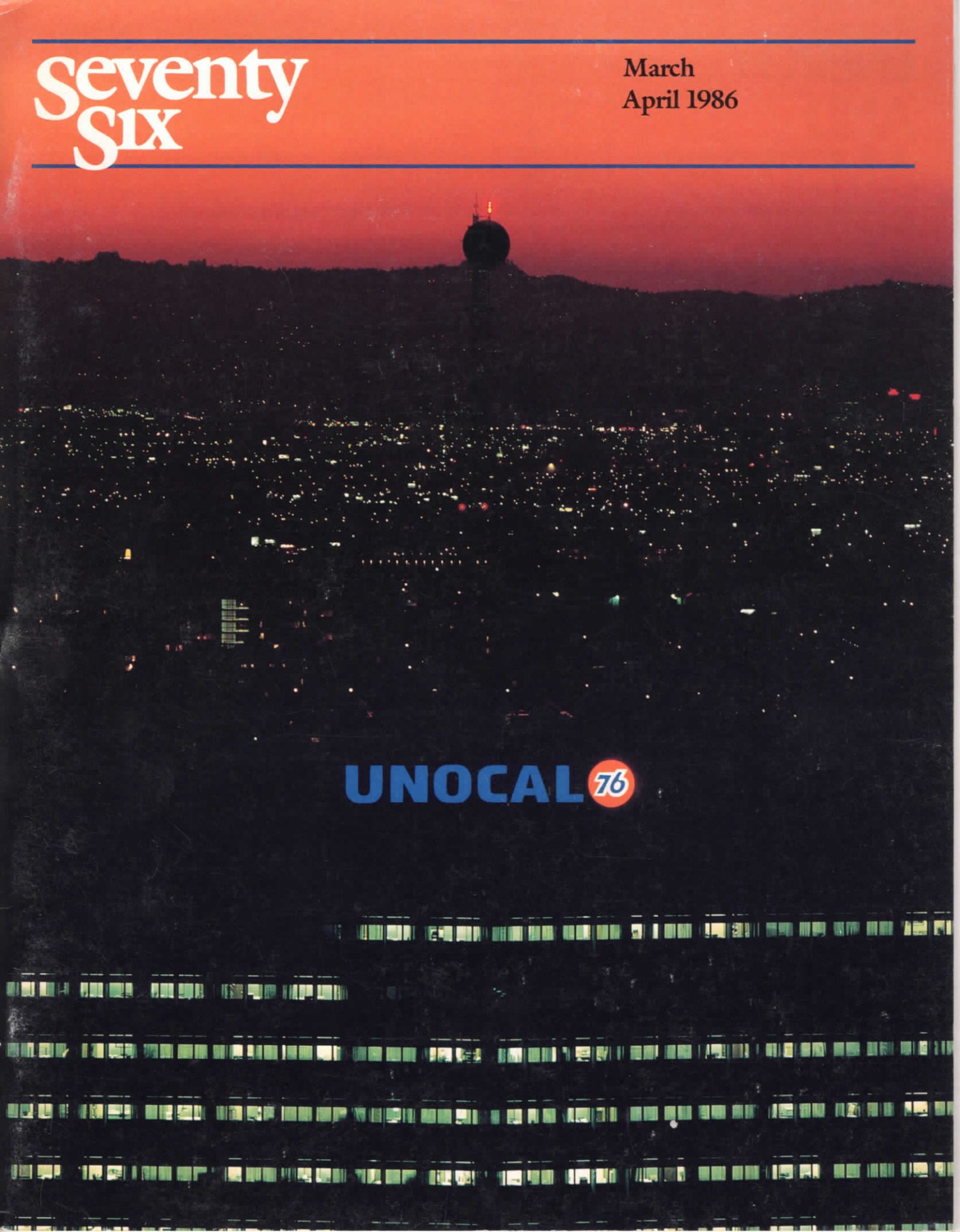
Seventy Six

March
April 1986



ENERGY AND AMERICA'S FUTURE

The recent steep plunge in world crude oil prices has deeply affected the U.S. oil industry. While lower oil prices bring an immediate benefit to consumers and any non-oil industries, the downside effects of this crude "price war" are serious and numerous.

The price slide has forced drastic cutbacks by Unocal and other oil companies in planned capital expenditures for exploration and development. Thousands of wells—now uneconomic to produce—have been shut in by some companies, resulting in lowered crude production, lost jobs, and economic hardship for oil-producing regions. And the long-term effects of continued crude oil price instability could be even more severe.

As the present situation continues to unfold, the questions are many. Why has this state of affairs come about, and how? What will be the long-term impact on the domestic oil industry, and on our nation as a whole, if depressed crude oil prices continue? Finally, what actions can and should we take to help stabilize this volatile situation and safeguard our nation's energy future?

Fred L. Hartley, Unocal's chairman and chief executive officer, addressed these and other issues in a speech given on February 27 at the University of La Verne. The occasion was the second annual Corwin D. Denney Lecture, part of a scholarly forum on energy issues held each year at the La Verne, California school. Mr. Hartley's speech is reprinted here for the benefit of Seventy Six *readers.*

Good morning, ladies and gentlemen. I am honored to participate in the Corwin D. Denney lecture series on energy issues at the University of La Verne.

Throughout most of our history, we Americans have never given much thought to energy. This was true despite the fact that our energy resources— including coal, oil and natural gas—have played a critical role in this country's economic and political growth.

In 1973, however, the rise of OPEC woke us up. Suddenly, oil prices skyrocketed, and temporary shortages—caused, I should point out, primarily by misguided government regulations—created long lines at gas pumps. These developments dramatically emphasized the importance of crude oil to our national security and our quality of life.

To those of us in the petroleum industry, it became clear that the United States faced not only temporary shortages of oil and gas, but a more serious shortage of accurate information about the economics and politics of energy.

Today, through the efforts of concerned individuals like Corwin Denney, that situation has improved significantly. Energy is gradually becoming an essential part of school and college curricula across the country. I'm glad to see it, because we are going to need all the wisdom and knowledge about energy that we can muster if we are to maintain our economic and political strength in the years ahead.

About two months ago, we entered a critical period in the history of energy use—an all-out price war between oil-exporting countries.

In the 1970s, OPEC took advantage of tight crude supplies to sharply raise oil prices and to increase its political influence around the world. Now, in 1986, some of these same countries are taking advantage of their huge crude reserves and low production costs to sharply *reduce* oil prices. Their immediate goal is to gain greater market share and increase total revenues. Their long-range objective is also obvious: to use low prices to discourage oil exploration and production in the United States and elsewhere, thus setting the stage for a return to the days when they can exert greater control over world oil prices. They also hope to strengthen once again their political power.

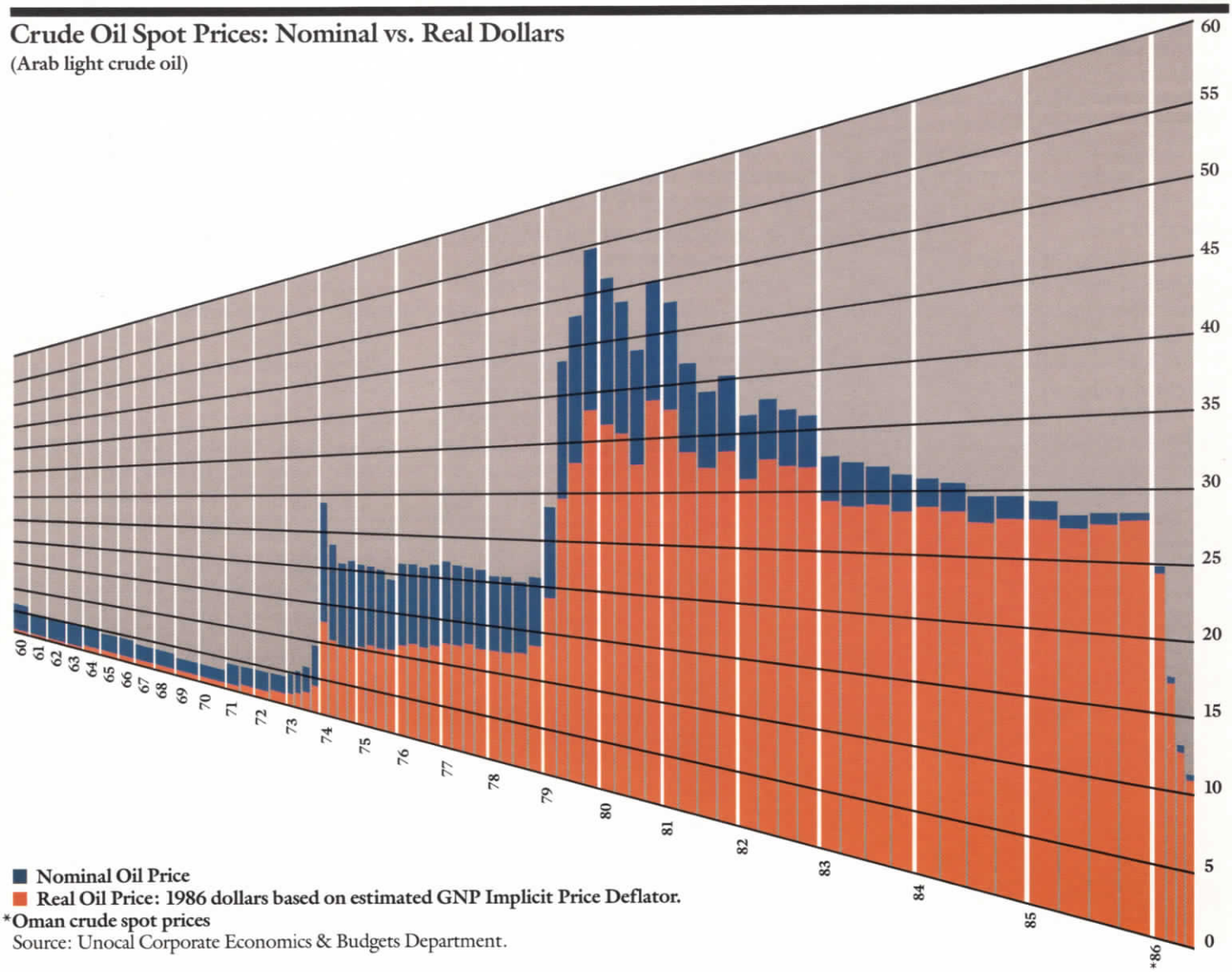
Although the United States is not a direct participant in this conflict—we are not an oil-exporting country—we still have an enormous stake in its outcome. In fact, we are victims of circumstances, and today's falling prices pose more of a long-range threat to America than yesterday's rising prices.

To see why this is the case, it's important to review briefly the history of energy use in this country. Less than two hundred years ago, America was basically an agricultural nation. Most people depended on wood, wind, and water to heat their homes, power their ships, and grow their crops. These, of course, are all renewable energy resources—but limited in supply and totally inadequate for a burgeoning industrial society.

Then came the industrial revolution, which dramatically improved human productivity. Powerful machines were invented that ran on steam, electricity or the combustion of gases. Manufacturing and farming were mechanized, and America's standard of living started to soar.

Fossil fuels made the industrial revolution possible, because they are a lot easier, cheaper and more efficient to use than wood, wind or water. Originally, coal was the key energy source, but in the 20th century we turned more and more to petroleum, primarily because it could be refined into highly cost-effective liquid fuels for cars, trucks, planes and other moving vehicles. Unfortunately, fossil fuels—unlike renewable energy sources—do not rapidly replenish themselves. Once consumed, they are, for all practical purposes, gone forever.

Crude Oil Spot Prices: Nominal vs. Real Dollars
(Arab light crude oil)



■ **Nominal Oil Price**
■ **Real Oil Price: 1986 dollars based on estimated GNP Implicit Price Deflator.**
***Oman crude spot prices**
Source: Unocal Corporate Economics & Budgets Department.

For a long time, we could use our own, relatively abundant coal, oil and gas reserves to fuel our economic growth. In 1947, however, the United States became a net importer of oil for the first time. We could no longer produce enough crude oil to satisfy our enormous energy appetite, particularly for liquid transportation fuels. At the same time, other industrial nations like Great Britain, Germany and Japan, along with the developing countries, were also increasing their consumption of petroleum.

In 1960, OPEC—the Organization of Petroleum Exporting Countries—was founded. Three Arab states—Iraq, Kuwait, and Saudi Arabia—met with Iran and Venezuela to discuss ways to exercise more control over the prices charged for their crude oil, which was then produced and marketed by European and American oil companies. Over the next decade or so, OPEC picked up several new members, but it still could not control the world oil market.

By the early 1970s, that was about to change. U.S. production of oil and gas hit its peak and started a gradual decline, but demand continued to grow —not just in America, but throughout the entire world.

Before long, OPEC accounted for one-half of total world production. The United States had to go shopping overseas for more and more of its oil needs. By 1973, imports made up almost 35 percent of our petroleum consumption. Nearly half of that came from OPEC countries, who suddenly found themselves in a position to dictate oil prices.

In October 1973, Egypt and Syria invaded Israel, setting off the Yom Kippur War. Soon thereafter, OPEC made its first big move, unilaterally raising crude prices from $2.90 to $5.12 per barrel, almost doubling the price. Several Arab countries also cut off oil exports to the United States in an effort to sway U.S. foreign policy in the Middle East.

A few months later, OPEC doubled the price again. Then, during the Iranian revolution in 1979, OPEC pushed prices above $30 per barrel.

OPEC, of course, is a "cartel"—an organization of independent, government-operated oil producers who seek to limit competition and fix prices. Throughout most of the 1970s, they were very successful at this game. Petroleum demand was expanding, so member countries could sell all their production, even though they raised prices repeatedly. Over time, however, higher crude prices caused four major reactions to occur in the non-OPEC world.

First, rising prices stimulated the development of new and increased sources of supply from outside OPEC —particularly from Great Britain, Norway, Mexico and the Soviet Union. These countries never joined OPEC, but they soon became significant exporters of crude oil, competing against the cartel.

Second, additional natural gas production came on line and new pipelines were built. Gas began to displace markets previously enjoyed by products made from crude oil. The use of coal and nuclear energy to generate electricity further reduced the demand for crude oil in many countries, including the United States.

Third, rising prices created a surge in exploratory and developmental drilling in the United States. The number of total wells drilled in this country rose for eight consecutive years, peaking at more than 88,000 in 1982 as compared to less than 33,000 in 1974.

Fourth, rising prices accelerated conservation efforts throughout the western world. Billions of dollars were invested in plants, buildings and homes to conserve heat and fuel. Cars were designed to go farther on a gallon of gasoline. These conservation efforts, combined with a recession in the early 1980s, also weakened petroleum demand. In fact, demand for OPEC oil dropped 12 million barrels a day between 1979 and 1983.

As demand declined, OPEC was forced to curtail production in order to maintain oil prices. Some of the poorer countries with large populations— determined to utilize their idle capacity and increase their oil revenues —began to cheat on the cartel price by offering discounts.

For a while, Saudi Arabia almost singlehandedly tried to prop up crude prices by cutting back on its own petroleum production. In 1980, Saudi output peaked at nearly 10 million barrels a day. Last summer, it had fallen to about 2.3 million barrels a day.

During this time, the Saudis repeatedly warned other oil exporters that they would not continue to be the world's "swing producer" forever, cutting production in order to shore up prices. By last fall, the Saudis were running short of patience— and cash flow.

In response to Saudi pressure, last December OPEC officially (and reluctantly) decided to abandon its efforts to enforce production quotas and defend a specific price level. Instead, members of the cartel now set out to capture what each calls its "fair share" of oil production and revenues, regardless of price.

To regain its lost market share, Saudi Arabia has more than doubled its petroleum exports during the past six months. The kingdom has also adopted a netback pricing system. Although details of these netback agreements are complex, the end result is that the Saudis adjust crude prices to guarantee buying companies a certain margin on their product sales. If product prices decline, the Saudis charge proportionately less for their crude so that buying companies do not lose money on the deal.

Primarily because of Saudi production increases and netback sales techniques, oil prices began to plunge in a kind of free fall. On December 2, for example, West Texas intermediate crude oil sold for $29.75 per barrel on the spot market in the U.S. Gulf Coast. On February 24, it sold for only $14.90 per barrel.

Other kinds of crude oil have also suffered price declines of 50 percent or more. In effect, the Saudis and their allies—especially Kuwait and the United Arab Emirates—have declared an oil price war against certain other petroleum-exporting countries, both in and out of OPEC. Because oil is a commodity traded around the world, the U.S. petroleum industry has faced the same price declines as everyone else.

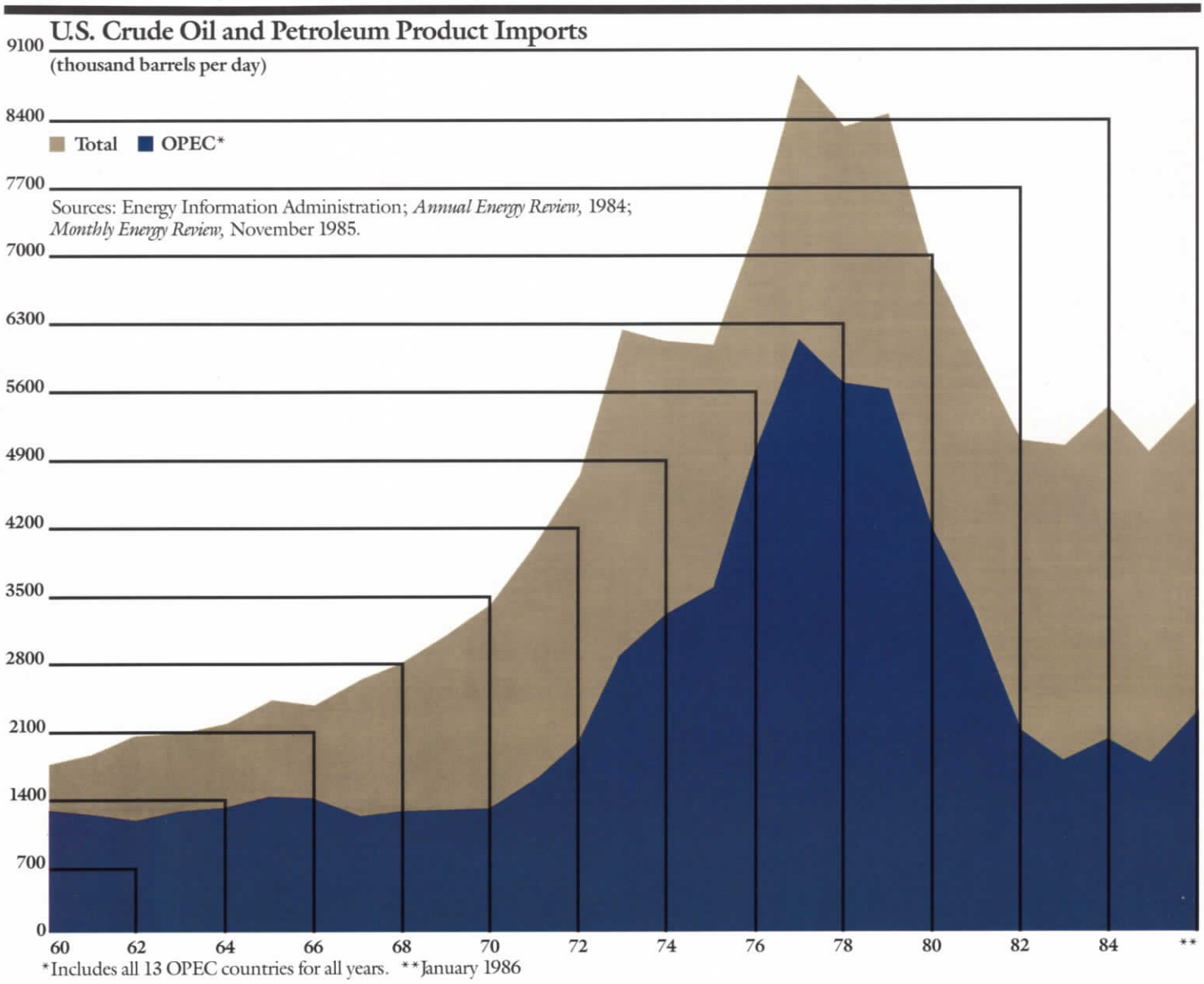
What, exactly, do the Saudis and their allies hope to win by throwing the world oil market into chaos?

