy G. Pearce,** Ardmore, Ok. **Phillip L. Reed,** Lafayette, La. **Kenneth S. Richards,** Orcutt, Ca. **John C. Robinson,** Santa Fe Springs, Ca. **William R. Ross,** Lafayette, La. **Fred L. Simpson,** Snyder, Tx. **Paul M. Spiro,** Anchorage, Ak.
August 1985	
40 YEARS	**Gerald M. Goldrick,** Cut Bank, Mt. **Helen F. Steck,** Pasadena, Ca.
35 YEARS	**Ford A. Bankston,** Houston, Tx. **Allen V. Dupont,** Houston, Tx. **Joanne G. Hovden,** Unocal Center **Hale B. Ingram,** Houston, Tx.
30 YEARS	**Boyd M. Barnett,** Coalinga, Ca. **Robert S. Doughty,** Unocal Center **E. A. Dezonia,** Santa Fe Springs, Ca. **Kenneth I. Garlinger,** Santa Paula, Ca. **Sophie M. Krauze,** Unocal Center **E. Dean B. Laudeman,** Unocal Center **William E. Leblanc,** Houston, Tx. **Clarence R. McKee,** Casper, Wy. **Joe E. Vaughn,** Midland, Tx.
25 YEARS	**Harold E. Adair,** Unocal Center **Doris R. Davis,** Midland, Tx.
20 YEARS	**Betty A. Bean,** Bakersfield, Ca. **Charles H. Edmonds,** Santa Paula, Ca. **Kenneth Fox,** Unocal Center **Robert J. Marron,** Pasadena, Ca.
15 YEARS	**Chester Boutte Jr.,** Houma, La. **Richard M. Brunner,** Worland, Wy. **Margaret E. Dill,** Casper, Wy. **Cheryl J. Goin,** Midland, Tx. **Fronzell Myers,** Van, Tx. **Luther E. Randolph,** Van, Tx. **Donald J. Suhoza,** Ventura, Ca. **Ruby J. Walker,** Casper, Wy.
10 YEARS	**Paul J. Brisco,** Houma, La. **Cecil R. Cooper,** Houston, Tx. **Gary F. Le Compte,** Houma, La. **William Love,** Van, Tx. **Wilfred J. Scott,** Lafayette, La. **Thomas H. Smith,** Anchorage, Ak. **Patricia A. Sonier,** Houston, Tx. **Daniel L. Quijada,** Bakersfield, Ca. **Raul Tarango,** Santa Paula, Ca.
5 YEARS	**George A. Alvary,** Santa Paula, Ca. **Kevin B. Armstrong,** Odessa, Tx. **Mark O. Bailie,** Bakersfield, Ca. **Jesse Hernandez Jr.,** Houston, Tx. **William C. Hesse,** Ventura, Ca. **Elyse A. Kutz,** Ventura, Ca. **Robert E. Miller,** Midland, Tx. **Marion F. Noches,** Pasadena, Ca. **Timothy R. Popp,** Worland, Wy. **Randy W. Randolph,** Ardmore, Ok. **Marcus V. Roberson,** Andrews, Tx. **Jesus G. Salcido Jr.,** Andrews, Tx. **Mark V. Wagenhoffer,** Anchorage, Ak. **Deborah D. Wiley,** Pasadena, Ca.

