

A night-time photograph of the Ras Tanura Refinery, featuring illuminated distillation columns and storage tanks against a dark sky. The image is framed by a large, semi-transparent blue circle and a background of a colorful dot pattern.

Ras Tanura Refinery:

Six decades of unparalleled service

RAS TANURA, Saudi Arabia — From the most humble of origins, Saudi Aramco's Ras Tanura Refinery has evolved and grown over the last six decades into one of the most celebrated industrial complexes in the Arabian Gulf region.

The enormous facility has a cornucopia of capabilities. It's a self-sufficient source of local energy, a sophisticated distillation facility, a natural gas liquids (NGL) industrial unit and a crude stabilization plant capable of meeting ever-changing global energy requirements.

"Ras Tanura Refinery has expanded to meet the needs of the Kingdom, the community and the world," explained Ibrahim K. Al-Naimi, manager of the Refinery Operations Department. "Not only is it a complete refinery, but beyond that, it has NGL fractionalization and crude stabilization facilities."

Written by Lori Olson White



“This is very unique, both in the Kingdom and in the world,” he said. “And, with the utilities, we are self-sufficient, generating our own steam, distilled water and plant air, as well as generating power, which goes also to the shipping terminal and the community. That’s something you don’t find worldwide.”

Ras Tanura Refinery is the oldest and largest of Saudi Aramco’s seven refineries, including five that are wholly owned by the company, and two that are joint ventures. It is the most well-established and productive refinery in Saudi Arabia, meeting more than 40 percent of the Kingdom’s energy needs, and it’s one of the leading refineries in the world, with a distillation capacity of 550,000 barrels per day (bpd) of crude oil and condensate.

As Saudi Aramco’s premier industrial facility, Ras Tanura Refinery distills all grades of crude oil, processing products, including gasoline, aviation fuel, kerosene, transportation diesel, asphalt, light naphtha and fuel-oil products. The refinery’s NGL facilities process propane, butane and natural gasoline. In addition, the stabilization plants process up to 330,000 bpd of crude for export by way of the Ras Tanura Terminal.



Taken individually, each of the manufacturing units of Ras Tanura Refinery has achieved incredible success. Taken as a whole, they represent a 60-year legacy of triumph unmatched in the oil industry.

Birth of a refinery

In 1943, representatives from America’s Petroleum Administration for War traveled to Saudi Arabia looking for some way to relieve the enormous drain on U.S. oil fields created by the Allied efforts in World War II. Commercially viable quantities of oil had been discovered in the region a few years earlier, and the U.S. government’s plan was to construct a 50,000-bpd refinery plus associated facilities for better access to the Kingdom’s rich assets.

Ras Tanura, a tiny Eastern Province camp on the Arabian Gulf built by Saudi Aramco forerunner California Arabian Standard Oil Company (CASOC), was the obvious choice for the refinery. A simple “tea-kettle” refinery had been put up there two years earlier and had processed 3,000 bpd of Saudi Arabian crude for six months before being shut down in June 1941 due to the war. Since then, the camp — which had grown to include several family

Ras Tanura Refinery’s key executives, at top, are Ibrahim K. Al-Naimi, left, manager of the Refinery Operations Department, and Abdullah S. Zaindin, manager of the Refinery Maintenance Department. Below: The refinery is a labyrinth of equipment and facilities.



cottages and employee bunkhouses, a movie theater and recreation hall, a water tank, mess hall and temporary clinic — had been nearly abandoned as the wartime workforce fell to fewer than 100 Americans and 2,000 Arabs.

Although the new refinery's location was obvious, how it would be funded was not. The idea of the U.S. government participating in private industry was unacceptable to most Americans and especially to the U.S. oil industry. In the end, it was decided that CASOC owners would finance the construction themselves, with the American government helping them obtain — and transport — the hard-to-find steel, building supplies, heavy equipment and manpower needed to construct a world-class refinery in the midst of wartime shortages and governmental prioritization.

Planning began almost immediately, and by 1944 when CASOC was renamed the Arabian American Oil Company (Aramco), actual construction had turned quiet Ras Tanura and neighboring Najmah — where construction workers were housed — into hives of activity. Construction had also returned Ras Tanura's original "tea kettle" distillery to service, supplying products needed to power equipment used in the new refinery's construction.