First, they can generate higher total revenues from their crude exports, even if the per-barrel price falls significantly. The Saudis can more than make up in volume what they lose in per-barrel sales — at least down to a certain price range.

Let me give you an example. Although the price of Saudi crude has dropped from about $27 to $17.50 per barrel since last August, their exports have more than doubled. As a result, Saudi export revenues have gone from about $1.3 billion to $1.8 billion per month despite the price declines.

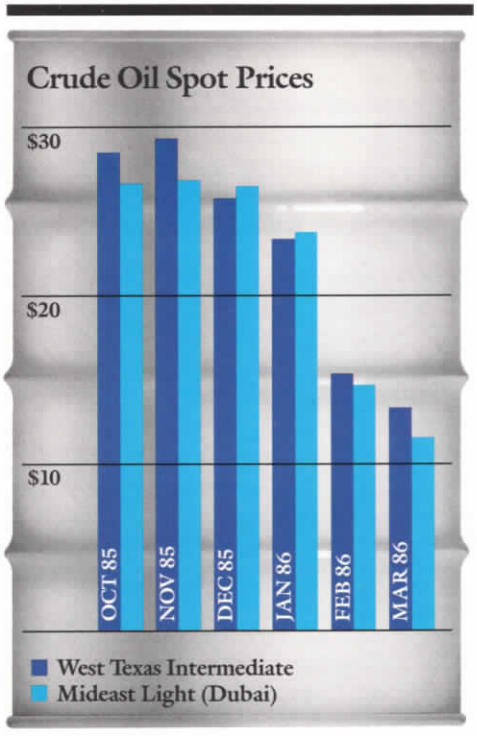
At this rate, Saudi Arabia can wage a price war indefinitely at the expense of those exporters who have lost market share. The effect on oil producers in the United States is already a near disaster.

That brings me to the second and third objectives of this price war. The Saudis and their allies are forcing a showdown with certain oil-exporting countries like Britain, Norway, Nigeria and Iran by taking away their markets or provoking deep price cuts for their products. In the end, they hope to return control of production and prices to the cartel.



Third, they want to stimulate world petroleum demand through lower prices, while discouraging new oil exploration and production, and inhibiting further efforts at conservation and alternative energy development. Over time, these developments would also tend to stabilize the world oil market (by lowering supplies and increasing demand) on terms more favorable to Saudi Arabia and other exporting countries.

Some people think the rich OPEC countries are bluffing and will soon voluntarily curtail production in response to pressure from other members of OPEC. Others think that non-OPEC exporters—plus the cartel's renegades—will agree to revised production quotas and, in effect, join hands in a newly dedicated cartel. Prices could then rise to last year's levels—or even higher.



Source: *Petroleum Intelligence Weekly,* various issues.

In either case, it is just a question of time. Whatever the Saudis decide to do, they clearly have the upper hand in an oil price war, although their position is at some risk.

Today, the world's proved oil reserves total about 700 billion barrels. More than half of this total is controlled by OPEC members in the Middle East. The United States has a relatively small share of known supplies—about 28 billion barrels. That's less than 5 percent of total world reserves. At our present rate of crude production and without new discoveries, that 28 billion barrels will only last us about ten years.

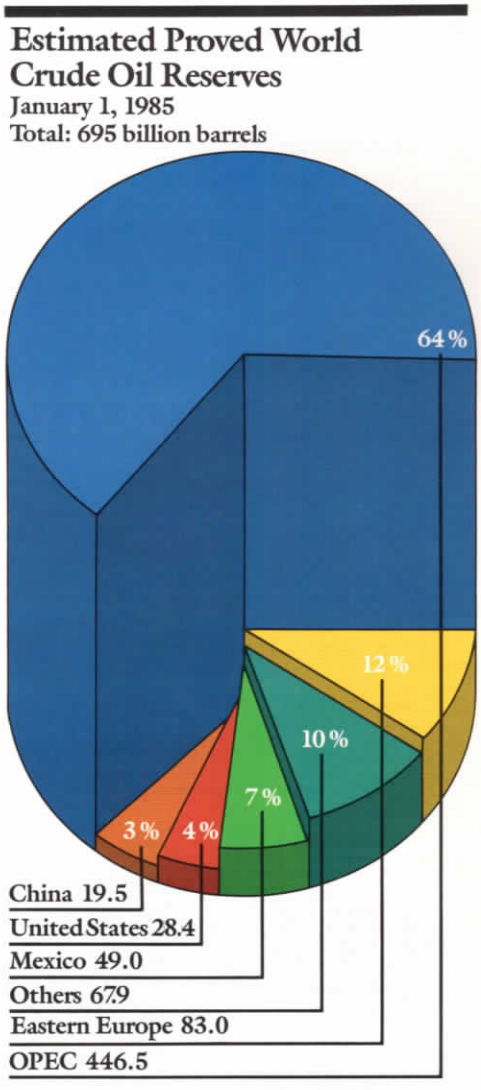
Given adequate opportunity, we will, of course, find more, just as we have in the past. Our petroleum reserves —and our national security— can be maintained. But not at today's crude prices.

The Saudis, on the other hand, have some 170 billion barrels of proved crude reserves—more than all the holdings of Mexico, Norway, Britain, the Soviet Union, and the United States combined.

The Mid-East members of OPEC, including Saudi Arabia, are also the world's low-cost producers of crude oil. According to recent studies, it costs anywhere from $16 to $24 per barrel to find and produce most new oil and gas in the United States. Production costs for several OPEC members, including Saudi Arabia, are probably less than $2 per barrel. And because they already have huge, highly productive oil fields, they do not need to incur any new exploration and development expenses. So these countries can make money at $15 per barrel, or $10 per barrel, or possibly at any price above $2 per barrel. U.S. oil companies cannot, nor can Britain, Norway and many other oil producers.

The Saudis, apparently feeling that their backs were to the wall, launched this oil price war in order to solve a problem. But the Saudi solution has created a serious problem for the United States. Unfortunately, many Americans fail to see the danger. America is being lulled to sleep by an "oil glut." With oil prices falling, conservation efforts are losing momentum and consumption is on the upswing.

Earlier this month, for example, the California Highway Patrol and CALTRANS issued a joint report urging that the speed limit on much of the state's freeway system be increased to 65 miles per hour. Recently, sales of large, relatively inefficient luxury cars have started to climb. And two of the "big three" auto makers have resisted meeting the most recent federally mandated fuel economy standards for their new automobiles.



Source: *Twentieth Century Petroleum Statistics,* DeGolyer and MacNaughton, 1985.

Meanwhile, some policy makers and economists both in and out of Washington have been heaping praise on falling crude prices. It would be tempting to sit back and enjoy the energy price slide. The economy would get a boost and our balance of payments problem would ease somewhat, because we would be paying significantly less for our imported oil. But we would be living in an energy dream world, and sooner or later that dream world would again become a nightmare of recurrent shortages and soaring prices.

Falling oil prices are having a devastating impact—both short-term and long-term—on America's petroleum industry. New exploration and development projects are being cancelled. In time, domestic production—and especially U.S. petroleum reserves—will significantly decline.

Several major oil companies have already slashed their exploration and development budgets by 20 to 30 percent this year. Smaller U.S. producers are closing down some of their higher cost wells. Independent exploration companies, drilling contractors and suppliers are losing their markets and struggling to avert bankruptcy. Many of their bankers could fail along with them.

In late December 1981, more than 4,500 drilling rigs were actively searching for new oil and gas in the United States. On February 24 of this year, the rig count was just 1,308—and falling fast.

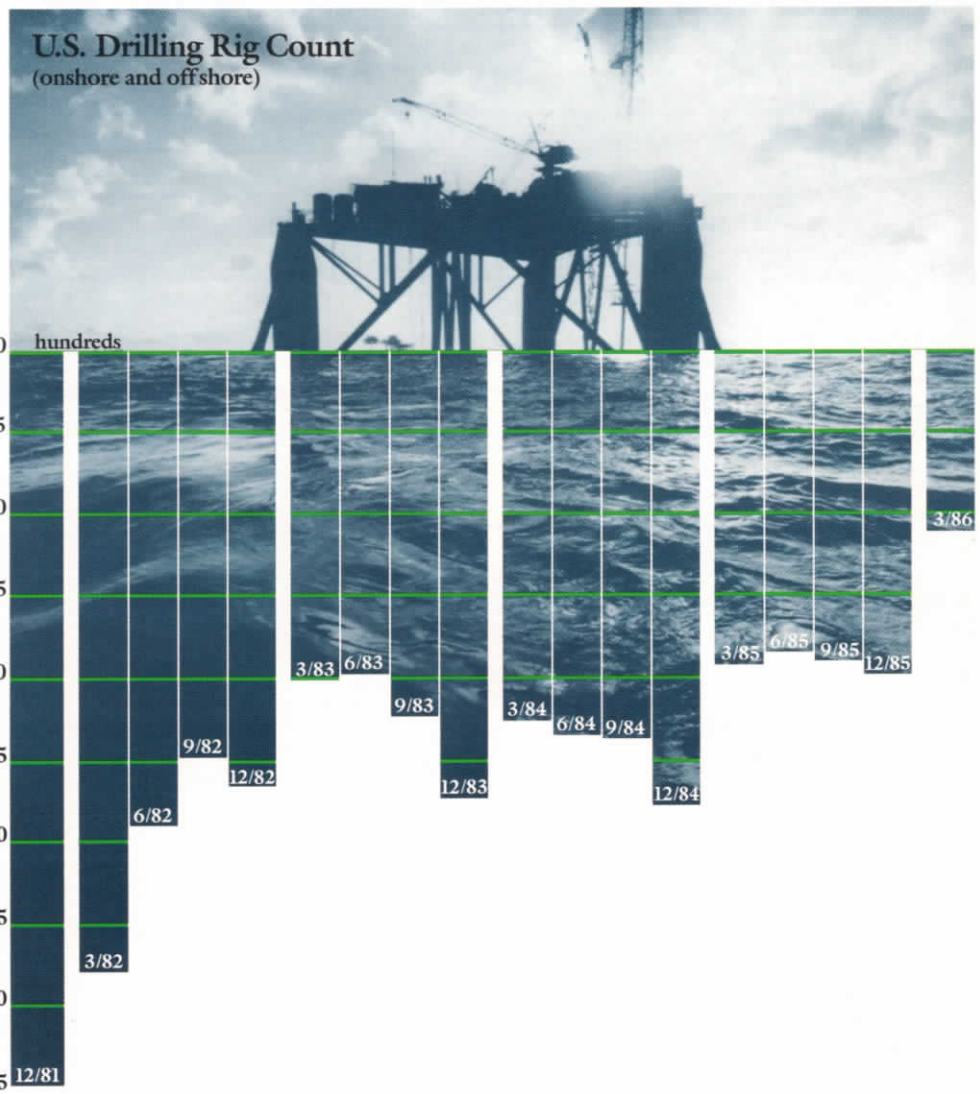
Last October, Interior Secretary Donald Hodel warned that America must find 32 billion barrels of oil equivalent during the next decade just to keep domestic production at current levels. "Unless we put forth a maximum effort and have a lot of luck," Hodel said, "the United States could be importing half of its oil by the turn of the century."

With crude prices in decline and the domestic oil industry forced to cut back on exploration, development and production, that day will come a lot sooner. We are threatened by a kind of oil-import time bomb, and time is gradually running out. If America is to avoid a serious new "energy crisis" in the 1990s that could threaten our military and economic strength, we must take some strong and bold steps today.

Most importantly, we need to establish a security import fee—levied, without exceptions, on all imported crude oil, refined products and petroleum-derived chemicals. This fee should be structured to create a floor price for crude oil imports of, say, $27 per barrel —high enough to support continued petroleum exploration and development activities in the United States, but low enough to provide gasoline and other products at prices consumers were paying just a few months ago.

The oil import tax should be based on a sliding scale. If the average world price of crude were $19 a barrel, the fee would be $8; if the average price of crude were $15, the fee would be $12, and so on. Once the average price reaches $27 a barrel or more, the fee disappears. In other words, such an oil import fee would protect the U.S. petroleum industry while the Saudis' predatory price war goes on. It would be a kind of insurance payment for safeguarding our future national security and economic vitality.

In addition, such a fee would help maintain continuing efforts at energy conservation—by industry, by government, and by individual consumers. Moreover, an oil import fee would generate substantial new reserves for the U.S. treasury.



Source: Hughes Tool Co., *Oil & Gas Journal,* various issues.

At current import and production levels, an effective oil import fee of $12 per barrel could generate some $43 billion in federal revenues each year: about $18 billion from the fee itself; $7 billion from the windfall profit tax, which would also take effect; and $18 billion from corporate income tax paid by oil companies. Approximately half of this total would be new revenues to the treasury; the rest would be revenues that would have been lost due to lower crude prices.

At a time when we are running up $150 billion to $200 billion federal budget deficits, these additional revenues are sorely needed.

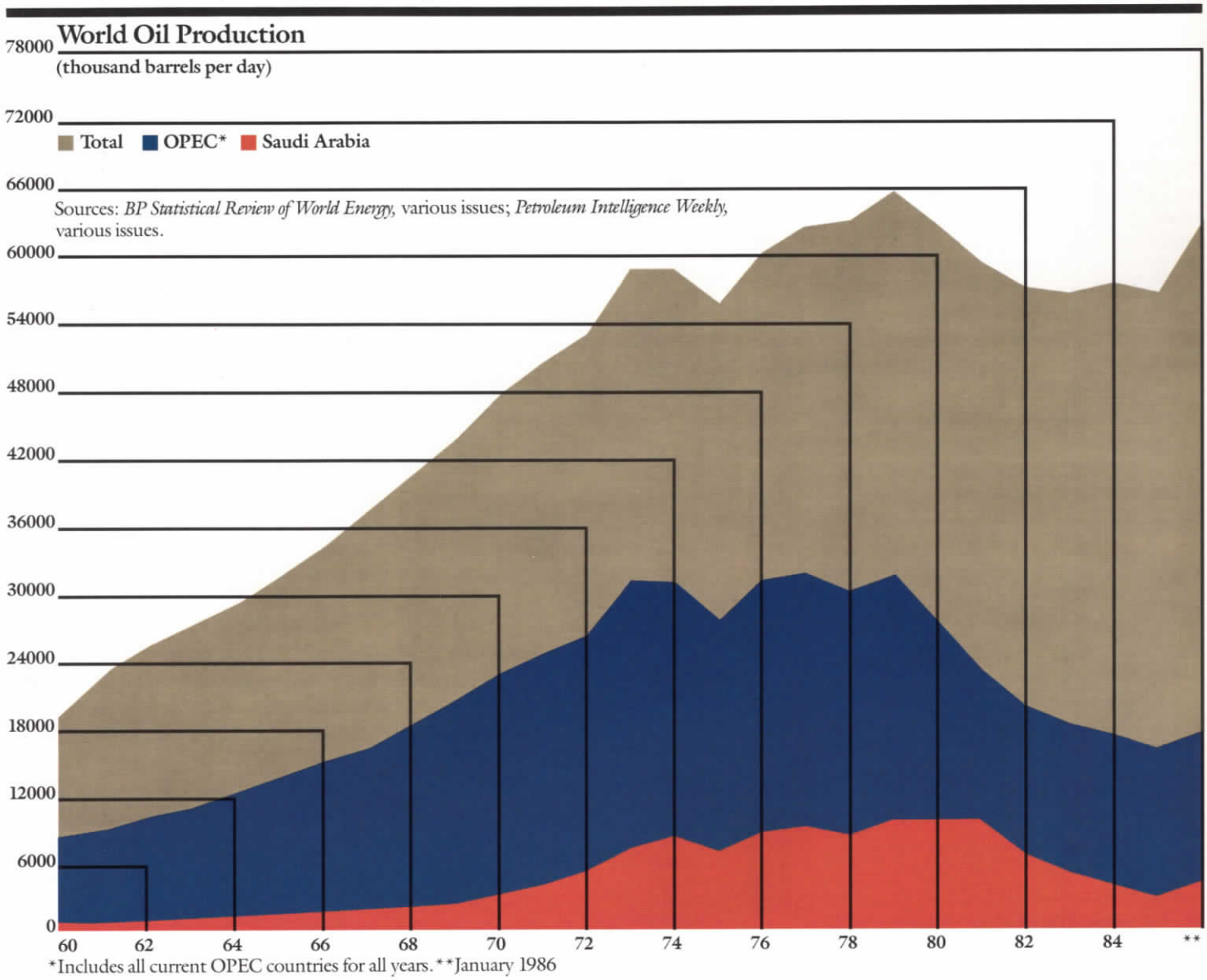
Some consumers and policy makers oppose an oil import fee, believing that it would interfere with the free market and unfairly penalize certain sectors of our economy. It is true that a free market—without needless government intervention—is the fairest and most efficient way to allocate scarce resources like oil. But oil is a strategic commodity. Without it, we cannot defend ourselves.

It is also true that an oil import fee will increase costs for some domestic industries. Yet without a strong domestic oil industry, we will become dangerously dependent on foreign, and eventually, OPEC crude. In a few years, this dependence could generate damaging price increases for *all* U.S. industries and consumers, a severe balance of payments drain, and a dangerous vulnerability to political and social upheavals overseas.

We have a precedent for federal intervention in the petroleum import market. During the late 1950s, a flood of cheap crude oil from the Middle East entered America, undercutting our domestic petroleum industry. In 1959, President Eisenhower, concerned about long-term damage to America's oil industry and to the country's national security, initiated a mandatory oil import quota system.

In a statement announcing the new program, the president said: "The certified requirements of our national security...make it necessary that we preserve to the greatest extent possible a vigorous, healthy petroleum industry in the United States."

These words are as true today as they were 27 years ago.



This quota system, which attempted to limit petroleum imports into the United States, remained in effect for the next 14 years. It helped the industry push exploration into harsher environments like the north slope of Alaska, where the country's largest oil field was discovered in 1968. Unfortunately, these quotas were riddled with special deals and privileges, crippling their effectiveness and creating gross inequities.

We can learn from these mistakes. An oil import fee could create some competitive distortions in the marketplace. Naturally, various special interest groups will be tempted to advocate exemptions and exclusions on their own behalf. The most equitable and effective system, however, is one without any exemptions and exclusions. If, for example, we need to provide any special consideration for home heating oil users, it should be done by tax rebates or credits.

Similarly, any special arrangements that are needed for imports from our neighbors, Canada and Mexico, should be handled on a direct, case-by-case basis, not through exemptions to the import fee.

Establishing an equalizing oil import fee is a big step in the right direction, but we need to do more. America needs to implement a rational policy concerning petroleum exploration and development on federal and state lands. Offshore, for example, our nation may have more than 12 billion barrels of crude oil still undiscovered—half again as much as we hold in proven reserves.

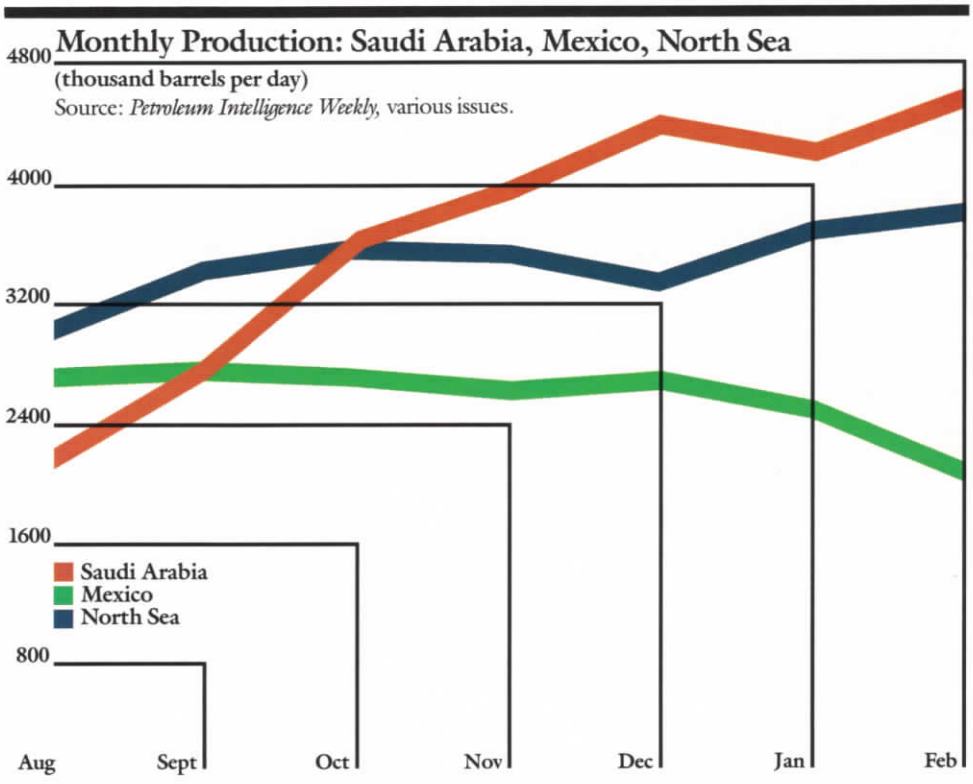
In 1978, Congress adopted a statement of national policy, stipulating that the outer continental shelf should be developed to meet America's energy needs, subject to environmental safeguards. Ever since, however, Congress has ignored its own policy statement by allowing a few members of Congress serving on one committee to impose their views on the entire country.