INTERNATIONAL OIL & GAS

July 1985	
30 YEARS	**Kenneth V. Zerda,** Jakarta, Indonesia
25 YEARS	**H. D. Maxwell Jr.,** London, England
20 YEARS	**Wade O. Lundstrom,** Aberdeen, Scotland
10 YEARS	**Norman R. Ashbury,** The Hague, Netherlands **Ron V. Christensen,** London, England
5 YEARS	**Eugene S. Brown Jr.,** Los Angeles, Ca. **Janine Hanna,** Los Angeles, Ca. **Judy P. McKeever,** Los Angeles, Ca. **David W. Montgomery,** The Hague, Netherlands **Milburn L. Summers,** Balikpapan, Indonesia
August 1985	
35 YEARS	**H. C. Wells,** Mendoza, Argentina
5 YEARS	**Myra E. Cordova,** Los Angeles, Ca. **Graham D. Dryden,** Balikpapan, Indonesia **Michael W. Elwood,** Balikpapan, Indonesia **Jose R. Espinoza Jr.,** Los Angeles, Ca. **Brantly S. Goodwin,** Los Angeles, Ca. **Linda R. Grijalva,** Los Angeles, Ca. **Prasert Israpanitpong,** Los Angeles, Ca. **Ricardo Martinez,** Los Angeles, Ca. **Deloris J. Sanders,** Los Angeles, Ca.

Union Oil Co. of Indonesia

July 1985	
10 YEARS	**Amirullah** **Nuriansjah** **Suwarso** **Taspripin** **Herman S. Aguw** **Zarkasi Bakri** **Joni Dama** **Wahjudi Sutrisno Hadi** **Andi Mappasabie K** **Margono K** **Ismet Karim** **Sasventarys Maha** **Hendrik Matande** **Asep Nugrahana** **Marthen Mangalik Pabiang** **S. Panna** **Marthen Dapo Paramban** **Francis Ratag** **Jaconias Rianekuay** **Sukarlan M.S.** **Daniel Bua Saleppang** **Rachel Samel** **Marthen Arie Wokas** **Agen Zulkiflie**
5 YEARS	**Rosehan Ismet** **Achmad Kayadi** **Mardji Martokarijo** **Titus Tiku Palabiran** **Suyuti R** **Rampo Rapa** **Freddy Sumoldng**

Service Awards

August 1985	
10 YEARS	**Elvie Arief** **Doris Chua Kwee Eng** **Effendie Kabil** **Atiek M. Nelwan** **Martha Oroh** **Mangasi Tua Sinaga** **Irvan Santosa Sukirno**
5 YEARS	**Bambang Soedibjo**

Unionoil Co. of Great Britain

July 1985	
5 YEARS	**Charles Shaw,** Aberdeen, Scotland

UNION OIL CO. OF CANADA, LTD.

July 1985	
25 YEARS	**Walter Panasiuk,** Calgary, Alta. **John Romanchuk,** Calgary, Alta.
5 YEARS	**Kim M. Cormack,** Fort St. John, B.C. **James A. Hauck,** Calgary, Alta. **Barry E. Olson,** Calgary, Alta. **Hal E. Rutz,** Fort St. John, B.C. **Dennis J. Sokoloski,** Calgary, Alta. **Roman J. Wynnyk,** Fairydell, Alta.
August 1985	
35 YEARS	**Doug B. Leitch,** Calgary, Alta.
5 YEARS	**Tom G. Creery,** Calgary, Alta. **Tony J. Field,** Calgary, Alta. **Stu G. Leson,** Calgary, Alta. **H. Maureen Olson,** Calgary, Alta.

UNION OIL CO. OF THAILAND

July 1985	
10 YEARS	**Conrad J. Perry** **William P. Purcell**
5 YEARS	**Suthep Suwannapo**
August 1985	
35 YEARS	**W. H. Niederhauser**
5 YEARS	**Craig D. Stewart** **Ing-Jye Tsai** **Chalam Veeratamkul**

GEOTHERMAL

July 1985	
10 YEARS	**Alvin S. Timmons,** Santa Rosa, Ca.
5 YEARS	**Gregg A. Nordquist,** Santa Rosa, Ca.

August 1985

15 YEARS	**Warren A. Smith,** Santa Rosa, Ca.
10 YEARS	**Terry W. Kelley,** Santa Rosa, Ca. **Philip H. Messer,** Imperial Valley, Ca.
5 YEARS	**Ray Bingham,** Big Geysers, Ca. **James B. Fallon,** Manila, Philippines **Itan Jordan,** Big Geysers, Ca. **Patrick S. Kelly,** Big Geysers, Ca. **Stanley N. Penzak Jr.,** Imperial Valley, Ca.