Despite scarcity and hardship, including the sinking of a shipload of critical supplies by enemy forces, the Ras Tanura Refinery was completed on time and placed in partial operation in late September 1945. Gladys Champion Stapleton, wife of Vic Stapleton, Aramco's management coordinator and the driving force behind the refinery's completion, lit the ceremonial fire putting the 50,000-bpd facility online. By December of that year, just five months after the close of World War II, the refinery was in full operation.

Growth of a refinery

With the end of military hostilities, worldwide demand for the refinery's products skyrocketed. By the end of 1945, Ras Tanura Refinery was exceeding planned capacity and producing 60,000 bpd. Four years later, that volume had increased to 127,000 bpd, and just three years after that, in 1952, the facility was averaging 177,000 bpd — more than three times its original rated capacity. All of these improvements were the result of hard work, accumulated experience and continual progress, characteristics that

In 1950, two-thirds of the world's refining capacity was located in oil producing-exporting countries. By 1962, that trend had reversed itself, with almost two-thirds of the world refining capacity located outside countries with big oil reserves.

quickly became a Ras Tanura Refinery trademark.

The years after 1952 marked a period of intense expansion at Ras Tanura Refinery, as various large construction projects and facility upgrades were completed. The additions of a crude topping unit and a "Poly plant" (California Acid Film Polymerization Process plant) were finalized in



Top: Workmen secure new pipe connections at Ras Tanura Refinery. Above: An engineer inspects a process unit.

1953, and a 12,500-bpd fluid hydroformer capable of producing high-octane gasoline went live in 1955. A new diesel desulphurization unit was added in 1957, and, four years later, a special-products blending facility was constructed at the refinery complex.

That same year, Ras Tanura's refrigerated liquefied petroleum gas (LPG) plant became the first facility in the Middle East to make liquid propane and butane gas available in refrigerated form for export. The unit processed 4,000 bpd of propane and butane combined.

Early in 1962, the billionth barrel of crude passed through Ras Tanura Refinery, marking yet another milestone in the refinery's profitable history. Two years

(cont. on page 11)



In the refinery's shadow, a bright, unique community

RAS TANURA, Saudi Arabia — When the Ras Tanura Refinery went online in September 1945, there were already three small settlements around it — the main camp, closest to and named after the refinery; the Italian camp, set off in the desert toward the sea; and the residential camp, nestled between the glistening sands of the Arabian Gulf and the refinery itself.

Main camp was the working camp for expat oilmen and their Saudi counterparts, with machine shops and company offices, a few wooden bunkhouses and a mess hall to feed hungry shift workers of all nationalities. A movie theater and a 20x60-foot recreation hall featuring billiards, bowling and snacks were available, as was a fully staffed clinic to patch up workers injured in the refinery or on adventures into the desert. And there was one water tank to provide precious sweet water for drinking.

The Italian camp was a self-sufficient collection of



bachelor bunkhouses and common halls established to house skilled Italian laborers and craftsmen from Eritrea, a former Italian colony located across the Red Sea from Saudi Arabia. When the Allies took control of what was called Italian East Africa in 1941, Aramco brought the hard-working, hard-playing Italians to Saudi Arabia.

With the end of World War II in 1945, expat wives and children, many of whom had left husbands and fathers behind in Saudi Arabia four years earlier, returned, and entire families arrived for the first time in the growing desert oasis. Family cottages with most of the amenities of home, including sweet water, were constructed and within a year lined the spectacularly beautiful seashore, extending back toward the refinery in an orderly street-by-street manner. There were yards covered with sand and whatever greenery the lady of the house could nurture into growing, and newly planted hedges protected by crisscrossed palm fronds.

Like the hopeful plants, within a year the residential camp at Ras Tanura had taken root.

Six years after the Residential Camp was established, Ras Tanura's Intermediate Camp opened up. The camp, designed specifically for those employees (most of whom were Saudi and expat bachelors) classed between senior staff and general employees, featured a series of U-shaped courts, each housing 24 men. Every court unit included kitchen facilities, a laundry room and a community bathroom with shower stalls, wash basins and toilets. The heart of the camp was an air-cooled cafeteria, canteen and dining hall with Middle Eastern and European selections, including café espresso made in special urns brought in from Italy. For off-work hours, there was a recreation hall with tennis and bocci ball courts, an open-air movie theater and even a swimming pool.