Since 1982, a series of one-year moratoria imposed by the House Appropriations Committee has stymied offshore exploration by deleting funds from the Department of Interior's budget. Each year these moratoria have passed by decreasing margins until finally, last year, the amendment failed by one vote. Even so, the delays and obstructions continue.

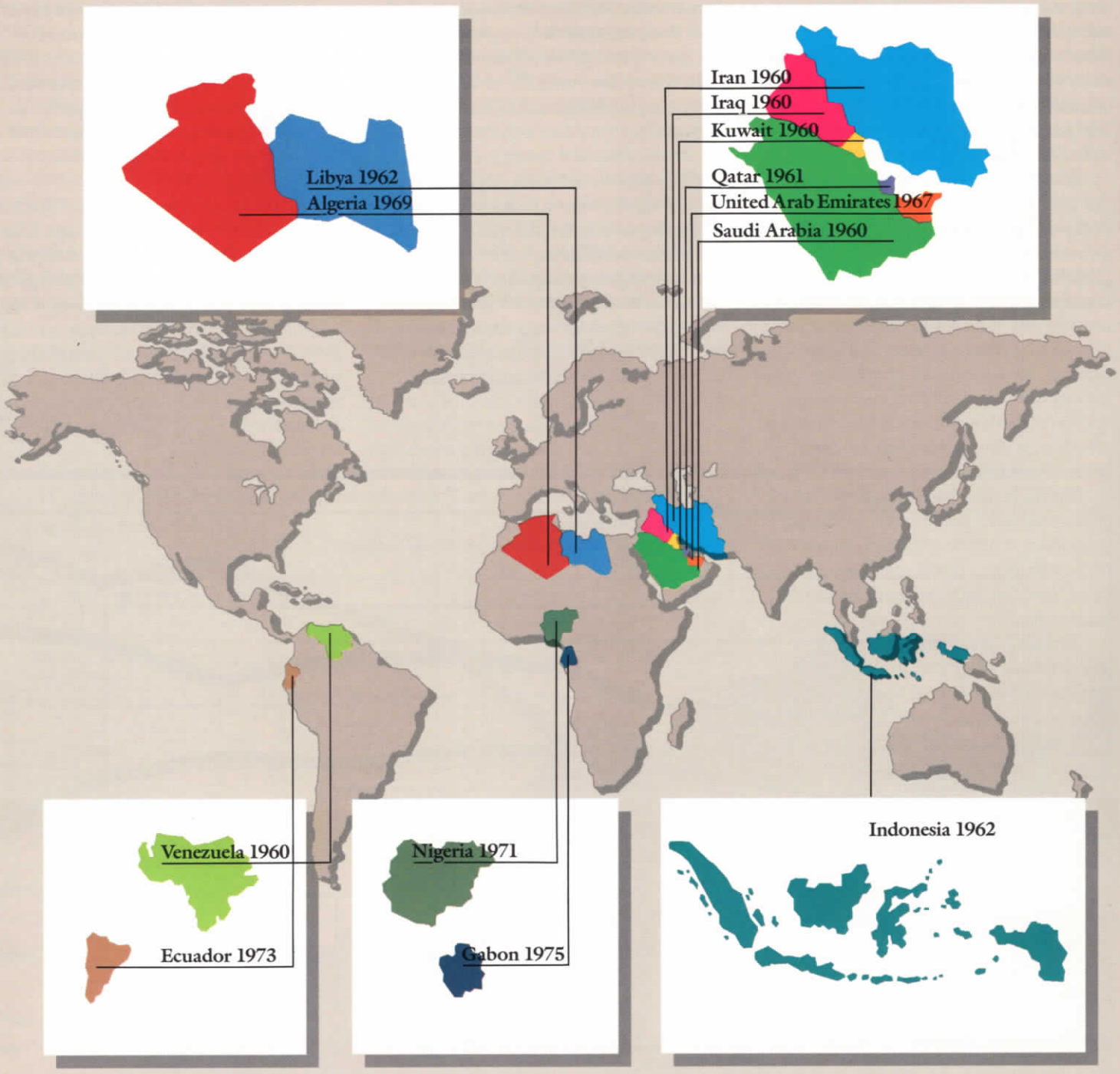
Environmental quality is important, and the petroleum industry has learned how to find and produce oil and gas while respecting the integrity of the sea, the coast and the land. But we cannot locate new energy supplies if we do not have access to prospective areas. It is shortsighted to lock up these lands instead of fostering reasonable levels of leasing, exploration and development activity.

It is also shortsighted to regulate natural gas prices. We need policies that allow the market to develop and distribute this important fuel in rational ways at reasonable costs without discriminating against certain groups of customers. And it could be shortsighted for the federal government to propose reducing the originally planned holdings of the strategic petroleum reserve from 750 million to today's 500 million barrels.

We must also continue our efforts to develop alternative energy sources. Some shortsighted people in and out of government believe that today's low oil prices make a concerted campaign to develop synthetic petroleum from shale and coal as well as other alternative forms of energy unnecessary and wasteful. How quickly they forget the traumas we experienced during the 1973 oil embargo and the 1979 revolution in Iran!



OPEC Members



Since 1981, in fact, federal support for alternative energy development has been gradually drying up. This kind of thinking plays right into OPEC's hands. As one industry observer recently told *The Wall Street Journal*: "We're basically canceling the nation's energy insurance policy."

At Unocal, we have long been committed to alternative energy development. Today, we are the world leader in the development of a key energy alternative—geothermal power. Geothermal energy is hot steam or steam flashed from hot water that is produced by drilling into hot regions of the earth. This steam can be harnessed to power electrical generating plants. It is perhaps the most commercially successful alternative energy resource.

Twenty-five years ago, geothermal energy production did not exist in the United States.

Unocal researchers and engineers pioneered the development of this untapped energy source, and now we are the world's largest producer of geothermal power. In 1985, Unocal competitively produced an average of 24 million kilowatt-hours of electricity per day from geothermal sources. That is the equivalent of 13 million barrels of crude oil per year.

The development of geothermal power proves what long-term investment in alternative energy development can accomplish. Eventually, we must learn to use our abundant reserves of oil shale and coal to produce liquid transportation fuels. But much research and development remains to be done. Finding and developing new energy sources is a costly, time-consuming process. We cannot begin pumping new oil supplies overnight or develop alternative energies at a moment's notice.

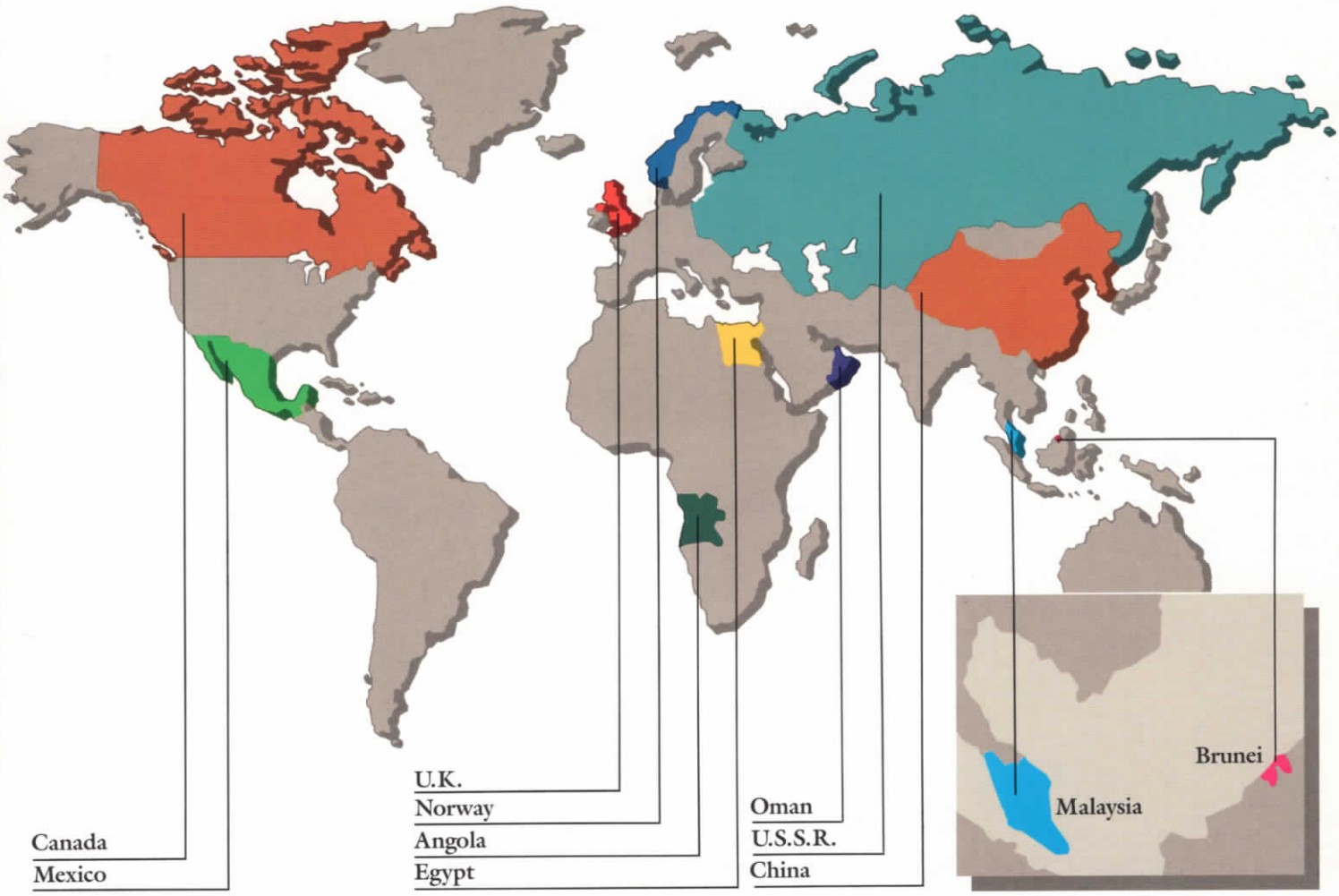
America's energy problem has not disappeared with falling oil prices. In order to enjoy continued economic growth and a high standard of living, we must find ways to enhance our domestic energy supplies, particularly our supplies of liquid transportation fuels.

It has been said that "it is only when we demand a solution with no costs that there is no solution." This morning, I have suggested some solutions to America's energy problem. These solutions all entail some costs. We can pay these costs today through rational plans and policies, or we can pay them tomorrow through crash programs, enforced conservation, and economic hardship. It will be a lot more expensive—and dangerous—if we wait until tomorrow.

Thank you.

Non-OPEC Oil-exporting Countries

Export more than 100,000 barrels per day.



Source: *International Energy Annual*, 1984

Patents reach a record high.

What could herbicides and motor oil have in common with refining processes and chemical solar cells? They all form the basis of technologies for which Unocal received a record number of patents last year. The U.S. government issued the company 69 patents in 1985—the most granted Unocal in a single year since 1972. In addition, the company filed 105 patent applications last year, the highest number ever.

"This achievement is a tribute to both the creativity of Unocal's inventors and the tremendous efforts of our patent staff," says Cloyd P. Reeg, president, Unocal Science & Technology Division. "We attained a record despite handling a large load of legal work that stemmed from filing an increasing number of patent applications."

Patents give inventors the right to bar others from making, using or selling the patented machine, process or material. Obtaining this valuable federal protection is often a long and complex procedure. After Unocal's researchers successfully complete a project, the company's patent department submits an application through the U.S. Patent and Trademark Office (part of the Commerce Department). The office, which carefully considers each application, takes an average of two years to issue a patent. Many applications are rejected because they do not meet the office's stringent requirements.

The patents issued to Unocal last year cover a variety of company-developed technologies in areas such as refining catalysts and processes, shale oil refining, geothermal resources, oil production, coke and carbon products, lubricant and gasoline additives, solar energy, and herbicides.

Dr. Don C. Young is one of several S&T researchers who developed processes patented last year. Young, a staff consultant in chemicals research, devised a herbicide that causes weeds to dissolve in their own water.

"You can spray a field and, 24 hours later, the weeds are not just dead—they're gone," states Young. "The herbicide can be used anywhere because it leaves no residue."

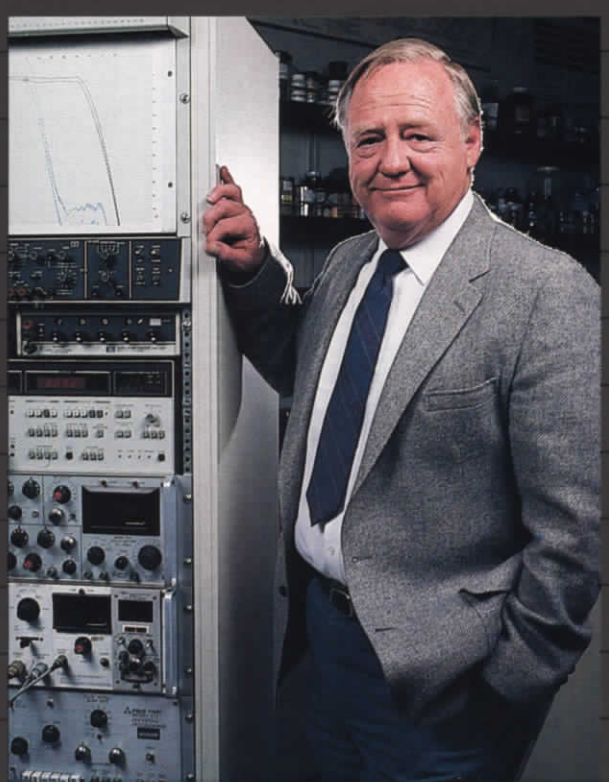
Brea Agricultural Service, a Unocal subsidiary, currently markets the product as "N-TAC." Although N-TAC is bad news for weeds, it will not harm crops or the environment. (Young actually made the preparation first as a fertilizer before modifying it into a herbicide.)

Dr. Jay A. Switzer is another scientist whose research ultimately resulted in patented processes. Through his work in solar energy conversion, he improved two types of cells—a photo-electrochemical cell and a solid-state photovoltaic cell—to more efficiently convert solar energy (sunlight) into electrical energy.

"Someday photo-electrochemical solar cells may be able to use the sun's energy in the production of hydrogen fuel from water," the senior research chemist explains.

Unocal holds more than 1,000 patents representing a diversity of successful research projects. The company sells 10 times more licenses on patented process technologies than it purchases from other firms. Last year, royalty income from licenses reached the highest level in Unocal's history.

Cloyd P. Reeg (seated, second from right) is surrounded by Unocal's patent department. From left: Daniel R. Farrell, Yale S. Finkle, Alan H. Thompson, Montgomery Smith, Gregory F. Wirzbecki, Michael H. Laird and Dean Sandford. June M. Bostich is standing (right). Research scientists Dr. Don C. Young (standing, second from right) and Dr. Jay A. Switzer (seated, right) have developed patented processes.



Dr. Don Young

Dr. Jay Switzer

Patent attorneys Keith Debrucky and Robert A. Franks are not shown.

SCCCAMP: helping clear the air.

In the predawn darkness on October 8, 1985, the crew boat to Unocal's Platform Gina left its port in Ventura, California. For the platform crew, this was just another early morning ride to work. For the members of the SCCCAMP team (South Central Coast Cooperative Aerometric Monitoring Program), it was the end of the field-study phase of their project. They would be rushing to dismantle their equipment on Gina today, making way for a workover rig scheduled to arrive at noon.

The ride through the brisk salt air was calm in the harbor, but once past the breakwater the 100-foot boat lurched through 10-foot swells. These channel waters are often choppy, the weather unpredictable—subject to sudden, gusting winds.

The turbulence at sea mirrors a growing storm of controversy onshore: does offshore oil and gas development contribute to the worsening air quality situation in the south-central coast region? SCCCAMP, a study of wind, weather and pollution patterns in the region, may help "clear the air." The data will help assess the impact of emissions from offshore activities on onshore air quality.

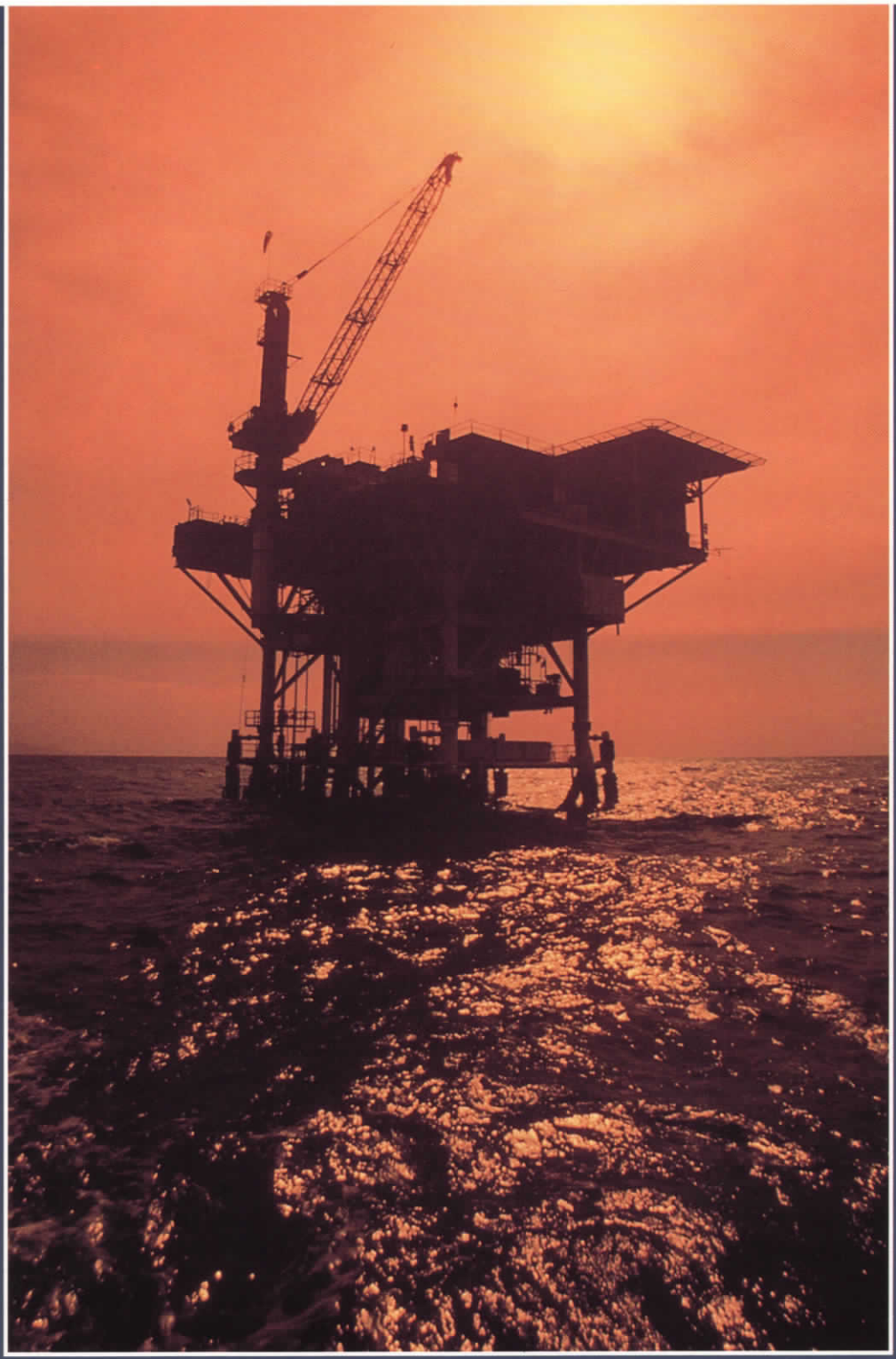
"We in the petroleum industry do not believe that outer continental shelf (OCS) operations have a significant impact on onshore air quality," says Anton Chaplin, coordinator for environmental programs for Unocal's Environmental Sciences Department.