Philippine Geothermal, Inc.

July 1985

10 YEARS	**Expedito C. Borre**
5 YEARS	**Minerva O. Batoon** **Regina J. Dayrit**

August 1985

10 YEARS	**Simeon B. Ugalde**
5 YEARS	**Dionisio P. Gascon Jr.**

REFINING & MARKETING

July 1985

35 YEARS	**Jack G. Potts,** Schaumburg, Il.
25 YEARS	**Louis F. Lucas,** Schaumburg, Il. **William J. Lucchesi,** San Francisco, Ca.
15 YEARS	**Michael P. Berry,** Schaumburg, Il. **Gail J. Cartwright,** San Francisco, Ca. **Donald R. Hammer,** Schaumburg, Il. **Diane M. Minix,** San Francisco, Ca. **Grace R. Rehner,** Schaumburg, Il. **Joseph K. Vickroy,** San Francisco, Ca.
5 YEARS	**Patricia L. Magnus,** San Francisco, Ca. **Harry Roesler,** Schaumburg, Il. **Susan E. Shearer,** Schaumburg, Il. **Kathleen A. Ullrih,** San Francisco, Ca.

August 1985

45 YEARS	**Beverly B. Mulliken,** San Francisco, Ca.
35 YEARS	**Shirley E. Salcedo,** San Francisco, Ca.
25 YEARS	**Frances L. Eirich,** Schaumburg. Il. **Robert H. Huebert,** Schaumburg, Il. **Robert J. Theis,** San Francisco, Ca. **James M. Pederson,** Schaumburg, Il. **Marilyn E. Songer,** Schaumburg, Il.
15 YEARS	**Elvia D. Sanchez,** San Francisco, Ca. **Carol M. Streetz,** Schaumburg, Ca. **Ross V. Walker,** San Francisco, Ca.
10 YEARS	**Barbara J. Olson,** Schaumburg, Il.
5 YEARS	**Marissa B. Berenguer,** San Francisco, Ca. **Jennifer J. Cox,** Mercer Island, Wa. **Raymond H. Groth,** Los Angeles, Ca. **Rolf K. Halthen,** Schaumburg, Il. **David R. Keasey,** Los Angeles, Ca. **Catherine F. Laskero,** Schaumburg, Il. **Juliann M. Lauer,** Schaumburg, Il. **Karen McCormack,** Schaumburg, Il.

Service Awards

EASTERN REGION

July 1985

35 YEARS	**Paul J. Branton,** Collins, Ms. **George J. Willer Jr.,** Schaumburg, Il.
30 YEARS	**Thomas P. McIntosh,** Memphis, Tn. **John C. Pearson,** Cincinnati, Oh. **Lawrence D. Smith,** Schaumburg, Il.
25 YEARS	**Amos R. Jones,** Atlanta, Ga.
20 YEARS	**Jan B. Hansen,** Macungie, Pa.
15 YEARS	**George R. Brown,** Chicago Refinery **Gerard F. Bykowski Sr.,** Chicago Refinery **Greg J. Cagwin,** Chicago Refinery **Leo D. Erchull,** Chicago Refinery **Donald R. Evans,** Chicago Refinery **Macedonio Flores Jr.,** Chicago Refinery **Lawrence T. Hawthorne,** Beaumont Refinery **Louis E. Konc Jr.,** Chicago Refinery **Ronald W. McLeod,** Chicago Refinery **Daniel W. Morse,** Chicago Refinery **Timothy J. O'Leary,** Chicago Refinery **Thomas V. Pearson,** Chicago Refinery **Richard C. Peterson,** Chicago Refinery **Chas B. Sasso,** Chicago Refinery **James F. Shredl Jr.,** Chicago Refinery **Carl D. Smith,** Cincinnati, Oh. **Jeffrey F. Smith,** Omaha, Ne. **Dale R. Spangler,** Chicago Refinery **Mary J. Stuewe,** Minneapolis, Mn.
10 YEARS	**Harold L. Haenggi Jr.,** Pure Trans. Co., Olney, Il. **Angelika M. Mercer,** Chicago Refinery
5 YEARS	**Thurmond W. Aylor,** Beaumont Refinery **James W. Cady,** Beaumont Refinery **Frederick J. Caldwell,** Beaumont Refinery **Robert K. Derutte,** Beaumont Refinery **Brad E. Jones,** Beaumont Refinery **Kerry J. Savoie,** Beaumont Refinery **Jeffrey A. Strachan,** Beaumont Refinery **Donald E. Word,** Beaumont Refinery