By 1954, Ras Tanura Refinery employed some 5,882 workers, and the surrounding community included nearly 800 family residents. Any boundaries there may have been between camps started to blur as more and more men, women and children began to call RT home.

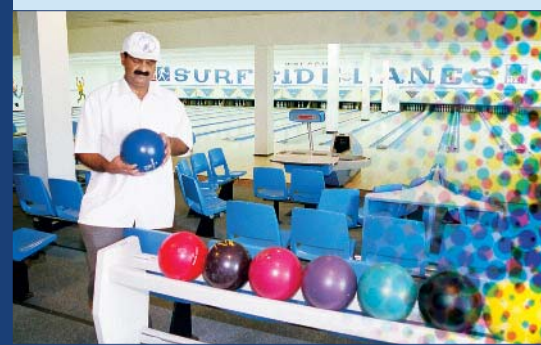
Today Ras Tanura Refinery employs 1,255 workers, and the Saudi Aramco camp of the same name is home to 1,330 residents. Within the gates of Ras Tanura there are all the amenities of a small city: a fully-stocked commissary complete with an in-house bakery and butcher; comprehensive medical and dental centers; schools and recreation facilities; multiple eating establishments offering everything from quick snacks to full-course dinners; transportation, postal and banking services; and personal care providers. Residents can participate in structured art, athletic and entertainment programs, and social clubs and civic organizations abound, ensuring something for everyone in the community. There is even an aviary alive with canaries as colorful as a rainbow, their cheerful songs floating across the lush and well-tended landscape and bringing joy to residents and visitors alike.

As in the past, the beach remains a focal point for Ras Tanura and its residents. The Gulf's natural beauty and vitality as an entertainment center have been continually enhanced. Recent improvements include Saudi Aramco's first-ever water park as well as attractive fountains, picnic areas and patios, and a surfaced and well-lit beach jogging path providing a beach-front exercise experience. In addition, residents have access to a wide range of non-beach recreational opportunities including golf, bowling, tennis,

outdoor swimming pools and first-run movies.

Ras Tanura is truly a complete community thanks to the efforts of both Saudi Aramco and the people — past and present — who have made the community their own. Seaside neighborhoods established all those years ago have flourished and merged with new neighborhoods,

In 1946, 29 girls and 22 boys attended class in a make-shift schoolroom inside the Ras Tanura mess hall, all under the watchful eyes of one instructor, Mr. Sam Whipple. By 1962, a permanent school with both classrooms and classroom teachers had been built in the community, and enrollment had ballooned to 1,127. Today that number is considerably less; however, Ras Tanura's schools continue their strong educational tradition, with 137 students enrolled in grades K–9.



office buildings and community facilities to meet the needs of residents, who, in turn, have come together to create a city as unique as the refinery around which it grew. ■

Saudi Aramco's Ras Tanura community is a lovely shoreline sanctuary. Boating and golf, opposite page, are popular pastimes. Community life is varied, including, this page from top: a well-stocked library, a bowling alley, grocery store and beach recreation facilities.

'The refinery made us who we are'

Employees, past and present, have soft spot for RT complex

RAS TANURA, Saudi Arabia — Mubarak Farhan Al-Marri vividly remembers the day the work order to dismantle Plants No. 1 and No. 2 (Ras Tanura's original "tea kettle" refinery) crossed his desk as maintenance superintendent.

"I put the paperwork in my drawer," recalls the 1996 retiree who joined Aramco in 1956. "I didn't take it out for a day. Those plants were our first plants. They were our history."

There's a long pause. "I cried internally that day," Al-Marri said.

Al-Marri makes no apologies about the deeply personal connection he had — and retains today — to Ras Tanura Refinery.

"It was our refinery," he explains, his voice filling with remembered pride. "We put on our shirt and trousers in the morning, and we were proud. We were going to our job. We would be at the refinery at 6 a.m., and we would wait to work. And when the day was done, we would take work

Retirees such as Mubarak F. Al-Marri and Salah A. Al-Ajam, above, retain cherished memories of working at the refinery in its early days. Both retired in 1996. Below: A dhow unloads supplies adjacent to the old Customs House at Ras Tanura in the 1940s.



with us to our homes. It was what we talked about in our homes and with our friends. It was everything."