However, since oil companies began announcing major new discoveries offshore California's south-central coast at the beginning of the 1980s, local environmental agencies and citizens of Santa Barbara, Ventura and San Luis Obispo counties have been concerned. They fear that development offshore will further degrade the quality of the atmosphere onshore. Air pollution control agencies in the tri-county area insist that, because of the unknown impact on air quality from offshore oil operations, they cannot produce strategies to meet federal ozone level requirements by 1987 as ordered by the Clean Air Act.

Atmospheric patterns in the south-central coastal area are complex. There is no undisputed scientific data to demonstrate that emissions from offshore development activities are a significant source of air pollution in the tri-county area. Studies up to now have been limited in scope and are used to fuel arguments on both sides.

"That makes us reluctant to spend money on expensive emission mitigation measures which could prove useless to improve onshore air quality," says Jerry Wasicek, manager of regional compliance for Unocal's Oil & Gas Division.

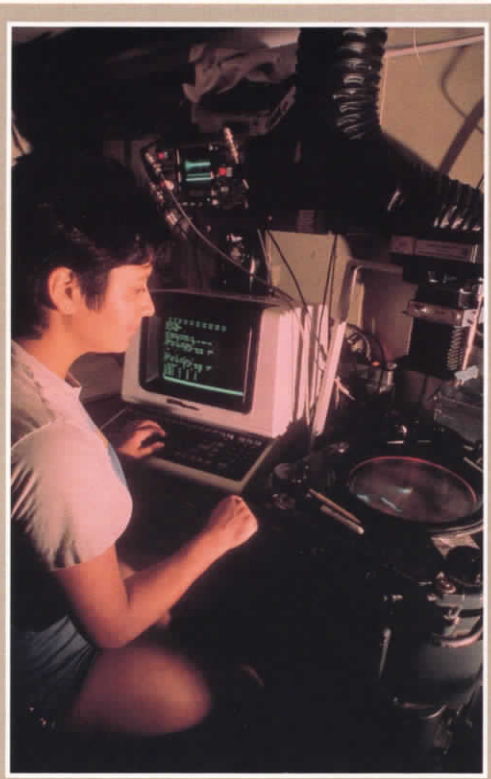
Yet, county, state and federal agencies need technically sound information if they are to address real environmental concerns and not just work from assumptions. Oil companies need this information, too, if they are to develop the area's extensive reserves—currently estimated at about 1 billion barrels—economically and without harm to the environment.



Unocal's Platform Gina and other oil and gas operations offshore California's south-central coast are fueling controversy about onshore air pollution.

Right, Taneil Uttal of the National Oceanic and Atmospheric Administration operated one of two Doppler radar installations used in the SCCCAMP field study. The station made intensive wind measurements during air pollution episodes, bouncing radar signals off tracer material released by aircraft.

Center right, Dr. Walt Dabberdt, formerly with SRI International and now with the National Center for Atmospheric Research in Boulder, Colorado, is SCCCAMP's technical director.



Permits for offshore platforms are already very difficult to get. The U.S. Minerals Management Service (MMS), which has jurisdiction in the OCS (waters beyond the three-mile state limit), has imposed stricter requirements—including air quality regulations—for development in offshore California than elsewhere in the country. The MMS is one of four federal agencies that have permit-issuing authority in the OCS. The California Coastal Commission has the authority to review development plans for consistency with local coastal plans prior to MMS permitting, according to Wasicek.

Pipelines carrying oil onshore and onshore support facilities are subject to permitting by a dozen state and local agencies, and to review by dozens more. As the air pollution issue looms larger, offshore development could be severely hampered—at a time when the country needs all the domestic production it can muster.

So, industry and government have agreed to cooperate in SCCCAMP. The industry is working through the Western Oil & Gas Association (WOGA). Primary funding has been provided by Exxon, Texaco, Chevron, Arco, Phillips and Unocal, with additional monies from other companies and some of the governmental agencies that are involved. All interested parties are participating in the study, so that all can agree on SCCCAMP as the definitive factual basis for future discussion concerning air pollution regulations for offshore operations.

There is no disputing that air quality in the south-central coastal region needs improvement. Portions of Santa Barbara and Ventura counties are "non-attainment" areas for ozone; that is, their air quality does not meet government standards. Specifically, ozone levels exceed state and federal standards about 10 times a year.

At least part of the problem is caused by the increase in population. More commerce, more cars and more industry are often accompanied by reduced air quality. Every year, the area's resorts and other attractions also draw more and more tourists—and their automobiles—adding to air quality problems.

The question is how much, if at all, offshore development contributes to this problem. Unocal currently operates five producing oil and gas platforms in the Santa Barbara Channel, and has interests in several of the other 14 producing platforms there.

North of the channel, a series of major oil discoveries have been made in the Santa Maria Basin from west of Santa Maria south to Point Arguello. Unocal's Platform Irene, installed just last October, is the first development in this promising area and is scheduled to begin producing an estimated 20,000 barrels of oil and 13.3 million cubic feet of natural gas per day in late 1986.

Continued offshore development could justify more than double the present number of platforms, and increase production from just under 100,000 barrels to 500,000 barrels per day by 1990.

SCCCAMP was conceived in late 1983 by the four members of WOGA's Air Quality Technical Subcommittee, chaired by Unocal's Chaplin. The committee members agreed that it was time to separate the facts from the fancies about the sources of air pollution in the south-central coast region, and WOGA supported the idea.

"We recognized from the beginning that any successful study would have to be a cooperative effort between the industry and the various government agencies," notes Chaplin. "We also recommended that non-industry scientific advisors be enlisted to provide unbiased technical expertise for the study."

During the next year, a WOGA task force coordinated efforts to organize the study and agree on procedures to initiate it. This resulted in a memorandum of agreement between the concerned oil companies and air pollution agencies. SRI International, a highly respected, independent research firm, was selected to manage and coordinate the study.

SCCCAMP is run by three committees. The program management committee includes representatives from the U.S. Minerals Management Service; the U.S. Environmental Protection Agency; the California Air Resources Board; the air pollution control districts of San Luis Obispo, Santa Barbara and Ventura counties; and WOGA. This group agrees on policy and procedures for the study.

The technical coordinating committee, also representing both industry and government, specified the study's objectives, outlined the technical issues, and developed guidelines for the consultants who would ultimately collect and handle voluminous amounts of SCCCAMP data. Chaplin, whose pre-Unocal experience includes directing a three-year national study of the potential air quality impacts of loading and unloading crude oil and gasoline from tankers and barges, serves on this nine-member committee.

Unocal's Platform Gina is one of 19 producing oil and gas platforms in the Santa Barbara Channel.

The scientific advisory committee is made up of six non-regulatory and non-industry people who provide technical oversight. They represent a high level of expertise from such institutions as the California Institute of Technology, Colorado State University and the Electric Power Research Institute.

SCCCAMP has so far consisted of a planning phase and the field study, which was conducted from September 3 to October 6, 1985. The field-study data are now being collected from the various consulting companies that participated.

By 1987, the SCCCAMP data will be compiled in a master data archive, which will then be available to the study's participants, as well as to the public, for various planning applications.

"Unocal and the other oil companies participating in SCCCAMP would like to see the data used to develop a computerized, mathematical model which could simulate the region's atmospheric conditions," says Chaplin. Such a model could be used for two primary purposes: to determine the impact of current offshore oil and gas operations on the quality of onshore air, and to predict the impact of future expanded offshore operations.

"There are much more stringent requirements for building a model than for implementing it," says Dr. Walt Dabberdt, SCCCAMP's technical director. "It's something like building a car. You need lots of special equipment and expertise to design the car. It must be able to handle curves, upgrades, braking situations, and other circumstances. But once it does those things, you only need a competent driver and the proper fuel."

The SCCCAMP field-study team used many sophisticated technologies to collect massive amounts of detailed information about wind speed and direction, turbulence, temperature, humidity, solar radiation levels, and the concentration of pollutants in the air. It was important to include a variety of weather regimes, so that any subsequent model would have a broad enough data base to simulate meteorology and atmospheric chemistry accurately.

Since SCCCAMP's objective is a better understanding of air quality problems, the field study was scheduled for a time when episodes of high air pollution levels could be expected to occur frequently. "We analyzed 10 years worth of pollution reports to determine that September was the worst month for air pollution in the area," says Dabberdt.

The weather did not cooperate—which was no particular surprise to the people who study it—and September 1985 turned out to have unusually good air quality. Even so, by the end of the field study, enough episodes of air pollution had occurred to satisfy the SCCCAMP data-collection efforts.

What were the SCCCAMP researchers looking for? Primarily, the movement of NOx, ROG and ozone in the air basin. These are only three of many air pollutants, but they are the focus of the current problems.

NOx are oxides of nitrogen formed by the combustion of fossil fuels, as in gasoline engines and power plants. ROG, reactive organic gases, are unburned hydrocarbons which escape from a number of sources, particularly motor vehicles. Sources offshore include oil and gas drilling platforms, tankers, storage tanks, helicopters, crew boats, and natural hydrocarbon seeps.

(The south-central section of the California coastline is dotted with more than 20 close-to-shore areas of oil and gas seepage from naturally occurring openings in the ocean floor. Seep emissions may be a significant source of ROG in the study area.)

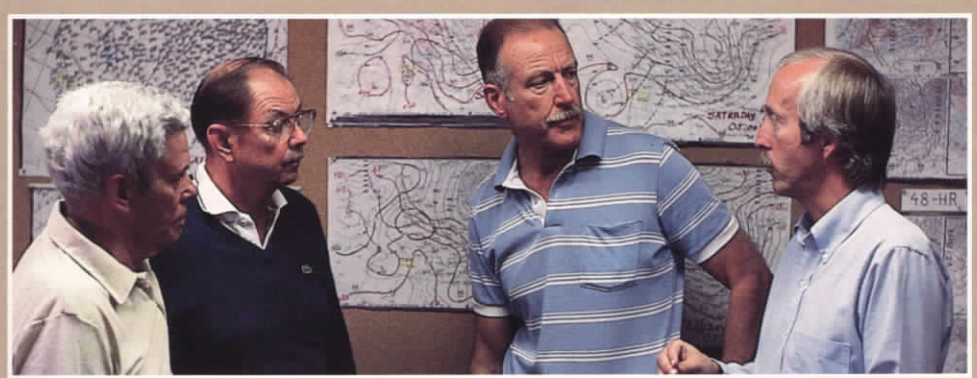
If NOx and ROG come together in high enough concentrations in the presence of sunlight, they form photochemical oxidants. One such oxidant is ozone, which burns your eyes and smells bad. Another is NO_2, which can cause shortness of breath. NO_2, which is brown in color, also contributes to reduced visibility. So, the SCCCAMP research was aimed at discovering if NOx and ROG emissions from offshore operations are carried inland to add to onshore concentrations of ozone and NO_2.

It is a much more complex problem than it might at first appear to be. "The atmosphere is random and turbulent," says Dabberdt. "Air is fluid with many of the same characteristics as water. But, its movements are much more complicated."

Since air is less dense than water, it heats and cools faster. Changes in air temperature can have dramatic consequences (thunderstorms, for example). Pollutants move with the air, but there is no universal formula to describe how different pollutants are distributed and mixed in the ever-changing atmosphere.

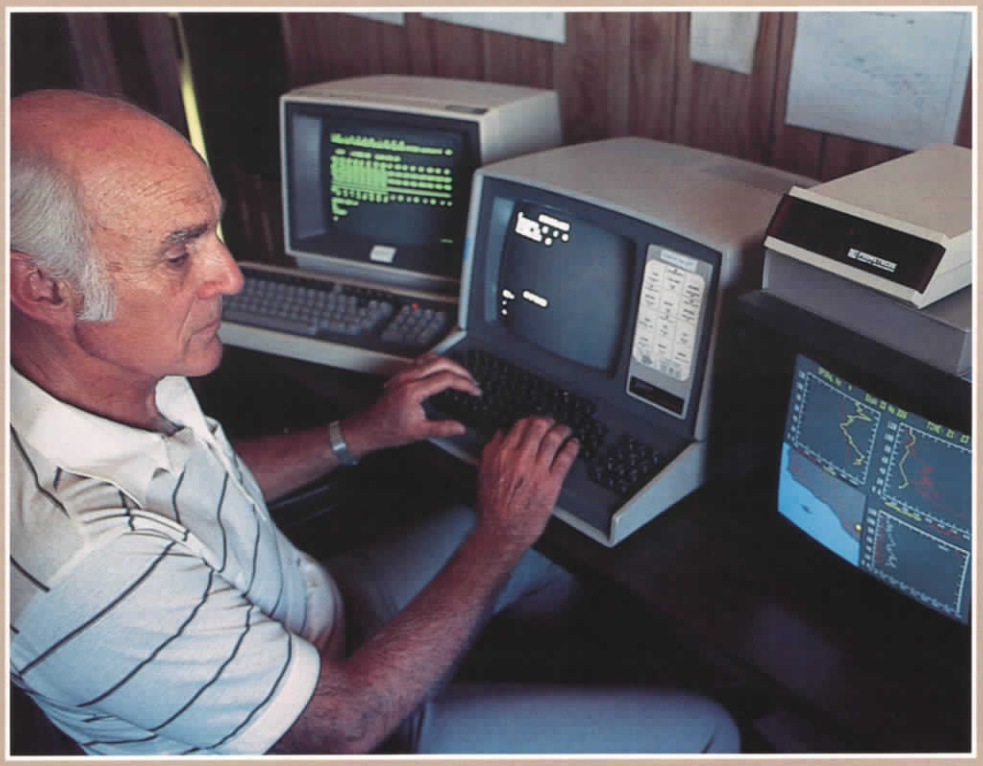
In the SCCCAMP study area, the wind is affected by many factors—such as the terrain. The wind sweeps across the flat ocean surface and coastal plains, only to change speed and direction when it encounters cities, mountains, valleys and other features on land.

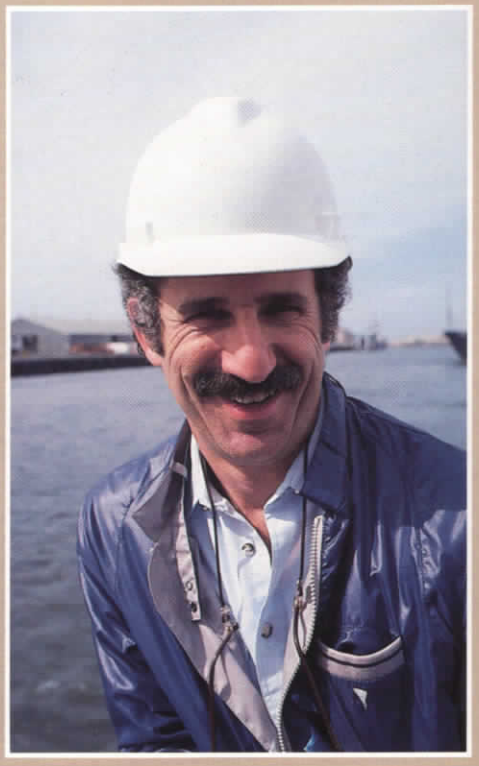
Temperature also affects air movement. The air heats up or cools down, depending on the amount of heat radiated from the surface below it. For example, daily land-sea breezes are formed as a result of the strong contrast between the temperature of the channel waters and the land surface. These breezes are influenced as the land temperature responds to the rising and setting of the sun.



Top and bottom, the Doppler acoustic sounding system on Gina is dismantled and loaded onto the supply boat at the end of the SCCCAMP field study.

Center, from left, Dr. Ted Smith and Dr. Einer Hovind, consultant meteorologists, William Viezee of SRI International, and Dr. Walt Dabberdt discuss the weather forecast to help plan SCCCAMP activities.





Center right, Anton Chaplin, Unocal's SCCCAMP representative.
Right, the study used airplanes and ground-based radar to collect data during episodes of heavy air pollution. Top, flight coordinator Al Schanot of the National Center for Atmospheric Research.
Above, Roy Endlich, senior research meteorologist with SRI International, combines different types of weather data using the GENASYS computer system.

In the south-central coastal region, three types of daily weather conditions (or "meteorological regimes") commonly contribute to increased onshore levels of air pollutants. One regime involves a strong-to-moderate wind flow from sea to land. The second is just the reverse. The third is general air-mass stagnation.

In the study area, the ground-level layer of air varies in thickness from a few hundred to 3,000 feet. Above this, shallow, very stable layers called "inversions" are typical. These inversion layers act like a lid, trapping air pollution close to the ground.

In the warm summer and early fall seasons particularly, the stagnation regime can lead to severe air pollution problems. Concentrations of pollutants, including NOx and ROG, build up to form ozone and other irritants. This is the same phenomenon, known as "photochemical smog," that makes eyes water during the summer months in Los Angeles, located about 100 miles down the coast from Santa Barbara.

Dabberdt directed the five-week field study from a trailer office at the Camarillo Airport. Data were collected around-the-clock from more than 100 stations—both on and offshore—throughout the study area. Measurements were taken as far south as Los Angeles to account for the possibility of that city's well-known air pollution moving north.

Existing data-collection stations operated by various government and private agencies were used, and where necessary, temporary stations were set up to accommodate SCCCAMP's needs. Channel buoys, an air-sensing balloon station, and the research vessel *Acania* also contributed to the effort.

Two of 12 Doppler acoustic sounding systems used in the SCCCAMP field study were installed on Unocal's Platforms Gina and "C." The "sounder" is a remote-sensing device that operates something like radar. It sends out sound pulses and measures the frequency shift of returning echoes. Shifts in frequency occur as the pulses encounter slight variations in temperature where the air is moving.

"The sound pulses go out in three directions, so you can triangulate to determine wind speed and direction," notes Chaplin. The system also identifies wind shear and turbulence, and is effective up to a height of 2,000 feet.

Platform Gina also accommodated a small trailer full of sensing and analytical equipment to measure atmospheric pollutants. A mast was erected above the trailer to measure wind speed and direction. Instrumentation on the roof of the trailer measured ultraviolet radiation and relative humidity.

During episodes of heavy air pollution, SCCCAMP made additional data-collection efforts using ground-based Doppler radar stations and six specially equipped airplanes.

Much of the ground-station data were transmitted throughout each day to SCCCAMP's field-study headquarters. Airplane data were recorded on floppy disks, which were received at headquarters usually within 45 minutes of a flight.

This information was integrated by a computer facility, called the Graphical Environmental Analysis System (GENASYS), developed at SRI International. It allowed the SCCCAMP team to monitor data collection and make adjustments if instruments were failing or unexpected circumstances were encountered. GENASYS also provided up-to-the-minute reports that helped the SCCCAMP team make forecasts and schedule the research flights.

"Ten years ago—without microcomputers—it would have taken months to review the data we can now analyze automatically in the space of a few hours," notes Chaplin.

The task of editing and verifying the data from the SCCCAMP field study is now being completed. This involves checking instrument calibrations and removing invalid data. For example, if an airplane banks to make a turn during a data-collection flight, the movement may throw off the equipment readings and invalidate some of the data.

Meanwhile, the U.S. Minerals Management Service has requested proposals for compilation of SCCCAMP's master data archive. In this archive, funded by the MMS, all the data collected by the different research groups who participated in the SCCCAMP field study will be brought together and reorganized into a comprehensive data base. Data will be regrouped according to date, time and location of collection. Further analysis will identify basic patterns in the information. The data will be public.

When the analysis is complete, SCCCAMP will have created the most comprehensive body of information yet available about the weather regimes, atmospheric chemistry and components of air pollution in California's south-central coast region. This will help planners determine current sources of air pollution and understand the probable effects of expanded offshore oil and gas operations.

"Then," says Jerry Wasicek, "maybe all the parties involved can sit down together and do something productive about California OCS development and onshore air quality." *B.P.* ⑯

Budding engineers get a corporate boost.

Unocal's Tim Wusz (foreground) and faculty advisor Dr. Donald Remer help students apply classroom knowledge to hands-on engineering work.