August 1985

40 YEARS	**Doreen Haynes,** Dayton, Oh. **Roy L. White,** Beaumont Refinery
35 YEARS	**George A. Boness,** Chicago Refinery **Robert J. Driscoll,** Chicago Refinery **Siverine C. Griffin,** Savannah, Ga. **Peter G. Harper,** Schaumburg, Il. **Roger H. Hay,** Schaumburg, Il. **Walter J. Magolan Jr.,** Chicago Refinery **Richard J. Rodeghero,** Chicago Refinery **Harold M. Runyon,** Indianapolis, In. **L. E. Stover,** Cleveland, Oh.
30 YEARS	**Barbara Burdett,** Atlanta, Ga. **Jerry E. Tyhurst,** Seattle, Wa.
25 YEARS	**Margaret W. Deberry,** Memphis, Tn. **Sherrill S. Mangels,** Schaumburg, Il. **George E. Sylvester,** Minneapolis, Mn. **Shirley A. Umfleet,** Pure Trans. Co., Olney, Il.
20 YEARS	**Allan I. Dahl,** Madison, Wi. **William C. Roach,** Charleston, W.V.
15 YEARS	**Raul V. Cesarez,** Chicago Refinery **Chester R. Davis,** Chicago Refinery **Mark L. Fumgalli,** Chicago Refinery **Mack B. Ganey Sr.,** Pensacola, Fl. **Cecil D. Horath,** Chicago Refinery **Paul M. Huffines,** Pure Trans. Co., Van, Tx. **Inocencio S. Martinez,** Schaumburg, Il. **Henry E. Verdon,** Pure Trans. Co., Houma, La.
10 YEARS	**Louise M. Sharp,** Beaumont Refinery **Cherian A. Shull,** Chicago Refinery
5 YEARS	**David A. Anderson,** Chicago Refinery **Amando A. Arias,** Chicago Refinery **Terry W. Blanton,** Beaumont Refinery **Edward D. Bradley,** Chicago Refinery **Marsha L. Brasky,** Schaumburg, Il. **Jaime J. Chambless,** Beaumont Refinery **Jill A. Corey,** Schaumburg, Il. **Debra A. Deculus,** Beaumont Refinery **Marvin E. Drummond,** Chicago Refinery **Michael Grangent,** Chicago Refinery **Betty J. Knox,** Chicago Refinery **Jean M. Lawler,** Chicago Refinery **Orvis L. Lewis Jr.,** Beaumont Refinery **James D. Miller,** Chicago Refinery **Michael J. Murphy,** Chicago Refinery **Douglas A. Nicola,** Wildwood, Fl. **Billy G. Ridings Jr.,** Beaumont Refinery **Nora H. Riojas,** Beaumont Refinery **Noel L. Soileau,** Beaumont Refinery **Ira P. Thomason,** Schaumburg, Il. **Gary J. Voitik,** Chicago Refinery **Mark A. Walker,** Chicago Refinery **Gearlene Williams,** Chicago Refinery **Wesley Williams,** Beaumont Refinery