Like most of their contemporaries, Al-Marri and Salah A. Al-Ajam, who retired from his post as operations superintendent in 1996, came to Aramco as what Roy Lebkicker, executive VP of the company's training program during that time, called, "raw material."

"We came fresh," Al-Ajam admits simply. "We had no education, no high school, no intermediate school. We learned everything we knew at the refinery, and it became part of us."

"We made ourselves there," he says. "The refinery made us who we are."

Despite a gap of some three decades in start dates at Saudi Aramco, Ibrahim K. Al-Naimi, current manager of Refinery Operations Department at Ras Tanura Refinery, echoes the sentiments of Al-Marri and Al-Ajam.

"There has always been a loyalty, a dedication and a commitment to Ras Tanura Refinery that makes it what it is today," he explains sitting next to his office window overlooking the refinery's interconnected columns and tanks. "We don't talk about it, but in our subconscious, we know that the refinery is a tough place. Deep inside, each of us wants to make it better, to change it for good — and we become dedicated to that cause. It becomes 'our' plant."

And, it's not only about the pride of ownership, according to Al-Ajam. It is also about the pride of accomplishment.

"There was a competition among the people," he explains, "everyone trying to make his life better, to progress in his job, to do better for his family."

"Aramco made it possible for us to learn what we needed to learn," he adds. "We knew that without learning, going to school and learning on the job, that we would not advance. And everyone wanted to advance."

This esprit de corps continues today.

"Ras Tanura Refinery employees — then and now —



were and are proud to be part of one of the largest refineries in the world and the biggest within Saudi Aramco,” said Abdullah S. Zaindin, manager of the Ras Tanura Refinery Maintenance Department. “Like former employees, current employees are devoted to their workplace and view themselves as part of a larger team.

“When faced with challenges, Ras Tanura Refinery employees work together to overcome them, and this contributes to the feeling of solidarity. Having witnessed the recent refinery upgrade and modernization, the refinery’s employees are enthusiastically looking forward to the upcoming refinery/petrochemical integration.”

The Ras Tanura Refinery training facility opened in 1940, offering each new Saudi employee a two-week course in personal hygiene, safety precautions, the names and uses of common hand tools, and simple numbers and measurements in preparation for their work in the plants. By the time Al-Marri and Al-Ajam came into the system, Ras Tanura Refinery had a well-developed system of classroom study and on-the-job training designed to prepare Saudi employees for a wide range of positions, including positions held

only by Americans at that time.

“In school we learned everything — English, algebra, science, math,” explains Al-Ajam, who was an operator in 1964 on the first five-man shift comprised entirely of Saudis, “and we learned all this besides learning

shift work at the refinery, always on-the-job.”

Each bolt was a teaching tool, each procedure another exam that needed to be passed on the road to advancement.