During a break between classes at Harvey Mudd College, Lori Wildhorn stops by the machine shop to see her team's project—a brightly painted automobile engine with sections cut away to show its inner workings. Wildhorn and two other engineering students are modifying the engine as part of a special assignment. As she inspects the machinery, touching its roughened edges, Wildhorn knows much work lies ahead. But she feels proud of what the team has already accomplished. Her T-shirt's message sums it up: "It's hard to be humble when you're the best."

Wildhorn and teammates Scott Cameron and Chris Donnelly have good reason to be proud. This year, as part of Harvey Mudd's Engineering Clinic Program, they are getting first-hand experience in becoming professional engineers.

Located 35 miles east of Los Angeles, California, Harvey Mudd College is the science and engineering school of the Claremont system's six colleges. Unocal is one of many firms and agencies that provides technical assistance and financial support to the school's clinic program. The companies specify a project in electrical, mechanical or chemical engineering, then provide materials for the task. Students provide the work—and get to experience the real-life challenges of their chosen career.

"We think the clinics are quite worthwhile," states Tim Wusz, an engineering associate for product evaluation at Unocal Science & Technology Division in Brea, located about 20 miles south of the college. "Helping students like this is a great way to contribute to their education."

Senior Lori Wildhorn plans to become a mechanical engineer in design and manufacturing. Clinic students are required to combine mechanical know-how with mathematical modeling, computer simulation, cost-benefit analysis and other technical skills.

As the liaison between Unocal and its clinic team, Wusz has assisted Wildhorn, Cameron and Donnelly since the project began last September, meeting with them regularly to check on progress and help with technical problems. "This is the first time many of these students have worked on a project for outside firms," he notes. "Here, they're part of a team working with a corporate representative, giving presentations, making written reports and completing an assignment—all of which simulate an industrial experience."

Dr. Rich Phillips, an engineering professor, works to make that experience rewarding. As director of the clinic program, he seeks to involve diverse organizations that can offer projects which will not only expand students' technical skills but appeal to their curiosity as well. When tackling projects they like, says Phillips, students learn more and work harder. "The crucial part of the program is that students are working on real industrial projects."

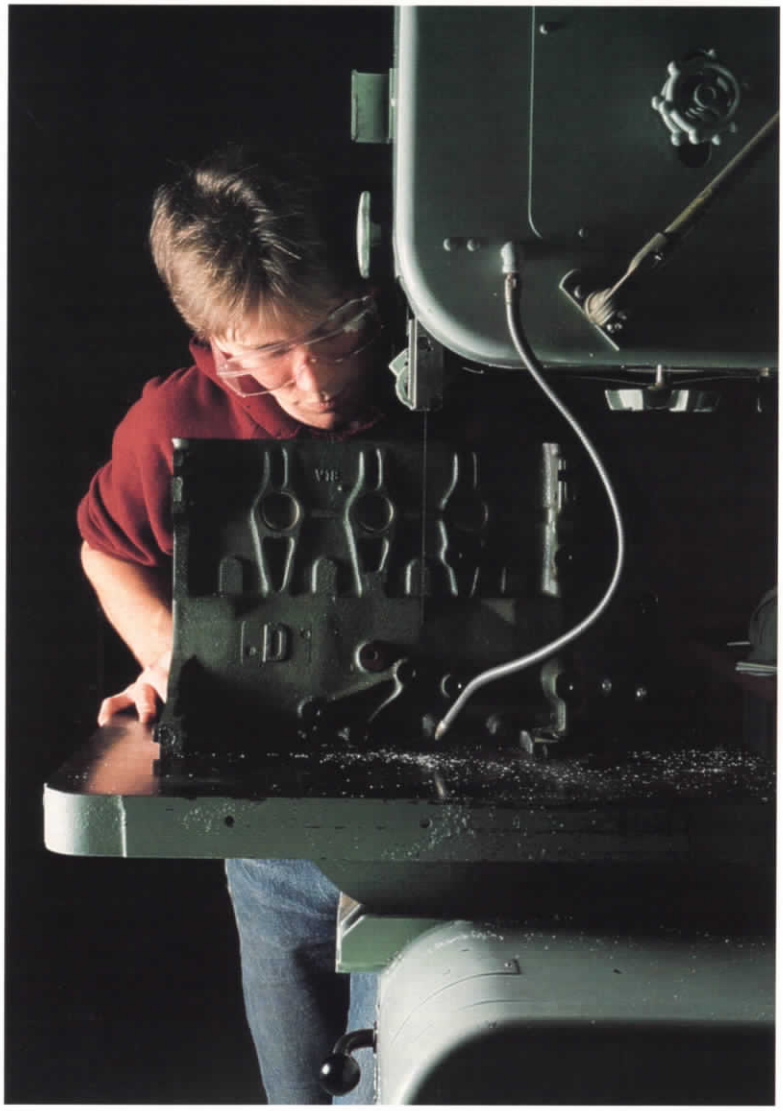
This kind of hands-on student involvement is what the college's administrators had in mind when implementing their unique program in 1963. Today, more than half of Harvey Mudd's 550 students are engineering majors. They will take part in the clinic program as juniors, seniors and graduate students. At the beginning of the semester, students select a clinic offered by a variety of business sponsors, then form work teams. Next they meet with company liaisons to learn more about the assignment. Before any work can begin, students must give the liaison a full written proposal to show they understand the project's requirements.

This year, Unocal's clinic team has taken on a rather unique problem in mechanical engineering—the "unmaking" of an engine. Wildhorn, Cameron and Donnelly are modifying two automobile engines—an eight-cylinder Chevy and a four-cylinder Volkswagen diesel—so that they can be used to help Unocal marketing representatives sharpen their knowledge of actual automotive functions.

The students are cutting out surface sections of the engines to expose the parts inside. Portions of the engine are being painted different colors for easier identification. "The models are designed to show how an engine works," explains Wusz. "Our trainees will see how parts move during normal engine operation."

Student projects have ranged from improving security systems at nuclear waste storage facilities to upgrading a pasteurization process for packaged beer.

Chris Donnelly carefully cuts through the engine block using a band saw. "The clinic's a great experience. You definitely have to keep up your end of the job."



"Each of us has an area of expertise, which makes problem solving easier."

Compared to other student clinics involving computers and electronics, this project may seem a bit elementary. It isn't. "Designing an engine to operate with parts of it cut away is no easy task," says Dr. Donald Remer, the team's faculty advisor. "Engines weren't made to work like that. It involves a lot of mechanical study."

Students faced special problems, for instance, when first sawing through the engine block. When portions of the cast-iron structure were cut away, the internal stress was reduced, causing alignment problems within the engine block.

"The electrical system was another consideration," recalls Donnelly. "We had to adapt the electric motor to turn at the right speed with the proper amount of power to drive the engine. The engine has to operate slowly enough so people can see the pistons, valves and other parts at work."

Not every problem clinic teams encounter has a tidy solution. "These aren't 'textbook' problems which can always be solved," states Dr. Kenneth Baker, president of Harvey Mudd College. "These are real projects from industry and some of them won't have solutions. But students who start to work on a project one way, then find they have to approach it differently, learn something as well."

Although Unocal's team has not run into any unsolvable problems, Wildhorn, Cameron and Donnelly are constantly battling another real-life industry challenge—lack of time. They carry full course loads and work part-time jobs in addition to spending 10 to 30 hours a week on clinic work.

Scott Cameron (below) and his teammates work long hours to make the project a success. Tightening bolts, smoothing rough edges and color-coding engine parts (left) are among the many tasks required in transforming a standard car engine into a cutaway model.

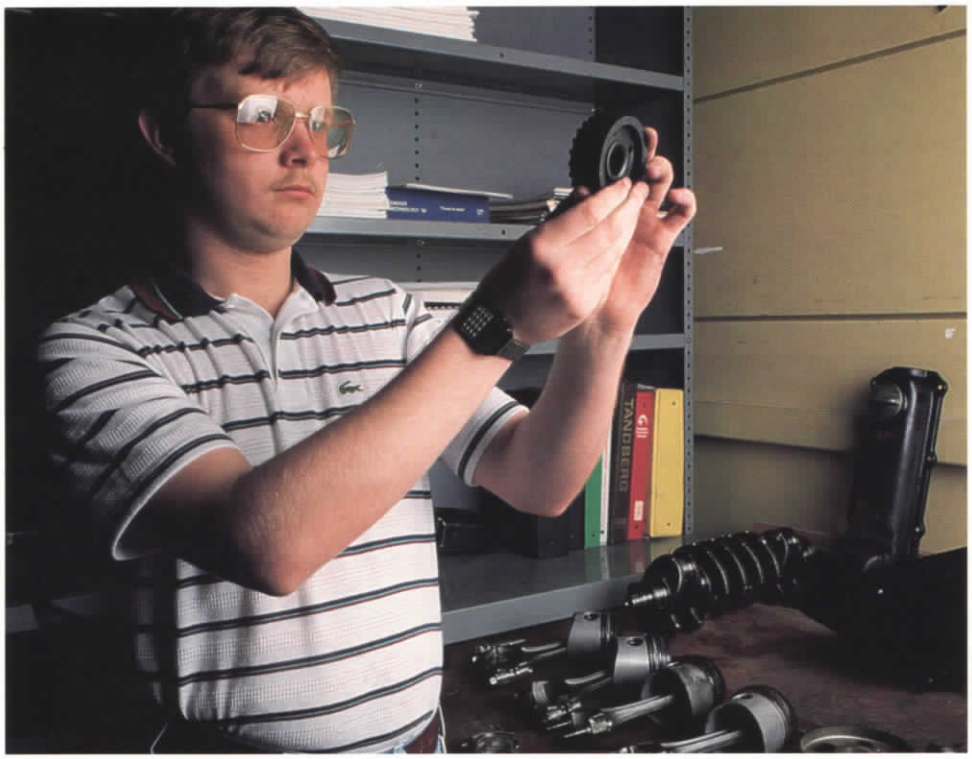
All projects, begun in September, must be finished by late April for the team's participation in Projects Day, the annual grand finale where some 300 business professionals visit the campus to view the results of the students' efforts. Meeting that deadline, despite the unexpected setbacks that sometimes occur, can create a lot of pressure.

"Time is a monster," quips Cameron. "Our biggest concern is managing it effectively."

Although the students count on assistance from their faculty advisor and business liaison, their most important support comes from each other. "Each of us has an area of expertise, which makes problem solving easier," Cameron points out. "For instance, Lori has a good metal shop background and Chris knows engines and has mechanical engineering experience. I've worked in electrical power engineering. It's important that we share our different points of view."

Remer agrees. "For a company like Unocal, you have to know how to work as a team."

Students also refine individual skills, such as public speaking. Each student is required to give various presentations on clinic projects both on and off campus. Last fall, Wildhorn, Cameron and Donnelly visited products research personnel at Unocal's Science & Technology Division to report on their work techniques, problems and progress on the project. "We got feedback from the audience, which gave us new ideas on handling the project," explains Donnelly. "It was also was a chance for us to get used to working within a company."



The sense of professionalism that students gain often has other far-reaching effects. Says Phillips: "The projects give students a concrete experience to talk about during a job interview—which is a whole lot different than discussing a grade-point average.

"The clinic also develops attitudes and skills that help students practice good engineering. There's a great maturation process that transforms young men and women into people ready to become professional engineers." *A.B.* ⑯

"Time is a monster; our biggest concern is managing it effectively."

A NEW WAY OF DOING BUSINESS

Quality is a word that's been bandied about quite freely of late. Indeed, these days the term is so loosely applied that many dismiss "quality talk" as nothing but empty hype.

Not so at Unocal Chemicals Division's Petrochemical Group, which manufactures and markets a wide variety of solvents, polymers, specialty chemicals and services.

"Quality is without a doubt one of the most important issues facing American industry today," says Nick Lynam, senior vice president, Petrochemical Group. "Customers are demanding it—in products, in services, in all aspects of business dealings. To meet this challenge we must produce demonstrably better products and services than those offered by our competition. Our customers and employees must recognize that our dedication to quality will not be compromised."

Indeed, quality is far from an empty concept around the Petrochemical Group offices, plants, and distribution centers. The Schaumburg-based group, which employs 900 people at 30 locations throughout the country, is now in the third year of an organization-wide Quality Improvement Process.

"The focus of this effort is not confined solely to manufacturing," Lynam says. "It encompasses every segment and all levels of our business—from product sales and customer service to management methods and individual job performance."

"The Quality Improvement Process is our prescription for success," says Nick Lynam, senior vice president, Petrochemical Group. Right, Schaumburg staff personnel (from left) Mike Brennan, Kay Bellew, Mary Lou Deuchler, Mark Alexander and Barbara Marinaro affix their signatures to an oversize representation of the Quality Policy kept on display in the office lobby.

The impetus for the Quality Improvement Process (QIP) came out of a growing awareness among Petrochemical Group management that the issue of quality was becoming paramount in all industries. After conferring with customers and employees about their needs and concerns, Lynam and his staff decided that quality improvement should be addressed in a structured, visible way.

"Concern for quality in people and products has always existed in our organization," Lynam explains. "But a well-defined quality policy was something that could only strengthen us in the marketplace. And that strength is mandatory to ensure our long-term survival and success."

"We weren't looking to institute a vague, short-term type of program," adds Lee Dodgion, vice president of manufacturing and quality. "We wanted a more focused approach—a quality process that would be ongoing and permanent, and that would involve employees at all levels of the organization."

Just such an approach was found in the ideas of Phillip B. Crosby, an author, consultant and former ITT executive who is widely regarded as the "Father of Quality." In November of 1983, Lynam and his 11-member executive staff attended a three-day seminar at Crosby's Quality College in Winter Park, Florida.

"Crosby made us all aware of the positive results that a quality improvement effort could yield," says Herb Pomerantz, general manager of the Petrochemical Group's APTECH division. Among the benefits would be improved efficiency and productivity, reduced costs, better communication, and heightened customer satisfaction.

Inaugurated in early 1984, the Quality Improvement Process adapted many of Crosby's theories to the specific needs and goals of the Petrochemical Group. To underscore its commitment to the QIP, the executive staff meets at least twice a month and is charged with directing the overall QIP. This guarantees top management involvement, which is the first requirement of any quality process.

As one of its first actions, the Council drafted an official Quality Policy. "The Petrochemical Group is committed to providing quality products and service," the statement reads. "Quality is defined as *conformance to requirements,* ours as well as our customers'. Quality is a responsibility shared by employees at all levels of the organization. It is a *team* effort. We challenge ourselves to meet our goal: 'Do it right the first time, every time.'"

The QIP got into high gear in May of 1984, when Jane Faustyn was appointed as full-time Quality Administrator. Faustyn's initial responsibility was to implement a quality training class for all Petrochemical Group employees. The one-day class—which has now been presented to all 900 employees in small groups—is an intensive session involving lecture, discussion, and role-playing exercises.

"The overall thrust is on quality awareness," Faustyn says. "More than anything else, our QIP encourages a new attitude on the part of every employee—a willingness to challenge established methods of operation. This extends from the ways we operate on the job to the ways we communicate and deal with problems."


Quality Polic

Above, Quality Administrator Jane Faustyn conducts a quality training seminar. All 900 Petrochemical Group employees have gone through the intensive, day-long session. At right, Nick Lynam videotapes a message to Petrochemical Group employees. Videos focusing on the QIP are one of several communications tools employed to help maintain "quality awareness."

Underpinning this change in attitude is a new interpretation of what quality performance means, drawn from Phillip Crosby's theories. Briefly, it boils quality performance down to four *absolutes:* conformance to requirements, measuring the cost of quality, preventing errors, and adopting a "zero-defects" standard.

The first of these, conformance to requirements, serves as a new definition for the word quality. "Conventional definitions of quality are very abstract and imprecise," Faustyn explains. "But re-defining it as conformance to requirements transforms quality into a more concrete, manageable concept."

Under the new definition, quality performance means determining the specific requirements of a task—be it a manufacturing process, a sales order, or a job function—and then meeting those requirements exactly. Non-conformance can result from not clearly defining the requirements or an inability to meet them as defined. Non-conformance also carries a built-in cost: the time, effort and expense required to re-do the task correctly. This is referred to as the "cost of quality."

Measuring this cost of quality (COQ) is the second quality absolute. Through use of logs and charts, employees are encouraged to keep track of non-conformance in various tasks—everything from billing errors and delivery delays to off-spec product batches and incorrect sales orders. These costs can then be translated into dollars and cents—a tangible, bottom-line measurement that everyone can understand.

The expense of non-conformance is much more substantial than one would expect, Faustyn points out. "Even little things like paper work errors have a cost—and those costs add up quickly in a large organization," she says. "In fact, COQ is typically 10 to 20 percent of a company's total revenues. And these are all expenses that can be eliminated if the tasks are done right the first time."

In addition to providing a means of identifying and placing a cost on non-conformance, measuring non-conforming actions also allows employees to set targets for improvement and to chart progress. "Charting is an excellent tool for getting a handle on problem areas," says Marty Hurlich, west coast operations manager. "It helps you see both where you are and where you're heading."

The other two quality absolutes—error prevention and adopting a zero-defects standard—are closely linked. "Basically, our QIP rejects the belief that errors are inherent in our business," Lynam explains. "We no longer budget for errors. Instead, we're working to prevent them at every phase of our operations, with the ultimate goal of attaining zero defects."

Lynam admits that this objective is quite ambitious. "But that's what the quality improvement process is really all about—challenging ourselves by setting tough goals and changing the way we operate."

Two of the most significant changes brought about by the QIP have come in the areas of organizational communication and problem-solving. Over 40 Quality Improvement Teams (QITs) have been set up at different Petrochemical Group locations. Composed of employees from each level of the location's work force, the QITs—which meet weekly—serve as a mechanism for communicating ideas on quality improvement and addressing problems. Employees are encouraged to contribute their input and become part of the decision-making process.

"A lot of problems have been buried for years—either pushed aside, or accepted as part of doing business—simply because there was no mechanism for dealing with them," says Jane Faustyn. "The QITs, which serve that function, have helped bring some of these institutionalized problems to the surface. They're a great communication tool."

"The QITs were not set up to actually solve problems," adds Lee Dodgion. "But they do allow employees to air them out, and decide how and where they can best be attacked. Our goal is to address the root causes of problems rather than merely band-aid the symptoms."

At some locations, employees have begun using special Error Cause Removal forms (ECRs) to report problem areas to the Quality Improvement Teams. The forms, which any employee may submit, boil down problems to a simple question: what is preventing you from doing your job effectively?

"The key to making the QIT system work lies in keeping a dialogue flowing," says Rob Baldwin, superintendent of the La Mirada polymers plant, whose QIT has handled more than 200 ECRs in the past year alone. "If someone takes the trouble to identify a problem, that problem deserves to be taken seriously—no matter how small it may seem."

Knowing they will get a response makes workers at all levels more willing to come forward, Baldwin says—both with problems and suggestions for solving them. And when everyone is combining their input, solutions are a lot easier to find.

"It's important to emphasize that this is not just a program for managers," Baldwin adds. "Every employee is involved, from the top on down. The people who actually do a job are the ones who know that job best, and they've come up with many unique ideas. Often we'll find that a simple change of procedure can eliminate a problem that we may have lived with for years."

An example of such a case involves a problem that has occasionally beset the shipping departments of several plants: customer complaints of frozen product deliveries in the winter months.

"This was a problem that was easy to ignore, because it would always disappear each spring," says Fred Bartholomew, general manager of polymer marketing. "But one of the QITs explored it, and found that many of these cases involved Friday deliveries. Our drivers discovered that drums of product were simply being left sitting outside on loading docks over the weekend, and they'd freeze up."

The upshot: shipments were rescheduled when possible to avoid Friday arrivals. "Here was something very easy to correct," Bartholomew points out, "but it had never been seriously looked into before."

The Newark, California polymers plant provides another example of a QIT successfully attacking a problem. One of the plant's products is a polymer used by customers in making envelope glues. Sales representatives had been receiving occasional complaints about black specks turning up in the product, and the cause of the specks was not clear. The immediate solution was to filter the product before shipment—a process which was both costly and time-consuming.

The Newark QIT addressed this problem, and learned from plant workers that specks were sometimes found in one of the raw materials used in making the product. One of the workers had an idea: why not isolate this raw material and filter it alone before making the product?