WESTERN REGION

July 1985

35 YEARS	**Glenn O. Burk,** Los Angeles, Ca. **John C. Havely,** San Francisco Refinery **Lavonne M. O' Neal,** San Francisco Refinery **Don E. Pederson,** Unocal Center **George K. Streeter,** Beaumont, Tx. **Jim J. Uribe,** Beaumont, Tx.
30 YEARS	**William M. Collier,** Los Angeles Refinery **Vern E. Grimshaw,** Los Angeles, Ca. **Gerald S. Hoyt,** Unocal Center **Elmer A. Lang,** Unocal Center **James E. Rath,** San Francisco Refinery
25 YEARS	**Charles H. Erikson Jr.,** Los Angeles, Ca.

Service Awards

20 YEARS	**M. Irene Darlington,** Santa Maria Refinery **Walter B. Eisenman,** Portland, Or. **Melvin L. Lusardi,** Avila, Ca. **Andre Van Der Valk,** Los Angeles, Ca. **Lelia J. Wickham,** Sacramento, Ca.
15 YEARS	**Jose R. Delgado,** Richmond, Ca. **Robert J. Erickson,** Los Angeles, Ca. **Michael D. Hawkins,** Los Angeles Refinery **Kenneth Higa,** Honolulu, Ha. **Wayne W. McBride,** Edmonds, Wa. **Norman H. Russell,** San Francisco Refinery **Richard M. Stellina,** San Francisco Refinery
10 YEARS	**Dennis M. Caston,** Anchorage, Ak. **Sandra K. Dodd,** San Francisco Refinery **Dominic D. Ferrari,** San Luis Obispo, Ca. **Julie A. Gaul,** San Francisco Refinery **Steven J. Giampaoli,** Los Angeles Refinery **Robert E. Parmenter,** Seattle, Wa. **Fidel L. Rivera Jr.,** Los Angeles Refinery
5 YEARS	**Timothy M. Achorn,** Beaumont, Tx. **Julio A. Balacy,** Los Angeles Refinery **Bettye J. Benson,** San Francisco Refinery **Joe M. Bradford,** Los Angeles, Ca. **Julie A. Crisp,** Seattle, Wa. **William J. Cygan,** San Francisco Refinery **Daniel K. Each,** Los Angeles Refinery **James A. Hindle,** Los Angeles, Ca. **Jay P. Hong,** Los Angeles, Ca. **Lisa M. Kinoshita,** San Francisco Refinery **Nick A. Massaro,** Las Vegas, Nv. **Gary D. Neville,** Los Angeles Refinery **Michael R. Renshaw,** San Francisco Refinery **David R. Roberts,** San Francisco Refinery **Valeriu Saitan,** Los Angeles Refinery **Steven D. Smith,** Los Angeles Refinery **David D. Teems,** Los Angeles, Ca. **Mark D. Winne,** Beaumont, Tx.
August 1985	
40 YEARS	**John W. Griffin,** San Francisco Refinery
35 YEARS	**William Fyock,** Los Angeles, Ca. **Earl Irvin Lash,** Los Angeles, Ca. **Howard Earl Parr,** San Francisco Refinery **Harry B. Rogers,** San Diego, Ca.
30 YEARS	**Daniel V. Noriega,** Los Angeles, Ca.
25 YEARS	**Gerald D. Cruse,** Los Angeles, Ca. **Tommy L. Morgan,** Juneau, Ak.
20 YEARS	**Manuel V. Castillo,** Los Angeles Refinery **John W. Grubb,** San Jose, Ca. **H. Paul Oldham,** Los Angeles, Ca. **John L. Scoggins,** Santa Margarita, Ca. **Harry A. Thomas,** Salt Lake City, Ut. **Curtis J. Walden,** Edmonds, Wa.
15 YEARS	**Velda K. Altig,** Portland, Or. **Willie F. Carr,** Taft, Ca. **Robert P. Dulop,** Beaumont, Tx. **Edgar A. Farmer,** Edmonds, Wa. **Thomas O. Mackey III,** Los Angeles, Ca. **Gerald J. Villa,** San Francisco Refinery **Jimmie D. Williams,** Portland, Or. **Allen L. Wright,** Orange, Ca.
10 YEARS	**Lawrence Jaramillo,** Los Angeles, Ca. **William R. Krenkel,** Avila, Ca. **Charlene Seymour,** Seattle, Wa. **Rand H. Swenson,** San Francisco Refinery
5 YEARS	**Kirk R. Elder,** Los Angeles Refinery **Joseph H. Joseph,** Santa Maria Refinery **Garabet Kocaoglu,** Los Angeles, Ca. **Mary Jo Mills,** Los Angeles, Ca. **Susan H. Mole,** Pasadena, Ca. **Larry A. Nunes,** Santa Maria, Ca. **Gale F. Richards,** San Francisco Refinery **Ronald F. Schwab,** Los Angeles, Ca. **Marie A. Steffen-Brown,** Los Angeles, Ca.