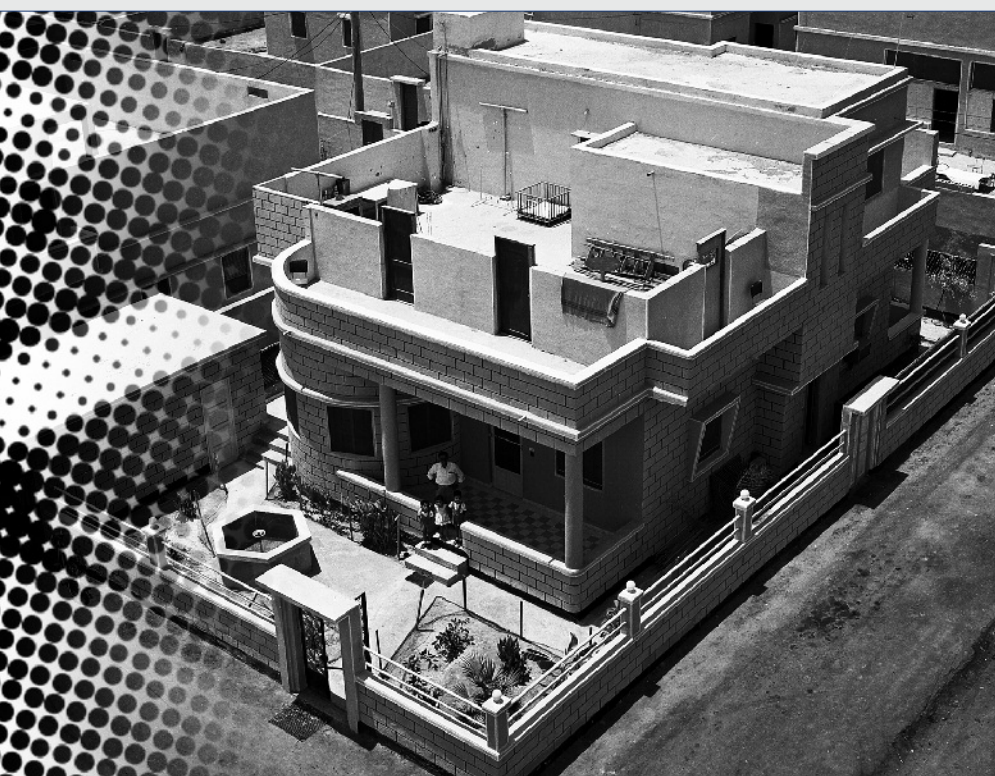
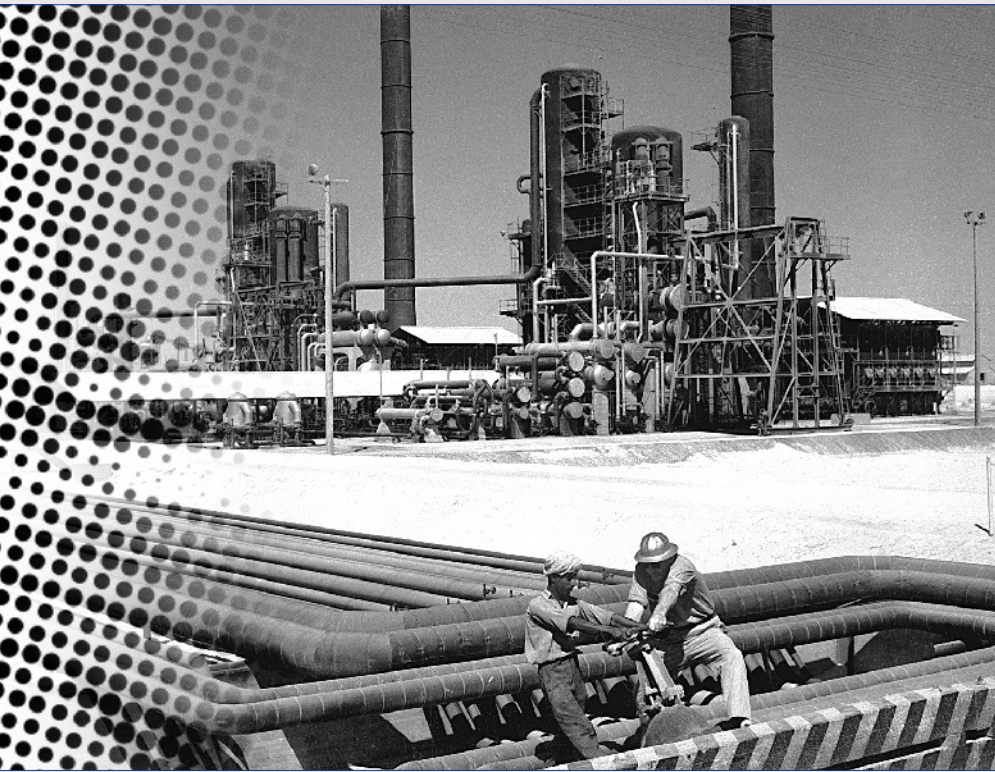
“Every piece of the refinery, every process, we saw it with our eyes and touched it with our hands,” recalls Al-Marri, “and that is how we learned — the hard way.”

The former superintendent is quick, however, to point out that Saudis weren’t the only ones getting an education.

“We were learning, and they were learning,” he laughs, referring to the population of primarily American, British and Italian expats. “The jobs, the customs, the languages — these were things we all had to learn.”

Above: Al-Marri and Al-Ajam, left and third from left standing, during their working years at the refinery. At right, from top: Ras Tanura’s first family homes go up in the early 1940s. Tankers await their turns at loading docks. The community was a bustle of activity in 1945 as World War II drew to a close. The *D.G. Scofield* loaded the first export shipment of Saudi crude at Ras Tanura in 1939.