"This not only solved the black speck problem, it saves us a lot of time and money," Marty Hurlich says. "The raw material is easier to filter, and we don't have to filter nearly as much material."

There are many other examples of QIT successes, both large and small. And the heightened attention to quality job performance—at all levels—has helped improve overall efficiency by encouraging a freer flow of ideas.

"In the past, we had a very uneven response to problems here," says Paul Pfeifer, quality control supervisor at the La Mirada polymers plant. "We'd put out fires only to have them erupt again. But the Quality Process has made everyone more aware, from the operations manager to the guy sweeping up. We're all trying to anticipate rather than react to problems."

"The essence of our Quality Process involves a transformation in culture and attitude," says Nick Lynam. "That's not easy. It's a long-term evolution, still in the early stages. But it's steadily intensifying.

"When I'm asked by people inside and outside our company what priority I put on quality relative to other projects, I simply state that quality is like air. Whatever activity an individual performs, he or she must breathe air. Likewise, we must perform all our activities in a quality manner."

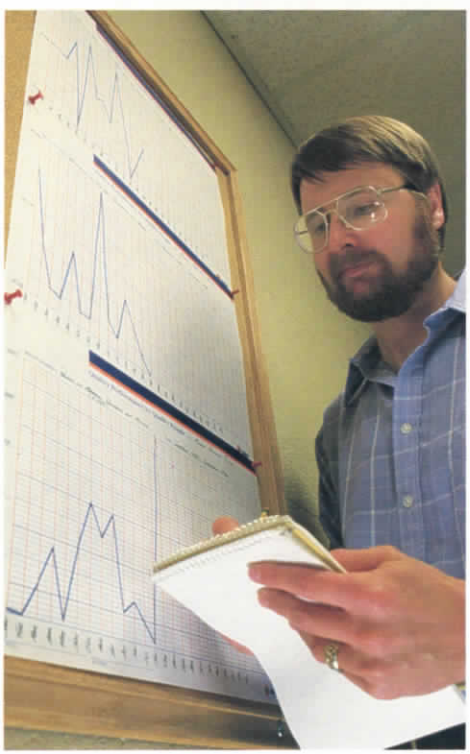
One of the keys to the QIP's continued success lies in keeping the process both fresh and challenging. Videos focusing on the QIP are circulated, contests are held, and every location has plans for a Quality Commitment Day. This past January, all Petrochemical Group managers gathered in Schaumburg for a three-day QIP conference. Current progress at the different locations was detailed, ideas were exchanged, and workshops were held in topics ranging from problem-solving techniques to conducting effective meetings.

What does the future hold for the QIP? In the next phase, Quality Improvement Teams will focus on addressing the "Cost of Quality" areas that employees have monitored. Special "Corrective Action Teams" will also be set up at various locations to attack the root causes of problems that can't be more easily solved.

Further down the road, Petrochemical Group plants are planning to implement a new quality control system called Statistical Process Control (SPC). The system uses computers to statistically monitor manufacturing processes, assuring that products meet all requirements and specifications. SPC is already being tested in some plants, and the polymer manufacturing group plans to have the system in place in all six of its plants in the coming year.

But the Quality Improvement Process will not end here. "Once the QIP is fully ingrained in our organization, the final step is to 'do it all again,'" Faustyn explains. "We'll reaffirm our commitment, look for new quality improvement opportunities, and establish new goals. The process never really ends, and that's its true strength."

Nick Lynam agrees. "Quality is our prescription for success," he says. "It is a commitment to the future with the accent on our people resources. Our vision is of an organization that excels in its chosen products, services and markets. We want to position ourselves as *the* premier supplier of quality products and services." *T.S.*



Left, Paul Pfeifer, quality control supervisor at the La Mirada polymers plant, measures the "cost of quality" by charting non-conformance. Top, Phil LaGrand, driver, and Rudy Villegas, master mechanic, display their "quality" patches. Above, a view of the plant's control room. "Every employee is involved, from the top on down."

So, you want to be a Dodger...

Dodgertown, the spring training home of the Los Angeles Dodgers, has been described as "baseball heaven." Located in Vero Beach, Florida, the 450-acre facility boasts three practice fields, batting cages, sliding pits, a health club, a 6,000-seat stadium, and housing for up to 180 players. The Dodgers—whom Unocal has sponsored for the past 27 years—have trained here each spring since 1948.

In recent years, Dodgertown has also hosted several adult baseball camps. During these week-long sessions, "civilians" can experience the identical spring training routine that the Dodger players go through.

Because of the Unocal's long-standing association with the Dodgers, the club felt that *Seventy Six* readers would enjoy an inside look at what baseball spring training—Dodger style—is like. Last February, *Seventy Six* magazine associate editor Tim Smight was invited by the team to dig out his baseball glove and participate in what was billed as the "Ultimate Adult Baseball Camp." His report follows.

DAY ONE:

"Welcome to Vero Beach"

The clubhouse at Dodgertown was much larger than I'd expected. Inside the front door, a set of gleaming Nautilus machines gave way to row after row of open cubicles—each hung with a bright white Dodger uniform. The aromas of hot towels, shaving cream and new baseballs mingled with the pungent smell of rubbing alcohol emanating from the nearby trainer's room. It wasn't yet 8 a.m., but already the place was alive with activity.

There were 64 of us enrolled in camp, our ages ranging from late 20s to early 60s. In the outside world we held a variety of occupations. But for the next five days, all of us would be baseball players.

We would keep the same schedule the Dodgers follow in spring training, with workouts, instruction, and drills in the morning followed by intersquad games each afternoon. We would eat meals identical to those served the Dodgers, and have our bodies administered to by the Dodger training staff. Evenings would be taken up with lectures and discussion, and we'd close out the week by playing a game against our instructors.

Those instructors would be some of the best ever to play the game. All 16 were members of baseball's Hall of Fame—among them such legendary Dodger greats as Sandy Koufax, Pee Wee Reese, Roy Campanella, Don Drysdale, Duke Snider and Hoyt Wilhelm. Other Hall-of-Famers on the staff included Ernie Banks, Lou Brock, Frank Robinson, Al Kaline, Bob Feller and Bob Gibson.

I found my locker, its uniform beckoning. Nearby, Pee Wee Reese and Duke Snider were suiting up. "These guys were my heros," whispered camper Arnie Weitz, lacing up his spikes across from me. "I've been pinching myself all morning."

Left, Duke Snider tutors a hitter on the batting tee. Facing page, from top: morning stretching, Pee Wee Reese spins a yarn, the Hall-of-Famers are introduced before the big game.

At 9:15 we assembled on the field at Holman Stadium, where Dodger head trainer Bill Buhler led us in an intensive half-hour session of jogging, stretching and warm-up exercises. This would be a morning ritual each day of camp. "Stretching is extremely important in helping prevent injuries," Buhler emphasized. "Get used to doing it every day."

At 9:45, instruction got underway. The drills were meticulously planned. Split up into small groups, we would rotate among various stations throughout the complex. Every thirty minutes an airhorn would sound, signaling us to move on.

As an outfielder, my first two hours of activity involved fielding instruction. Twelve of us gathered on one of the practice diamonds with instructors Lou Brock, Al Kaline, Duke Snider and Frank Robinson.

"Let's start out by shagging a few flies," Snider said. An odd-looking machine set up at second base began dispensing a succession of towering fly balls. We took turns fielding them, under the watchful eyes of our instructors. The outfield seemed immense, the ball a tiny speck. I wondered how the pros made it look so easy.

"One important thing to remember is to stay on your toes out here," Kaline told us. "Running flat-footed jars your head, and that makes the ball much tougher to track."

At the next horn, we split up into smaller groups to practice charging the ball, throwing, and fielding grounders and line drives. By 11:45, when we broke to head for the batting cages, I was drenched with perspiration. But I'd learned a heck of a lot about playing outfield.

Each of the eight batting cages sported a pitching machine that served up fastballs, curves and occasional knucklers. Stepping up to bat, I was a little uneasy. I hadn't faced fast pitching in years, and these machines were hurling baseballs at 80-plus miles per hour. I let the first two pitches whistle by; they seemed incredibly fast. I shuddered to think of what facing 90-m.p.h. fireballers like Dwight Gooden or Nolan Ryan must be like.

Feeling awkward, I swung at and missed five pitches in a row. "Keep your eye on the ball and your head steady," said Frank Robinson, watching me from behind the cage. I flailed at three more balls before finally hitting one.

After lunch we split up into four squads, each with three instructors as coaches. Each team—named after one of the Dodgers' farm clubs—would play the others twice in a six-game "season." My team, Vero Beach, boasted a pretty impressive coaching staff. Robin Roberts, our manager, had racked up 286 wins during a stellar pitching career. Our third base coach was Pee Wee Reese, captain of the great Dodger teams of the '40s and '50s. Lou Brock, baseball's all-time leading base stealer, completed the staff.

"Boys, I really want to win this thing," Roberts said. "I've got just one sign that I want you all to learn." The sign was a clenched fist. Its meaning, roughly translated, was "play hard." But not exactly in those words.

Our first game was against the Bakersfield team, coached by Warren Spahn, Harmon Killebrew and Bob Gibson. We got off to a surprisingly good start, moving out to a 12-4 lead by the fifth inning. But disaster struck late in the game. Aided by our woeful defense, Bakersfield blasted us for eight runs in the final innings. The game ended in a 12-12 tie. (Due to a time limit on games, no extra innings were played.)I did horrendously at the plate, going hitless and striking out twice. I also committed a costly error in the outfield.

"Guys, we really choked out there," Roberts told us after the game. "I want everyone to get to bed early tonight. And no carousing."

Left, from top: Dodger greats Sandy Koufax (center) and Don Drysdale in the dugout, Lou Brock demonstrates his sliding technique, lunch time in the clubhouse. Facing page, Roy Campanella chats with a fan.

DAY TWO:

"The Agony of Defeat"

Today's instruction began with a base running clinic taught by Lou Brock. His scientific discussion of the physics of body motion was fascinating. "If we only had Brock's speed, we'd be all set," commented teammate Reid Cherner, our catcher.

Next was live batting practice, with Dodger pitching coach Dave Wallace throwing. As in the cages yesterday, I swung and missed repeatedly, getting more discouraged by the minute.

"You've got to relax up there," said Roy Campanella, watching me take my cuts. "Wait for the ball to come to you, then let the bat do the work."

Later, at the batting cages, Pee Wee Reese took me over to Duke Snider, who was tutoring hitters using a batting tee. For the next 15 minutes, Snider worked intently with me to correct my errant swing. "You've got a good stance, but you're turning your head and uppercutting when you swing," he said. "Concentrate on leveling it out."

One after another, I swung at balls that Duke placed on the tee. Before long I began to get the rhythm and feel of hitting a baseball squarely.

"Duke, I've got one question," I said when we'd finished. "Can I use this tee in the game?"

This afternoon's opponent was the Albuquerque squad, who'd won their game handily the day before. Managed by Don Drysdale, the team was odds-on favorite to win the championship. We soon learned why. They had good hitting, excellent pitching and defense, and a fiery, competitive attitude on the field.

They bombed us, 21-6. Obliterated might be a better word. Despite Duke's tutoring, I went hitless at the plate once again. I had a few good defensive plays in the outfield, but also made two more errors and ran myself ragged. I understood all too well how a struggling rookie must feel.

In the locker room our team was very demoralized—not to mention sweaty, sore, beat-up, dirty and dog-tired. Reese came by, smiling and shaking his head. "Boys, we looked pitiful out there today," he said. "But there's nowhere to go but up."

DAY THREE:

"Turning the Corner"

The training room this morning resembled the M*A*S*H field hospital. Battered bodies were strewn everywhere, and a chorus of groans lilted through the air. Bill Buhler and his two-man staff shuttled among the room's four tables, applying tape, ice, lotions, antiseptics and all manner of bandages to the ailing.

"It's great to come in here and be treated like a million-dollar ballplayer," said camper Alan Richmond, who was taped up like a mummy and covered with bags of ice. "I just wish my body was a little more forgiving."

As Buhler finished tending a blister on my heel, I asked him what the Dodgers' most common spring training ailments were. "The same as with you guys—blisters, muscle pulls, and sore joints," he said. Then he uttered the training room's most common spoken word: "Next."

After our morning stretching exercises, my team assembled for clinics on sliding and rundown plays. Sandy Koufax wandered by to watch, and before long a knot of campers was gathered around him. Tanned and fit at 50 years old, Koufax looked the same as he had in his glory days pitching for the Dodgers in the '60s. The aura he projected was almost tangible.

"We're standing here talking with a living legend," teammate Mike McComsey said. "I feel like a little kid."

We moved on to the batting cages, where I hit three buckets of baseballs—over 100 pitches—swinging until my arms ached. Finally, I was beginning to feel more comfortable at the plate. "You're looking better in there, Timmy," Pee Wee Reese said. "Just keep working at it."

Our game today, with San Antonio, was hard fought from the start. Both teams were winless, and another loss would mean elimination. In my second at bat, with the game tied 6-6, I stroked a fastball to center field for my first base hit. I stole second and then scored on the next play, putting us ahead.

"Way to go, Tim," Lou Brock said, as I trotted back to the dugout, panting. "Now let's hear you whistle."

At the end of seven innings we clung to a 10-8 lead. A cluster of fans was watching now—the Dodgers keep the complex open to the public—and several of them were cheering us on. But in the eighth inning, disaster struck: San Antonio nailed us for eight runs. Now we were down 16-10, and the cellar loomed ahead.

"C'mon, guys, get your heads up," Brock exhorted. "It's not over yet."

He was right. Unbelievably, we rallied to score seven runs and win the game, 17-16. At the season's halfway point, we were still in the race with a record of 1-1-1. We whooped and cheered and jumped around as if we'd just won the World Series.

"It's pretty nice to win, isn't it?" Roberts said, laughing at our antics.

DAY FOUR:

"The Thrill of Victory"

At breakfast this morning, the entire camp was keyed up and eager for the day to get started. After three days here at Dodgertown, we were all beginning to feel like real baseball players. Suiting up in the clubhouse each morning, practicing on the beautifully tended fields, taking our cuts in the batting cages, eating delicious training table meals—all of this was starting to feel amazingly natural.

The team spirit we'd developed was also quite remarkable. Few of us had even met just three short days ago. But sharing the aches and pains, the learning, and the ups and downs of baseball camp, each team had quickly developed a close camaraderie. Our competitiveness was also coming out. All of us, including the instructors, really wanted to win the championship.

Today's schedule called for a doubleheader. If we could win both games, we'd be in great shape heading into the camp's final day. "Today we're going to find out if all this hard work has paid off," Roberts said as we prepared to take the field.

We rose to the occasion, winning the first game against Bakersfield easily, 17-7. Our second game was against league-leading Albuquerque, the squad that had humiliated us two days earlier. But we were a different team now—improved, confident, and brimming with spirit. We whipped them 15-7, completing a sweep of the doubleheader. I had my best day yet, going three for six at the plate and throwing out two runners.

When the dust cleared, we were sitting alone in first place at 3-1-1. "We've gone from oblivion to first place in three days," said teammate Jim Zrake. "Imagine what a six-month season must be like."

Each night after dinner, our instructors have led discussions on various aspects of baseball. Tonight's session, on pitching, was the best yet. Moderator Don Drysdale emphasized that pitchers were a different breed from other ballplayers.

"Most pitchers won't talk to hitters much," he said. "We want to keep an edge." Sandy Koufax agreed, adding that he'd often use psychology on hitters: "I'd try to upset their concentration, keep them wondering what I was going to throw."

"Heck," said Bob Gibson, "I'd just knock 'em down."

DAY FIVE:

"One Brick Shy of a Load"

Suiting up this morning, our team was excited and a little tense. One more victory would give us the championship—but could we pull off four straight wins?

We played San Antonio, who at 1-4 were itching to knock us off. Jittery in the early innings, we couldn't put anything together. They were up 5-0 after four. We rallied in the fifth and sixth to take the lead (I contributed with a triple), but things see-sawed from there. When we came up in the final inning, we trailed by a single run.

"All we need is two more runs for the title," Pee Wee Reese said. "How much do you guys want it?"

We wanted it a lot. But sometimes desire just isn't enough. With runners on second and third, our last two batters struck out, ending the game. We lost in a heartbreaker, 11-10. Meanwhile, Albuquerque was winning in a romp, 18-2. That gave them the championship with a 4-2 record. We finished second at 3-2-1.

"Guys, we gave it a good run," Lou Brock said as we slouched back to the clubhouse. "It's not the end of the world."

"Yeah," someone replied, "but it sure is close."

By mid-afternoon, the sun-drenched stands of Holman Stadium were brimming with over 4,500 fans. They had come to view the week's big finale: our game against the Hall-of-Famers. The contest was scheduled for eight innings, with each of the four squads playing two innings against the instructors. Every camper would get to bat once.

This would be a "fun" game, but the Hall-of-Famers had let us know—in no uncertain terms—that they didn't intend to lose. "During our playing days, we were always looking for a team we could really beat up on," Bob Gibson said one night. "And you guys are it."

Albuquerque played superbly in the first two innings, holding the Hall-of-Famers scoreless. But high-kicking Juan Marichal, on the mound for the instructors, had no trouble disposing of our league champs. In the third inning, it was my team's turn to take the field. As we headed down to the dugout, the stadium erupted in applause. But the clapping wasn't for us. Sandy Koufax was taking the mound.

Warming up, Koufax looked simply awesome. You could almost hear his fastball sizzling. "He looks like he could still pitch in the majors," teammate Tom Riggs commented. Sixteen stomachs fluttered in unison.

Koufax didn't disappoint the crowd. He struck out five of the first eight batters he faced, and retired the other three on weak ground balls. He'd fanned three more by the time my turn at bat finally came in the next inning.

Settling into the batter's box, I tried to relax. But that wasn't easy. There on the mound, staring me down, was one of the greatest pitchers of all time. Koufax shook off two signs, then fired a fastball. It was the hardest pitch I'd seen all week, from man or machine. I swung and just barely got a piece of the ball, fouling it back.

"Level it out, Timmy!" Pee Wee Reese yelled from the dugout.

The second pitch was another fastball, and I swung again. This time I made full contact, hitting a ground ball down the first base line. Ernie Banks scooped it up and easily beat me to the bag. My big moment was history. Robin Roberts, coaching at first, patted me on the back and smiled.

"At least you can say you hit the ball off Koufax," he said. I trotted back to the dugout, glowing.

The instructors went on to rout us, 16-4. Among the highlights were a tremendous homerun by our coach Lou Brock, four strikeouts by 67-year-old Bob Feller, and a picture perfect slide at home plate by Pee Wee Reese. These guys weren't Hall-of-Famers for nothing.

Everyone lingered in the clubhouse for a long while after the game, reluctant to take their uniforms off for the last time. Fleeting as it had been, we'd gone through a season together as real baseball players. We'd discovered just how demanding—and how rewarding—the Dodgers' training regimen is. And each of us had known the thrill of facing a big league pitcher from that lonely batter's box, with thousands of fans watching.

"This week has been a childhood dream come true," said camper Junior Marques, summing up the feeling. "I'm not quite ready to wake up yet." ⑯

Photos by James Norman

Facing page: Pee Wee Reese instructs the Vero Beach team, Sandy Koufax displays his legendary form on the mound. Above, the author gets his uniform dirty.

Service Awards

UNOCAL 76

CORPORATE

March 1986

30 YEARS	**Elizabeth H. Lavers,** Unocal Center
25 YEARS	**Robert C. Schoettler,** San Francisco, Ca.
15 YEARS	**Ernest L. Brown,** Santa Rosa, Ca. **Sara E. Gibson,** Unocal Center **Catherine E. Peterson,** Unocal Center
10 YEARS	**Janet E. Boulter,** Unocal Center **Steven W. Thomas,** Taft, Ca.
5 YEARS	**Michael P. Anderson,** Unocal Center **John F. Chisum Jr.,** Guadalupe, Ca. **Kit T. Evans,** Unocal Center **Maurice E. Harrison III,** Los Angeles, Ca. **Joseph V. Heisler,** Schaumburg, Il. **Veronica P. Johnson,** Unocal Center **Sandy L. Martinez,** Unocal Center **Mark J. McAndrew,** Schaumburg, Il. **Michael O'Malley,** Unocal Center **Avelina Sianez-Paterna,** Unocal Center **Jeanette D. C. Vasquez,** Unocal Center

April 1986

45 YEARS	**William D. Farr,** Unocal Center
35 YEARS	**Jeanette D. Jones,** Schaumburg, Il.
30 YEARS	**Gloryn G. McKee,** Unocal Center
15 YEARS	**Leslie A. Gibson,** Unocal Center
10 YEARS	**Byron C. Mobus,** Sacramento, Ca. **Phillip R. Robbins,** Unocal Center
5 YEARS	**Kathryn O. Foster,** Unocal Center **Salvador Garcia,** Unocal Center

ENERGY MINING

March 1986

5 YEARS	**Michael S. Lawson,** Parachute, Co. **Robert W. Parrish,** Parachute, Co.

April 1986

5 YEARS	**Shannon K. Archibeque,** Parachute, Co. **Steven D. Birckett,** Parachute, Co. **David R. Courtney,** Parachute, Co.