JOBBERS & DISTRIBUTORS

July 1985	
20 YEARS	**Irvin L. Hanville,** McMinnville, Or.
15 YEARS	**Baille Oil Co.,** Brule, Wi. **S & S Petroleum Products,** Round Lake, Il.
10 YEARS	**Albert C. Voltz,** Chewelah, Wa.
5 YEARS	**Inter-City Oil Co. of Brainerd, Inc.,** Duluth, Mn. **Peninsular Petroleum Co., Inc.,** Crescent City, Fl.
August 1985	
60 YEARS	**Scott County Oil Co.,** Jordon, Mn.
40 YEARS	**Mid South Sales, Inc.,** Helena, Ar.
35 YEARS	**Robert Garwood,** Bingen, Wa.
30 YEARS	**Fort Oil Company,** Lumpkin, Ga. **Troutman Enterprises, Inc.,** Maupin, Or.
25 YEARS	**Tri County Oil Co.,** Virden, Il.
15 YEARS	**Kennedy Gas Company,** La Grange, In.

CHEMICALS

July 1985	
30 YEARS	**Theodore W. McGirr,** Kenai, Ak. **Robert E. Tobin,** Brea, Ca.
25 YEARS	**David M. Triplett,** Unocal Center
20 YEARS	**Clyde O. Griffin,** Charlotte, N.C. **Tommi G. Lovern,** Arroyo Grande, Ca. **Kenneth S. Wilder,** Conshohocken, Pa.
15 YEARS	**Mike M. Culler,** Charlotte, N.C. **William L. Springer,** Cincinnati, Oh. **Waino A. Taipale,** La Mirada, Ca.
10 YEARS	**Lawrence N. Croft,** Kenai, Ak. **Christine C. Geller,** Unocal Center **Lester W. McCoy,** Kenai, Ak. **Lawrence E. Nudson,** Kenai, Ak. **David P. Smith,** Charlotte, N.C. **Donald E. Telshaw,** Kenai, Ak.
5 YEARS	**Daniel L. Anderson,** Lemont, Il. **Albert Barner,** Lemont, Il. **John E. Forbes,** Rodeo, Ca. **Linda J. Kory,** Unocal Center **Victor H. Lipke,** Lemont, Il. **Dorothy S. Morgan,** Baltimore, Md. **Fred J. Nahas,** Lemont, Il. **Raymond F. Ortell,** Lemont, Il. **David K. Rice,** Kenai, Ak. **Mary A. Sniegoski,** Lemont, Il. **Terry L. Stanley,** Lemont, Il. **Jon P. Terhune,** Kenai, Ak. **Mark D. Winchester,** Lemont, Il.
August 1985	
35 YEARS	**Max Taitel,** Rolling Meadows, Il.
25 YEARS	**Charles K. Harkins,** Lemont, Il.
20 YEARS	**Oscar Rodriguez,** Arroyo Grande, Ca.
15 YEARS	**Joni L. Bartz,** St. Paul, Mn. **Kathleen G. Derby,** Tampa, Fl. **Juanita S. Mutton,** Kenai, Ak. **Helen M. Palamara,** Clark, N.J.
10 YEARS	**Mohammed Latiff,** Miami, Fl. **Richard A. Link,** Kenai, Ak. **Charles L. Sims,** Schaumburg, Il.
5 YEARS	**Anton C. Brandenhoff,** Lemont, Il. **Catherine M. Bush,** Kenai, Ak. **Paul C. Staples,** Miami, Fl.