Top: In a photo shot by R.Y. Richie, Aramco workmen labor at the original Ras Tanura “teapot” refinery in 1946. **Bottom:** A 1950s Aramco Home Ownership Program residence of a Saudi employee and his family in the town of Najmah, adjacent to Ras Tanura.

He fondly recalls friendly interactions with fellow employees. “We loved to take the expats home with us,” he remembers, a smile brightening his face. “We’d feed them real Arab food, and sometimes they would invite us to their homes. We learned to eat with a fork, and they learned to eat with their hands! We were a team, inside and outside of the refinery. We were learning, and they were learning. We were all learning together, and everyone was your brother.”

Like Al-Marri and Al-Ajam, Al-Naimi says his early years in the refinery were filled with intense learning and growth, despite coming to Ras Tanura Refinery with a college education.

“The older generation made Ras Tanura Refinery the school it is today,” he admits. “They knew it then, but they did not bring it up or say it. Instead, they made the younger ones — like myself — learn the refinery the hard way, the way they had learned it, and we picked it up from them. Now, we are trying to pass that knowledge onto that next generation of operators, maintenance technicians and engineers, and in turn, that is helping the refinery.”

“Because of this, I know the refinery by heart,” he says. “It is part of me.”

Looking back on a life both defined and refined at Ras Tanura Refinery, Al-Marri sums up the special feelings the sprawling complex overlooking the Arabian Gulf evokes in himself and others when he says, “I came to Aramco and Ras Tanura Refinery when I was 14 from a village with nothing but donkeys and camels. No cars. Everything, it was new, the lan-

guage, the culture, the work.

“I told my father I would come for two years just to please him, but at the end of two years he asked me if I wanted to stay and I said I did. I didn’t want to leave! Even today, when I am away from the refinery, I miss it here, in my heart, and when I return and I see the flare, I am happy.” ■

(cont. from page 5) later, a new crude stabilizer with a capacity of 170,000 bpd was put on-stream, increasing Ras Tanura Refinery's stabilization capacity to 275,000 bpd.

Ongoing improvements continued at the refinery during the 1970s, as various storage tanks were added as well as NGL Fractionation Plant No. 490, and the first motor gasoline production plant built in the Eastern Province in 20 years, Rheniformer Plant 488.

In 1978, an NGL fractionation plant was added with a capacity of 130,000 bpd.

In 1984, to kick off a comprehensive modernization effort, the largest test and inspection (T&I) in Saudi Aramco history was carried out at Ras Tanura Refinery. The month-long operation involved 742 employees from Ras Tanura as well as outlying Saudi Aramco facilities, and ensured the safety and efficiency of all Ras Tanura Refinery facilities. Over the next two years, modernization efforts included construction of a 250,000 bpd two-stage crude unit (atmospheric and vacuum distillation), and a 300-metric-ton-per-day sulfur plant, along with modifications to the rheniformers and Plants No. 488 and 493. In total, the extensive modernization effort effectively made obsolete six plants with no loss in refinery capacity.

It was also during this time that the refinery took a giant leap into the future of technology, replacing old analog instrumentation throughout the complex and consolidating the refinery's computerized distribution control system for all facilities into one central control room.

The most substantial upgrade in the refinery's history went online in 1999 and included a 44,000 bpd hydrocracker that increased the production of motor gasoline, diesel and kerosene; a 60,000 bpd visbreaker that increased motor gasoline and kerosene production; and a 40,000-bpd continuous catalytic reformer that produced a higher-octane product used in gasoline blending. New blending, storage and transfer facilities were added to the refinery complex. A supporting diglycol amine (DGA) regeneration plant and sour water stripper were also included in the

The crude topping unit that went online in March 1953 marked a milestone in Aramco's history, as it was the first big producing unit designed and fabricated entirely in Saudi Arabia. The unit, which added 22,000 barrels a day of capacity to the refinery, was built from parts and pieces of the Dhahran stabilizer, gas/oil separators in Abqaiq, three old refineries at Ras Tanura and company reclamation yards.

upgrade. These facilities remove primarily hydrogen sulfide (H₂S) and are part of the utilities unit of the refinery.