REAL ESTATE

April 1986

20 YEARS	**Paula M. Young,** Unocal Center

SCIENCE & TECHNOLOGY

March 1986

20 YEARS	**Hayden T. Bowles,** Brea, Ca. **Samuel C. Hanson,** Brea, Ca. **Roy M. Matsuo,** Brea, Ca. **Helen F. Roberts,** Brea, Ca.
10 YEARS	**LaVonn Staub,** Brea, Ca. **William P. Torok,** Brea, Ca.
5 YEARS	**Steven R. Molinari,** Brea, Ca. **Nellie V. Nacua,** Brea, Ca. **Edgar Rojas,** Brea, Ca. **David E. Royal,** Brea, Ca. **Richard Salampessy,** Brea, Ca. **Donna H. Sato,** Brea, Ca. **Benjamin R. Sterling Jr.,** Brea, Ca.

April 1986

30 YEARS	**Robert E. Helander,** Brea, Ca. **Raymond A. Whisenand,** Brea, Ca.
20 YEARS	**Charlotte L. Rubidoux,** Brea, Ca.
15 YEARS	**Jerome Kalinowski,** Brea, Ca.
10 YEARS	**E. Gale Smith,** Brea, Ca.
5 YEARS	**Shana J. Bereznay,** Brea, Ca. **Robert A. Billings,** Brea, Ca. **Leonard A. Bray,** Brea, Ca. **Irene E. Davis,** Brea, Ca. **Lawrence J. Evans Jr.,** Brea, Ca. **Patricia S. Garcia,** Brea, Ca. **Alain P. Lamourelle,** Brea, Ca.

ENERGY RESOURCES

OIL & GAS

March 1986

40 YEARS	**Donald B. Newton,** Santa Maria, Ca.
35 YEARS	**James W. Burnside,** Casper, Wy.
25 YEARS	**Mary K. Valencia,** Pasadena, Ca.
20 YEARS	**Lyle R. Davis Sr.,** Orcutt, Ca. **William D. Powers,** Santa Fe Springs, Ca.
15 YEARS	**Brian K. David,** Moab, Ut. **M. C. Griffin Jr.,** Houston, Tx. **Judith M. Howick,** Unocal Center **Rudolph Lopez,** Ventura, Ca.
10 YEARS	**David A. Cole,** Ventura, Ca. **Edward J. O'Donnell,** Unocal Center **Howard M. Santillan,** Taft, Ca. **John D. Traylor,** Ardmore, Ok.
5 YEARS	**Adoracion A. Abcede,** Unocal Center **Lee E. Bailey,** Bakersfield, Ca. **Leonard W. Barfield,** Mobile, Al. **Robert W. Barker,** Midland, Tx. **Edward J. Bonvillain,** Houma, La. **James P. Brady,** Anchorage, Ak. **Michael T. Bridges,** Ventura, Ca. **Harold D. Brown Jr.,** Oklahoma City, Ok. **Scott E. Brownell,** Orcutt, Ca. **James D. Burress,** Santa Paula, Ca. **Carol A. Butcher,** Ventura, Ca. **Ellen F. Castleton,** Lafayette, La. **John R. Cowell,** Orcutt, Ca. **Blake A. Crochet,** Houma, La. **Laurence D. Fisk,** Taft, Ca. **Larry B. Gable,** Mobile, Al. **Ashok K. Ghosh,** Houston, Tx. **Estle E. Giles Jr.,** Houma, La. **Stephen P. Glenn,** Orcutt, Ca. **Dale E. Golike,** Orcutt, Ca. **Calvin D. Harrison,** Santa Paula, Ca. **James S. Hollimon,** Anchorage, Ak. **Catherine L. Huska,** Anchorage, Ak. **Steven H. Jimenez,** Orcutt, Ca. **Peter A. Keegan,** Mobile, Al. **Wayne S. Marshall,** Orcutt, Ca. **Mary Ann Montez,** Midland, Tx. **Allan T. Olson,** Orcutt, Ca. **Randy J. Ponder,** Ventura, Ca. **Edward S. Poole,** Midland, Tx. **Ronnie L. Ramey,** Orcutt, Ca. **Robert C. Regnier,** Orcutt, Ca. **Johnny L. Reynolds,** Orcutt, Ca. **Sherryl A. Schussler,** Bakersfield, Ca. **Carol J. Smith,** Odessa, Tx. **Frank D. Stillwell,** Midland, Tx. **John L. Sweezy,** Lafayette, La. **Douglas W. Taylor,** Anchorage, Ak. **Victor L. Tenney,** Clay City, Il. **Edward E. Thompson,** Anchorage, Ak. **Jimmie Toloudis Jr.,** Houma, La. **Clyde Verdin,** Houma, La. **Barry G. Wallace,** Midland, Tx. **Chris E. Williams,** Orcutt, Ca. **Tony K. Williams,** Worland, Wy. **Henderson Young,** Van, Tx.

Service Awards

April 1986

40 YEARS **Glenn D. Thompson,** Houston, Tx.

35 YEARS **Roy A. Kendrick,** Houma, La.
Lawrence R. Leek Jr., Coalinga, Ca.
Grantlen O. Shannahan, Oklahoma City, Ok.

30 YEARS **Janie R. Morris,** Houston, Tx.

25 YEARS **Clark H. Dugas,** Houma, La.
Floyd G. Fleming, Lafayette, La.
David L. Knutson, Santa Paula, Ca.

20 YEARS **William E. Goffinett,** Santa Fe Springs, Ca.
David E. Johnson, Casper, Wy.
George E. Moore, Midland, Tx.
Raphael A. Pourciau, Houma, La.
Byron R. Scott, Bakersfield, Ca.
Nancy Alice Watson, Orcutt, Ca.

15 YEARS **Dora L. Alcaraz,** Pasadena, Ca.
Leroy J. Charles, Houma, La.
Eddie J. Istre Jr., Houma, La.
Ruben G. Jaramillo, Santa Paula, Ca.

10 YEARS **Clemmie H. Adkins,** Coalinga, Ca.
James T. Braxton, Lafayette, La.
Melvin W. Coats Jr., Santa Fe Springs, Ca.
Robert D. Conklin, Olney, Il.
Clifton Faulkner, Anchorage, Ak.
Mark V. Filewicz, Ventura, Ca.
William R. Green, Andrews, Tx.
Eris A. Porche, Lafayette, La.
John R. Rohner, Coalinga, Ca.
Walter G. Tezeno, Lafayette, La.
James R. Webster, Andrews, Tx.

5 YEARS **Linda S. Adams,** Worland, Wy.
Louis J. Antonini, Lafayette, La.
Gary M. Beckerman, Bakersfield, Ca.
Linda S. Cunningham, Houston, Tx.
Lawrence O. Cutting, Ventura, Ca.
Stephen G. Davidson, Cut Bank, Mt.
Charlie Easterling Jr., Jackson, Ms.
Clarence E. Farley, Houma, La.
Matthew W. Glassman, Ventura, Ca.
Robert C. Gnagy, Midland, Tx.
Todd T. Grimmett, Ventura, Ca.
Richard B. Hill, Oklahoma City, Ok.
Alan L. Hurt, Ventura, Ca.
Jonell S. Johnson, Houston, Tx.
Walter E. Lacy, Oklahoma City, Ok.
Johnnie D. Lee, Worland, Wy.
Kristine A. Manson, Orcutt, Ca.
Kent E. Newsham, Ventura, Ca.
David L. Niichel, Ventura, Ca.
Gregory A. Nunn, Houston, Tx.
Connie Griffin Ray, Jackson, Ms.
John E. Rowland, Worland, Wy.
James R. Schultz, Anchorage, Ak.
Keith A. Schwindt, Orcutt, Ca.
Barbara L. Shultz, Casper, Wy.
George A. Sims, Ventura, Ca.
Joe A. Smith, Andrews, Tx.
Colling K. Tam, Houston, Tx.
William P. Thornton, Snyder, Tx.

INTERNATIONAL OIL & GAS

March 1986

15 YEARS **Brian W. G. Marcotte,** The Hague, Netherlands

10 YEARS **Chung H. Yu,** Unocal Center

5 YEARS **David J. Kelsey,** London, England
Oong K. Youn, Los Angeles, Ca.

April 1986

10 YEARS **John M. Thompson,** The Hague, Netherlands

5 YEARS **Patricia Teasley,** Los Angeles, Ca.
Vincent Dominici, Los Angeles, Ca.

Unocal Indonesia, Inc.

March 1986

15 YEARS **Daud Martalogawa**

10 YEARS **Priyonggo**
Ruwadji
Sudiyono
Sugitrisno
Sutarno
M. Basuki
Sidik H. Guntoro
Widya Latief
Eddy I. Muhayang
Robert Raintung
Andy Rifai
Abdullah Sadiman
Salim Vincent Saragi
Lahud Simanungkalit
M. Amir Sjarifuddin
Hary Soetarto
Bambang Sudiwasono

April 1986

10 YEARS **Edeng**
Hasan Ali
Sulhan Askandar
Zeth M. J. Lapian
Paul Lengkey
Henky Masoko
Julian Rembet
Nelly Rosandi
Tedja Sukmadjaya
Adinda Sunoko
Maxi Wowor

5 YEARS **Hanafarin**
Matadji
Peter Iwan Bolung
Petrus Lamba Mangiwa
Peggy S. Odang
Indra Ruslan Pohan
Benny Benyamin Sidik
Hidayat Taufik
R.I. Trijanto

Unocal Netherlands, Inc.

April 1986

5 YEARS **Gerard Boestert Den,** The Hague, Netherlands

Unocal Norge A/S

March 1986

5 YEARS **Steinar Vik,** Sandnes, Norway

Unocal U.K.

March 1986

5 YEARS **Doris Shepherd,** London, England

April 1986

5 YEARS **Rhona Mann,** Aberdeen, Scotland

UNOCAL CANADA LIMITED

March 1986

35 YEARS **C. W. Dumett Jr.,** Calgary, Alta.

5 YEARS **Keith P. Koppert,** Hinton, Alta.
Peter Naychuk, Fort St. John, B.C.

April 1986

20 YEARS **Charles T. Maxwell,** Calgary, Alta.

15 YEARS **Marcel H. Levac,** Fort St. John, B.C.

10 YEARS **Donald T. Brown,** Grande Prairie, Alta.
Diane N. Willgoose, Calgary, Alta.

5 YEARS **Malcolm D. Anderson,** Calgary, Alta.

UNOCAL THAILAND, INC.

March 1986

5 YEARS **Raymond R. Coleman**
Michael H. Majer
Suwattana Phakdeetham
Robert G. Stephens

April 1986

10 YEARS **Amporn Tanmeesilp**
Narongchai Tantrakul

5 YEARS **Thomas Barley**
Pirote Chansuwanpong
Sopon Charoensuk
John Dixon
Michael J. Feaver
Seri Hararak
Subharerk Hemarat
Chiravid Jao-Javanil
Chaowalit Kaeomano
Somchai Kaivalkrittiyakul
Tirapol Kalambaheti
Nut Kanchanachoti
Decha Kocharoenkit
Krisada Koseedechapalanont
Rojn Laoprasopwattana
Piroje Launprueg
Subin Leeyaanan
Anusorn Phutarak

Yiam Pradidtham
Panot Puangrub
Wichian Rasanocha
Paitoon Rujireksarygul
Khavee Sigkhaman
Khunchai Sridakoon
Phithak Surasarang
Bopitt Tongsak
Anont Tungsrirut
Anake Veerasarn
Hibbraheng Wasani
Boonchouay Wimolsukpirakul
Tonghcai Tonsuwunnarat
Uchai Tungsatitporn
Soontorn Yokyongsakul

GEOTHERMAL

March 1986

5 YEARS
Joe E. Comstock, Jakarta, Indonesia
Albino Z. Perez, Santa Rosa, Ca.
David E. Schultz, Santa Rosa, Ca.
William P. Warren, Santa Rosa, Ca.

April 1986

10 YEARS
Joseph I. Morford, Santa Rosa, Ca.
Brian P. Roberts, Santa Rosa, Ca.

5 YEARS
John F. Copp, Santa Rosa, Ca.
Richard C. Eliason, Santa Rosa, Ca.
John L. Featherstone, Imperial Valley, Ca.
David T. Gambill, Santa Rosa, Ca.
Patrick E. Laursen, Santa Rosa, Ca.
Iris M. Lutz, Santa Rosa, Ca.
Vincent J. Signorotti, Santa Rosa, Ca.

Philippine Geothermal, Inc.

March 1986

10 YEARS
Pedro A. Banogon
Emilna A. Mendoza

5 YEARS
Elsie B. Capili
Gregorio Tito T. Veloso

April 1986

10 YEARS
Graciano R. Dela Cruz
Evelyn R. Puno
Rosendo M. Sarza
Roberto Q. Talavera

5 YEARS
Antonio C. Anonuevo
Rey C. Balcueva
Pedro C. Brusola
Lorenzo C. Calites
Consoricio C. Cordenete
Abundio C. Crenechez
Anastacio C. Cruel
Cyril C. Cruel
Emmeline C. Elma
Eulalia M. Gaspar
Rafael S. Ondis
Hilarion T. Querubin
Jose O. Rebillon

Service Awards

REFINING & MARKETING

March 1986

25 YEARS
Gary C. Piatanesi, San Francisco, Ca.

20 YEARS
Robert P. Frank, San Francisco, Ca.
Sonja M. Stanfield, San Francisco, Ca.

15 YEARS
Glennette C. Hofmann, Schaumburg, Il.
Sharon L. Vallejo, San Francisco, Ca.

10 YEARS
Russell J. Prokuski, Schaumburg, Il.

5 YEARS
Rhonda M. Jefferson, San Francisco, Ca.

April 1986

30 YEARS
Humberto L. Diaz, Schaumburg, Il.
Robert F. Gleason, San Francisco, Ca.

25 YEARS
Andrew A. Zywicke, Schaumburg, Il.

20 YEARS
Lawrence W. Hughes, Schaumburg, Il.

15 YEARS
Karin M. Adams, San Francisco, Ca.
Lily M. Mar, San Francisco, Ca.
James L. Prince, Schaumburg, Il.

10 YEARS
John A. Gilski, Schaumburg, Il.

5 YEARS
Nancy T. Duffy, Schaumburg, Il.
Dorothy L. Korsvik, Schaumburg, Il.
Anicia A. Nelson, San Francisco, Ca.
Fatima L. Willis, San Francisco, Ca.

EASTERN REGION

March 1986

45 YEARS
Delos L. C. Ostrander, Pure Transportation Co., Olney, Il.

35 YEARS
Eddie S. Anderson, Chicago Refinery
George Ballew, Chicago Refinery
Thomas P. Fabek, Chicago Refinery
Lyle P. Loflin, Charleston, W.V.
Thomas G. Thompson, Dayton, Oh.

30 YEARS
Ronald R. Runge, Schaumburg, Il.
Carroll A. Scogin, Birmingham, Al.
Richard E. Strauss, Schaumburg, Il.

25 YEARS
Norma A. Elwell, Schaumburg, Il.
Myron S. Podgurski, Schaumburg, Il.
Lewis E. Smith, Pensacola, Fl.

20 YEARS
Ronald D. Batte, Birmingham, Al.
James B. Knasel, Cincinnati, Oh.
Warren A. Sproule, McFarland, Wi.

15 YEARS
Philip E. Bumblauskas, Chicago Refinery
Michael R. Clem, Chicago Refinery
Bernard M. Coleman, Charlotte, N.C.
Richard L. Favero, Chicago Refinery
James T. Gant, Chicago Refinery
Thomas H. Grimes, Toledo, Oh.
Gerald A. Grochmal, Chicago Refinery
Donald R. Hardwick, Dayton, Oh.
Stephen E. Lagger, Chicago Refinery
William Laurie, Chicago Refinery
James R. McKinney Jr., Chicago Refinery
William J. Mueller, Chicago Refinery
Johnny R. Peacock, Macon, Ga.
William A. Privara Jr., Chicago Refinery
Gregory Shawver, Chicago Refinery
Leon A. Ulfers, Chicago Refinery

10 YEARS
Deborah K. Beath, Beaumont Refinery
Stanley R. Bochenek, Mt. Prospect, Il.
Betty J. Larsen, Wildwood, Fl.

5 YEARS
Joseph F. Austin, Savannah, Ga.
Jack L. Dixon, Beaumont Refinery
James C. Dykes, Beaumont Refinery
Michael P. Farrell, Schaumburg, Il.
Robert E. Geiger, Chicago Refinery
Thomas R. Graaman, Chicago Refinery
Floyd J. Guillory Jr., Beaumont Refinery
Julie M. Jacques, Schaumburg, Il.
Joel J. Johnson, Beaumont Refinery
Sallye R. Jones, Chicago Refinery
James C. Karcz, Chicago Refinery
John J. Labarbera Sr., Beaumont Refinery
Patricia A. McFarlin, Pure Transportation Co., Van, Tx.
Gary A. McLaughlin, Beaumont Refinery
Cecil R. Morris, Chicago Refinery
Frank N. Purcell, Chicago Refinery
Mary A. Robinson, Chicago Refinery
Caryn L. Roty, Pure Transportation Co., Schaumburg, Il.
James Saldana, Chicago Refinery
Karen L. Spears, Beaumont Refinery
Steven P. Stefanski, Chicago Refinery
Michael L. Sumrow, Chicago Refinery
John J. Tamayo, Chicago Refinery
Richard L. Vanderhoff, Chicago Refinery
Milford H. Wead Jr., Beaumont Refinery
Harold C. Whitney Jr., Beaumont Refinery

April 1986

40 YEARS
John H. Halleran, Schaumburg, Il.
Jack C. Lepper, Chicago Refinery

35 YEARS
Joyce N. Fowler, Pure Transportation Co., Van, Tx.
Homer F. Lambert, Atlanta, Ga.

30 YEARS
Carroll H. Nichols, Dayton, Oh.
Gerald W. Schwimley, Schaumburg, Il.

Service Awards

20 YEARS	**Terry L. Kennedy,** Cincinnati, Oh. **Charles W. Reed,** Bay City, Mi.
15 YEARS	**Junior L. Golden,** Pure Transportation Co., Van, Tx. **Eddie Paige Jr.,** Atlanta, Ga.
10 YEARS	**Doyl E. Beard,** Memphis, Tn. **Stuart M. Cannes,** Schaumburg, Il. **Geraldine R. Chauvin,** Pure Trans. Co., Houma, La. **Lance M. McGilliard,** Schaumburg, Il. **Gregory S. Sidor,** Schaumburg, Il.
5 YEARS	**Sharon J. Abbott,** Beaumont Refinery **Pamela A. Fletcher,** Beaumont Refinery **Cynthia A. Hilsabeck,** Schaumburg, Il. **Nina M. Jenkins,** Beaumont Refinery **John E. Lebouef,** Beaumont Refinery **Michael J. Mills,** Beaumont Refinery **Charles R. Rowland,** Beaumont Refinery **Elwood F. Sevison Jr.,** Beaumont Refinery **Linda F. Tibbitts,** Beaumont Refinery **Larry S. Traylor,** Beaumont Refinery **Diane L. Wilkinson,** Chicago Refinery

WESTERN REGION

March 1986

40 YEARS	**Frank B. Board,** San Francisco Refinery **Albert M. Cargo,** San Francisco Refinery
35 YEARS	**John E. Campbell,** Richmond, Ca. **John G. English,** Sacramento, Ca. **William H. Holmes,** Los Angeles Refinery
30 YEARS	**William J. Bodiford,** Los Angeles, Ca.
25 YEARS	**Patsy R. Hardy,** Los Angeles, Ca. **Ronald E. Ness,** Bakersfield, Ca.
20 YEARS	**Elfriede Ella Adams,** Richmond, Ca. **Jack H. Green,** San Francisco Refinery **Robert E. Hardinger,** Los Angeles, Ca. **Douglas O. Johnson,** Unocal Center **Horace G. Lutz,** Los Angeles Refinery
15 YEARS	**Janet I. Domingo,** Los Angeles, Ca. **Michael H. Geigle,** Portland, Or. **Kenneth A. Larson,** Santa Maria Refinery **Johnie D. Stinde,** Tukwila, Wa.
10 YEARS	**John M. Bedlion,** Santa Maria Refinery **Nathaniel Foster,** San Francisco Refinery **Frank C. Kruger,** Richmond, Ca. **Timothy F. O'Brien,** Los Angeles, Ca. **Robert L. Owens,** Sacramento, Ca. **Thomas J. Prusa,** Colton, Ca. **Larry W. Roberts,** Portland, Or. **Rebekah J. Taba,** San Francisco Refinery **Wilfred B. Turner,** Tukwila, Wa. **Sipuon Uong,** Los Angeles, Ca.
5 YEARS	**Jonathon A. Brown,** Los Angeles Refinery **William C. Brown,** Pasadena, Ca. **Paul B. Davis,** Los Angeles Refinery **Chris W. Elder,** Los Angeles, Ca. **Janice M. Fetch,** Seattle, Wa. **Ruben Gonzales,** Seattle, Wa. **Linda E. Herold,** Los Angeles Refinery **Vernon J. P. Kim,** Honolulu, Hi. **Michael A. Skehen,** Santa Maria Refinery **Thomas R. Valley,** Seattle, Wa. **Peggy A. Vandelden,** Los Angeles, Ca. **Brian L. Woo,** Portland, Or.