MOLYCORP, INC.

July 1985	
20 YEARS	**Robert L. Jezek,** Louviers, Co.
15 YEARS	**Geyza I. Lorinczi,** Sydney, Australia **Cletus C. Eyster,** York, Pa.
10 YEARS	**Garry Dunlop,** Questa, N.M. **Juan F. Rivera,** Questa, N.M.
5 YEARS	**John M. Ackerman,** Unocal Center **Fred J. Archuleta,** Questa, N.M. **Brian K. Darling,** Louviers, Co. **Valdemar Deherrera Jr.,** Questa, N.M. **Victor P. Ortiz,** Questa, N.M. **Tony V. Romo,** Questa, N.M. **Ted R. Santistevan,** Questa, N.M.
August 1985	
20 YEARS	**William B. Cook,** Denver, Co.

POCO GRAPHITE, INC.

July 1985	
10 YEARS	**John M. Eckeberger,** Decatur, Tx.
5 YEARS	**Ran'oul G. Greanead,** Decatur, Tx. **Addie M. Warner,** Decatur, Tx.
August 1985	
15 YEARS	**Wilburn A. Fox,** Decatur, Tx. **Cody P. Murphree,** Decatur, Tx. **Harold R. Robinson,** Decatur, Tx.
10 YEARS	**Edwin J. Brajer,** Decatur, Tx. **Lawrence W. Liles,** Decatur, Tx.
5 YEARS	**Thomas L. Barnett,** Decatur, Tx. **John J. Brown,** Decatur, Tx.

Service Awards

RETIREMENTS

May 1983

Menard A. Martinez, Molycorp,
El Prado, N.M., April 25, 1964

April 1985

William R. Moran, Molycorp,
La Canada, Ca., October 1, 1943

May 1985

Lyman Frugia Jr., Refining & Marketing,
Vidor, Tx., March 7, 1949
Thomas W. Knox, Refining & Marketing,
Dolton, Il., May 1, 1973
James E. Robinson, Refining & Marketing,
Sauk Village, Il., February 22, 1971
Thomas M. Wills, Refining & Marketing,
Nederland, Tx., April 23, 1943

June 1985

Callie A. Bentley, Refining & Marketing,
Charlotte, N.C., February 9, 1967
Billy W. Carter, Refining & Marketing,
Stone Mountain, Ga., April 12, 1954
Robert F. Clevenger, Oil & Gas,
Santa Maria, Ca., October 5, 1950
Marvin N. Craig, Refining & Marketing,
Paw Creek, N.C., October 28, 1947
Olga Dianovsky, Refining & Marketing,
Chicago, Il., March 31, 1947
Robert J. Driscoll, Refining & Marketing,
Lockport, Il., August 21, 1950
Clara B. Filip, Refining & Marketing,
Chicago, Il., April 12, 1948
James H. Hollimon, Refining & Marketing,
Pensacola, Fl., July 20, 1948
Carl R. Lomenick, Oil & Gas,
Moab, Ut., May 28, 1962
Dale E. Retherford, Oil & Gas,
Hacienda Heights, Ca., August 25, 1947
Alban C. Scheuber, Refining & Marketing,
Joliet, Il., July 19, 1948
Michael A. Schneider, Refining & Marketing,
Mt. Prospect, Il., October 15, 1954
Malcolm E. Wimpress, Refining & Marketing,
Walnut Creek, Ca., January 20, 1947
Carl R. Zylstra, Science & Technology,
Anaheim, Ca., October 24, 1950

July 1985

Russell E. Anderson, Refining & Marketing,
Lockport, Il., April 21, 1952
William A. Arnold, Refining & Marketing,
Concord, Ca., July 31, 1951
Donald F. Bello, Refining & Marketing,
Concord, Ca., October 27, 1941
Henry H. Fukai, Refining & Marketing,
San Francisco, Ca., June 8, 1959
Leslie O. W. Gilkerson, Refining & Marketing,
Beaumont, Tx., October 29, 1946
Gerald M. Goldrick, Oil & Gas,
Cut Bank, Mt., July 31, 1964
Ruth C. Johnston, Refining & Marketing,
Rolling Meadows, Il., November 1, 1959
Harry F. Kelly, Oil & Gas,
Ontario, Ca., July 31, 1965
Kenneth L. Kobus, Refining & Marketing,
Lockport, Il., September 1, 1948
Don E. Merritt, Refining & Marketing,
Hoffman Estates, Il., April 3, 1951
Walter A. Munch, Refining & Marketing,
Lockport, Il., October 26, 1953
Charles B. Murff, Refining & Marketing,
Beaumont, Tx., August 14, 1952
John M. Peterson, Chemicals,
Minneapolis, Mn., June 17, 1947
Veronica M. Ramstad, Refining & Marketing,
Tonka Bay, Mn., December 12, 1949
Wilfred Souza, Oil & Gas,
Santa Maria, Ca., May 21, 1948
Robert E. Vicha, Refining & Marketing,
Richmond, Il., February 2, 1948
Annemarie Vlack, Corporate,
Los Angeles, Ca., March 28, 1963
Donald L. Wickert, Refining & Marketing,
Palatine, Il., September 23, 1946

IN MEMORIAM

Employees

Bruce P. Lain, Refining & Marketing,
Lockport, Il., May 18, 1985
Leland Pierson, Chemicals,
Pasadena, Ca., May 23, 1985
Dennis M. Rogers, Refining & Marketing,
Los Angeles, Ca., May 23, 1985

Retirees

Dolling Cameron, Refining & Marketing,
Houston, Tx., May 8, 1985
Willie Cardenas, Molycorp,
Questa, N.M., May 15, 1985
Harold W. Christoffers, Refining & Marketing,
Beaumont, Tx., May 8, 1985
Carl K. Dunaway, Refining & Marketing,
East Toledo, Oh., May 13, 1985
Frances W. Hall, Refining & Marketing,
Chicago, Il., May 15, 1985
Alfred G. Hilton, Oil & Gas,
Westminster, Ca., May 9, 1985
Lea C. Keeler, Corporate,
Millbrae, Ca., April 30, 1985
Homer T. Kirby, Oil & Gas,
Victoria, Tx., April 26, 1985
Johnie Mitchell, Refining & Marketing,
Cordele, Ga., April 28, 1985
A. B. Moses, Refining & Marketing,
Decatur, Al., May 22, 1985
Milton S. Oliver, Oil & Gas,
Santa Paula, Ca., May 8, 1985
Henry W. Olson, Oil & Gas,
Brea, Ca., May 22, 1985
James F. Sanford, Refining & Marketing,
Corrigan, Tx., May 16, 1985
Harold E. Smith, Oil & Gas,
Kermit, Tx., April 25, 1985
Charles T. Wyke, Refining & Marketing,
Compton, Ca., May 10, 1985
Ethel R. Ziesmer, Refining & Marketing,
Joliet, Il., May 21, 1985

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VOLUME LXIV, NUMBER 4
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COVER: Unocal driver Nancy Malm makes a late-night fuel delivery at a Southern California service station. It takes a special kind of person to handle an 80,000 pound truck-and-trailer rig. Story on page 12. **Photo by Larry Lee.**

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