April 1986

40 YEARS	**James M. Loughridge,** San Francisco Refinery
35 YEARS	**Robert H. Braun,** Los Angeles Refinery **George R. Johnston,** Los Angeles Refinery **John R. Lorge,** Los Angeles Refinery
30 YEARS	**Edwin G. Hyder,** Los Angeles Refinery **Daniel Piro,** Redding, Ca. **Andre J. Roy,** Torrance, Ca.
25 YEARS	**R. R. Huddleston,** San Francisco Refinery **Robert J. Sommerseth,** Edmonds, Wa. **Louis D. Trost,** San Francisco Refinery **George K. Yamamoto,** Honolulu, Hi.
20 YEARS	**Harris T. Clabaugh,** Phoenix, Az. **Ramon F. Dechant,** Los Angeles Refinery **James A. Hayashi,** Los Angeles, Ca. **Benjamin D. Kell,** Los Angeles Refinery **Glen A. MacMaster,** Los Angeles Refinery **Klepper Mason Scott,** Los Angeles Refinery
15 YEARS	**Socorro Amezcua,** Los Angeles, Ca. **Thomas E. Glazier,** Anchorage, Ak. **David G. Hov,** Portland, Or. **David C. Keith,** Richmond, Ca. **Donicio Lagodlagod,** Honolulu, Hi. **Michael E. Lindner,** Walnut Creek, Ca.
10 YEARS	**Linda M. Bogue,** Los Angeles, Ca. **Ronald C. Brinkman,** Santa Maria Refinery **James C. Fleming,** Anchorage, Ak. **Narciso Guerrero,** Los Angeles, Ca. **Gary M. Lefebvre,** Tacoma, Wa.
5 YEARS	**Zanna Alden,** Los Angeles Refinery **James O. Anderson,** Los Angeles, Ca. **Bruce W. Bailey,** Los Angeles, Ca. **Steven L. Baird,** Los Angeles, Ca. **Christopher G. Denis,** San Francisco Refinery **Juan J. Hernandez,** Santa Maria Refinery **Karen M. Hillyard,** Taft, Ca. **Albert Jones,** San Francisco Refinery **Judy A. Kaba,** Los Angeles, Ca. **Janis Kawano,** San Diego, Ca. **Frederick F. Kuist,** Los Angeles Refinery **Alton D. Masters,** Los Angeles, Ca. **Jack R. Moore Jr.,** Los Angeles Refinery **Benjamin Pacheco Jr.,** Los Angeles Refinery **Terry L. Spain,** Los Angeles Refinery **Arthur Tinajero,** Cerritos, Ca. **Ronald W. Toten,** San Francisco Refinery **Robert C. Tyler,** Santa Maria Refinery

MARKETERS & DISTRIBUTORS

February 1986

40 YEARS	**Charles Grigg,** Kingman, Az.

March 1986

50 YEARS	**Citizens Oil Co.,** Gaffney, S.C.
40 YEARS	**Les A. Esposito,** San Pedro Marine, Ca.
15 YEARS	**Brandon & Hull,** Greenville, Tn. **Security Oil Co., Inc.,** Concord, N.C. **Shirley Oil Co.,** Morristown, Tn.
5 YEARS	**Lorin Weiss Oil Co., Inc.,** Turlock, Ca.

April 1986

60 YEARS	**Levens, Inc.,** Carrollton, Ga.
35 YEARS	**Boice & Barbee, Jobber,** Nogales, Az.
25 YEARS	**Leeward Petroleum, Inc.,** Waianae, Hi.
20 YEARS	**Clark Oil Co.,** Eufaula, Al. **J. E. Scott,** Isabella, Ca.
5 YEARS	**Heater Oil Co.,** Gassaway, W.V.

CHEMICALS

March 1986

35 YEARS	**Charles J. Cornell,** Denver, Co.
30 YEARS	**Leon E. Hinkle,** La Mirada, Ca.
25 YEARS	**Francis Ullersberger,** Carteret, N.J.
20 YEARS	**John H. Jones,** Atlanta, Ga. **Donald L. Smith,** Charlotte, N.C. **Walter M. Tarpley,** Schaumburg, Il. **Lorraine M. Wiswedel,** St. Clair Shores, Mi.
15 YEARS	**Charles R. Sheehan,** Charlotte, N.C.
10 YEARS	**David A. Fay,** Kenai, Ak. **James D. Ferguson,** Brea, Ca. **David W. Isaac,** Charlotte, N.C. **Leslie M. Kosydar,** Kenai, Ak. **Floyd K. McGahan,** Kenai, Ak. **Marilyn A. Newell,** La Mirada, Ca. **Timothy J. Wilkes,** Charlotte, N.C.

5 YEARS	**Billy C. Benton,** Wilmington, N.C. **Lucia E. Goins,** Brea, Ca. **Albert J. Gonzalez,** Dallas, Tx. **Michael J. Graham,** Schaumburg, Il.

April 1986

30 YEARS	**Elsie M. Hufstetler,** Clark, N.J. **John K. Laskey,** Conshohocken, Pa. **Bill R. Sponsler,** Brea, Ca.
20 YEARS	**Perry A. Friday,** La Mirada, Ca. **Elizabeth Kron,** Schaumburg, Il.
15 YEARS	**Tommy Barnette,** Charlotte, N.C. **Beatrice L. Barthelmeh,** La Mirada, Ca. **Lucius J. Harris,** Rolling Meadows, Il.
10 YEARS	**Erlend A. Hoag,** Kenai, Ak. **Richard L. Kustwin,** Bridgeview, Il. **Daniel M. Lee,** Charlotte, N.C. **John K. McCauley Jr.,** Aloha, Or. **Joseph A. Pascual,** Tucker, Ga. **Herbert M. Rooper,** Kenai, Ak. **Billy B. Smith,** Charlotte, N.C. **Ray A. Thomas,** Charlotte, N.C.
5 YEARS	**Richard A. Binkley,** Nashville, Tn. **Elizabeth S. Doyle,** Brea, Ca. **Jeffrey A. Evans,** Lemont, Il. **Susan R. Fechtig,** La Mirada, Ca. **Andrew J. Ford,** Brea, Ca. **Richard A. Kolpin,** Brea, Ca. **Catherine S. McMahan,** Charlotte, N.C. **Marcia K. Peco,** Schaumburg, Il. **David Quiroz,** Brea, Ca. **Alexander P. Sandoval,** La Mirada, Ca.

MOLYCORP, INC.

March 1986

25 YEARS	**Keith H. Steever,** Mountain Pass, Ca.
20 YEARS	**Milton R. Cisneros,** Questa, N.M. **Luis I. Fernandez,** Questa, N.M. **Cipriano N. Garcia,** Questa, N.M. **Eddie Garcia,** Questa, N.M. **Gilbert C. Martinez,** Questa, N.M. **Leo J. Potvin,** Questa, N.M. **Bert Quintana,** Questa, N.M. **Doroteo Sanchez,** Questa, N.M.
5 YEARS	**Joseph T. Fernandez,** Questa, N.M. **Lawrence R. Fresquez,** Questa, N.M. **Liberato Gonzales,** Questa, N.M. **Malcolm A. Harris,** Mountain Pass, Ca. **Raymond A. Pacheco,** Questa, N.M. **Anna J. Quintana,** Questa, N.M. **Melvin M. Tompkins Jr.,** Questa, N.M. **Gerald N. Radford,** Mountain Pass, Ca. **James A. Trujillo,** Questa, N.M. **Marcello J. Vialpando Jr.,** Questa, N.M. **James K. White,** Mountain Pass, Ca.

April 1986

10 YEARS	**Kathleen Carpenter,** Louviers, Co. **Chris J. Welch,** Denver, Co.

Service Awards

5 YEARS	**James G. Clark,** Denver, Co. **David K. Gallegos,** Questa, N.M. **Jack L. Gallegos,** Questa, N.M. **Lloyd Gonzales,** Questa, N.M. **David F. Martinez,** Questa, N.M **Dean P. Martinez,** Questa, N.M. **Allen E. Mayhew,** Denver, Co. **Richard J. G. Moore,** Mountain Pass, Ca. **William L. Proud,** Louviers, Co. **Ronald C. Soto,** Mountain Pass, Ca. **Ernest D. Trujillo,** Questa, N.M. **Kenneth R. White,** Mountain Pass, Ca.

POCO GRAPHITE, INC.

March 1986

5 YEARS	**Ricky C. Slagle,** Decatur, Tx.

RETIREMENTS

January 1986

Wayman Boudineer, Molycorp, Espanola, N.M., November 15, 1965
Telesfor E. Duran Jr., Molycorp, Questa, N.M, August 26, 1957
Otto Guentzel, Corporate, Dekalb, Il., May 1, 1953
Fredolin Rael, Molycorp, Questa, N.M., February 7, 1958
John R. Sanchez, Molycorp, Questa, N.M., June 21, 1965
Ben Santistevan, Molycorp, Cerro, N.M., January 7, 1964
Luther Tafoya, Molycorp, Costilla, N.M., May 24, 1969
Vicente J. Trujillo, Molycorp, Rancho De Taos, N.M., December 11, 1967

February 1986

George H. Anderson, Molycorp, Questa, N.M., March 30, 1964
Iris F. Douglas, Oil & Gas, Paramount, Ca., November 21, 1963
Harry E. Gove, International Oil & Gas, Sun City, Az., February 16, 1963
Robert T. Grissom, Refining & Marketing, Nederland, Tx., December 31, 1946
Gerald W. Hogan, Refining & Marketing, Napa, Ca., December 5, 1967
William Liragis, Chemicals, Glendora, Ca., January 31, 1956
Conrado Martinez, Molycorp, Taos, N.M., May 2, 1967
Lorraine F. Ness, Refining & Marketing, Schaumburg, Il., November 14, 1973
Carl Netter, Refining & Marketing, Carson, Ca., August 2, 1951
Doroteo Sanchez, Molycorp, Arroyo Seco, N.M., March 29, 1966

March 1986

Henry Arnaud, Oil & Gas, Lafayette, La., April 5, 1955
Charles E. Baysinger, Refining & Marketing, Cullman, Al., June 2, 1952
William C. Bennett, International Oil & Gas, San Marino, Ca., December 16, 1963
Julia Bernal, Molycorp, San Gabriel, Ca., May 7, 1963
C. E. Bernasconi, Corporate, Burbank, Ca., August 16, 1965
Lynn C. Brown, Oil & Gas, Santa Maria, Ca., March 11, 1952
William A. Catlett, Refining & Marketing, Knoxville, Tn., November 1, 1949
Muriel A. Caves, Corporate, Diamond Bar, Ca., December 14, 1953
Billy B. Creech, Refining & Marketing, Port Neches, Tx., February 8, 1949
Chris J. Dovalis, Refining & Marketing, Edina, Mn., August 3, 1949
Walker K. Harmon, Refining & Marketing, Savannah, Ga., September 2, 1953
Patrick B. Kelly Jr., Refining & Marketing, Greensboro, N.C., January 1, 1952
Regis W. Kepp, Refining & Marketing, San Pedro, Ca., September 22, 1959
George L. McCoy, Oil & Gas, Midland, Tx., February 23, 1951
Jack L. McCullough, Refining & Marketing, Tulsa, Ok., July 1, 1951
Daniel E. Mitrius, Refining & Marketing, Downers Grove, Il., May 25, 1970
William S. Nye, Molycorp, York, Pa., August 27, 1951
Chalmer L. Pearson, Refining & Marketing, Bloomingdale, Il., November 1, 1956
Bert Quintana, Molycorp, Costilla, N.M., March 15, 1966
Walter E. Raack, Refining & Marketing, Des Plaines, Il., May 10, 1948
Gilbert A. Reinemann, Oil & Gas, Anaheim, Ca., July 12, 1965
Roy M. Robinson, Refining & Marketing, Helendale, Ca., October 30, 1950
Joe C. Sabatino, Refining & Marketing, Saginaw, Mi., May 11, 1950
Wade E. Sanders, Oil & Gas, Santa Maria, Ca., October 1, 1962
Benjamin F. Schmidt, Oil & Gas, Sedona, Az., January 15, 1951
J. L. Bud Votaw, Refining & Marketing, Norwalk, Ca., January 29, 1954
William H. Woodruff, Refining & Marketing, Savannah, Ga., January 16, 1950

April 1986

Bronson M. Akins, Refining & Marketing, Port Neches, Tx., October 31, 1949
Richard N. Allen, Refining & Marketing, Detroit, Mi., January 23, 1951
Donald A. Ambler, Refining & Marketing, La Mesa, Ca., March 4, 1954

Thomas A. Buckle, Refining & Marketing, Long Beach, Ca., March 9, 1953
Darnell A. Falterman, Oil & Gas, Houma, La., August 20, 1948
James M. Hagerty, Refining & Marketing, Lockport, Il., October 2, 1950
Thomas H. Johnson Jr., Refining & Marketing, Nederland, Tx., August 22, 1949
John R. Jones, Refining & Marketing, Acworth, Ga., October 30, 1947
Howard Jordan, Refining & Marketing, Cleveland, Oh., April 1, 1953
Lawrence A. Peterson, Refining & Marketing, Tinley Park, Il., December 5, 1951
Eugene E. Schommer, Refining & Marketing, Livonia, Mi., August 1, 1951
Noble T. Solomon, Refining & Marketing, Beaumont, Tx., May 24, 1949
Robert D. Swick, Oil & Gas, Midland, Tx., December 3, 1948
Deane O. Todd, Refining & Marketing, Fairfield, Ca., February 1, 1971

IN MEMORIAM

Employees

Charles L. Hughes, Refining & Marketing, Greenville, S.C., January 22, 1986
George E. Leflinger, Refining & Marketing, Lakewood, Ca., March 6, 1986
Nevin E. Miller, Refining & Marketing, Alliance, Oh., January 19, 1986
Daniel E. Woodcock, Refining & Marketing, Lakewood, Ca., March 6, 1986

Retirees

Thomas V. Akins, Oil & Gas, Noble, Il., December 30, 1985
Kenneth B. Allen, Oil & Gas, Homeland, Ca., January 10, 1986
Roy Anderson, Refining & Marketing, Seattle, Wa., December 28, 1985
Glenn P. Beavers, Refining & Marketing, Columbus, Oh., February 13, 1986
Sidney Bourque, Refining & Marketing, Gueydan, La., January 31, 1986
John Catrino Sr., Refining & Marketing, Pinole, Ca., January 26, 1986
Claude R. Clark, Oil & Gas, Lynwood, Ca., February 12, 1986
Warren F. Conway, Oil & Gas, Yucca Valley, Ca., January 24, 1986
Robert E. Corbitt, Oil & Gas, Schulenburg, Tx., January 2, 1986
Martin A. Cormier, Refining & Marketing, Watertown, S.D., January 25, 1986
James H. Daley, Refining & Marketing, Arcata, Ca., February 17, 1986
Dorothy M. Davis, Refining & Marketing, Rolling Hills, Ca., December 25, 1985
Thomas V. Dickens, Refining & Marketing, Columbus, Oh., December 18, 1985
Hal H. Dronberger, Refining & Marketing, Sun City, Az., January 17, 1986
Matthew John Ellis, Chemicals, South Gate, Ca., January 24, 1986
Thomas F. Farris, Oil & Gas, Mountain Home, Ar., February 13, 1986
Neil W. Fisher, Refining & Marketing, Newark, Oh., November 15, 1985
Richard R. Footh, Refining & Marketing, Birmingham, Al., January 9, 1986
Fay S. Fox, Oil & Gas, Supulpa, Ok., February 1, 1986
Sue R. Garren, Refining & Marketing, Hendersonville, N.C., December 16, 1985
Allen J. Gilchrist, Refining & Marketing Lone Pine, Ca., January 24, 1986
Everett B. Haedecke, Refining & Marketing, Edina, Mn., December 7, 1985
Arthur B. Hall, Refining & Marketing, Dundas, Il., January 26, 1986
Clarence K. Hohu, Refining & Marketing, Honolulu, Hi., January 2, 1986
Orrin C. Holbrook, Science & Technology, Fullerton, Ca., January 4, 1986
Hugh H. Jones, Refining & Marketing, Brea, Ca., January 27, 1986
John De Jong, Refining & Marketing, Carnation, Wa., February 10, 1986
Stanley I. Kovolisky, Chemicals, Kearny, N.J., December 30, 1985
Willard J. Larson, Corporate, Whittier, Ca., January 20, 1986
Glenn A. Lawson, Refining & Marketing, Mt. Prospect, Il., February 10, 1986
Charles K. Layton, Refining & Marketing, Sacramento, Ca., January 1, 1986
Ernest McCartney, Refining & Marketing, Beaumont, Tx., January 18, 1986
Neill Morris, Oil & Gas, Van, Tx., January 14, 1986
Ira L. Mount, Refining & Marketing, Port St. Joe, Fl., February 14, 1986
George V. Musselman, Refining & Marketing, Seattle, Wa., December 31, 1985
Francis K. Norris, Refining & Marketing, Concord, Ca., January 31, 1986
Harmon J. Orr, Refining & Marketing, Heath, Oh., January 17, 1986
Russell K. Pace, Refining & Marketing, Prescott, Az., February 5, 1986
Harry C. Piatt, Refining & Marketing, Long Beach, Ca., February 12, 1986
Jerry Pisani, Refining & Marketing, Burlington, Ma., January 4, 1986
Harry Wilson Rike, Refining & Marketing, Rodeo, Ca., January 16, 1986
Clarence J. Ritter, Refining & Marketing, Lawrenceburg, In., February 2, 1986
Walter E. Schlais, Refining & Marketing, Huntington Beach, Ca., January 9, 1986
Virginia Schmeltzer, Refining & Marketing, Des Plaines, Il., January 28, 1986
Nelson C. Schubert, Refining & Marketing, Wooster, Oh., February 7, 1986
Thomas A. Seavey, Refining & Marketing, Forest Park, Il., February 18, 1986
Wilbert A. Shmoldt, Refining & Marketing, Arlington Heights, Il., January 3, 1986
Walter S. Smyrl, Oil & Gas, Palo Pinto, Tx., January 24, 1986
Bernard T. Stimmel, Refining & Marketing, Merritt Island, Fl., January 4, 1986
John Troino, Pure Transportation Co., Gueydan, La., December 17, 1985
Charles S. Walker, Oil & Gas, Long Beach, Ca., January 22, 1986
Robert E. Wetzler, Refining & Marketing, Ida, Mi., January 22, 1986

UNOCAL 76
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Seventy Six

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COVER: Atop corporate headquarters, the Unocal 76 logo — measuring 7-1/2 feet high and 58-1/2 feet across—stands out in a western sunset. **Photo by Steven Burr Williams.**

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