The upgrade boosted Ras Tanura Refinery's output of gasoline from 18 percent to 32 percent for each barrel of oil processed; the yield for middle distillates, including diesel and kerosene, rose from 37 percent to 41 percent per barrel;



Above: A Saudi Aramco employee drives through the immense refinery complex. **Middle:** Oil tankers take on cargo from a loading pier at Ras Tanura. A floating dry dock is one of the many state-of-the-art facilities that make up the Ras Tanura Refinery and terminal complex.

and the output of lower-value fuel oil fell from 42 percent to 24 percent.

HRH Amir ‘Abd Allah ibn ‘Abd al-‘Aziz, then crown prince and vice president of the Council of Ministers and head of the National Guard, was on hand to inaugurate the 1999 facility upgrades, which raised Ras Tanura Refinery’s

capacity by 144,000 bpd and reaffirmed its status as an industry leader.

During 2002–2003, a new 200,000-bpd NEAT Khuff condensate fractionation facility further increased refinery’s ability to capture high-value “white” products such as diesel, naphtha and kerosene from gas condensate, and therefore increase profitability. The facility featured a 74-meter-tall column (C-200) weighing more than 550 tons. Two Multi-Effect Desalination (MED) units to convert seawater into sweet water were also completed in 2003, and in September 2004 WiFi technology was introduced at Ras Tanura Refinery, allowing operators and engineers remote access to technology, documents and data.

Environmental stewardship

During decades of awesome growth and constant modernization, the importance of

protecting the refinery’s natural and industrial environments has never been lost in the maze of competing primacies.

“Ensuring that employees are living and working in a healthy environment has always been a high priority of Ras Tanura Refinery,” said Abdullah S. Zaindin, the manager of the Refinery Maintenance Department. “In ensuring that its operations do not create undue risk to the environment or public health, the refinery has undertaken a number of initiatives, including expanding the wastewater treatment plant, dismantling tetraethyl lead facilities, removing asbestos from the refinery building, automating steam flow to the North Flare to accommodate smokeless flaring, further minimizing the use of

chlorofluorocarbons and implementing a new technology for emissions monitoring that may be used company-wide.”

Zaindin said the refinery is also working to create an environmentally aware workforce well-versed in safety and environmental policies and acutely sensitive to the well-being of the community. “The refinery also regularly sponsors seminars and lectures in the local community to educate the wider public about safety and environmental issues,” Zaindin said.

What the future holds

Saudi Aramco’s Ras Tanura Refinery has continued to change with the times over the past 60 years, evolving into a world-class processing facility, efficiently meeting the needs of the community, the Kingdom and the world.

One key to the refinery’s unprecedented success over the years has been the ability to anticipate, evaluate and meet future market demands.

“We are always looking to the future,” explained Al-Naimi from his desk overlooking the refinery, “and now we are having discussions on how to integrate the refinery with petrochemicals in the Kingdom.”

A study is currently underway on a proposal to form the Ras Tanura-Ju‘aymah Petrochemical Program. Under the proposal, Ras Tanura Refinery would produce feedstock — by-products already produced by processes at the refinery — for petrochemical facilities in Ju‘aymah. Further processing would yield petrochemicals used for such things as antiseptics, automobile antifreeze, cups, detergents, insulation lubricant additives, molded toys, nylon fibers, pharmaceuticals, resins and various plastic-based products.

Facilities under consideration in the \$6 billion proposal include an ethane-naphtha cracker, an aromatics recovery complex and complementary downstream derivative units to produce secondary petrochemicals.

Any formal relationship between the refinery and the petrochemical industry is expected to increase Saudi Aramco’s profitability and result in significant capital investment savings through resource sharing. However, according to Al-Naimi, the bottom line is the long-term benefits the program would net for the company, the community, the Kingdom and the world.

“The integration of Ras Tanura Refinery with petrochemical development would increase our gasoline production [for the local market] and help Saudi Arabia’s basic petrochemical industry,” Al-Naimi said. “The project would support privatization, provide employment opportunities for Saudis and generate revenue.”

“This is what we have always done,” he said. “looked to the future.” ■

1954 – An airlift of mammoth proportions delivered 109,336 pounds of heavy parts and materials to Aramco’s Dhahran airport during an incredible eight-day journey which began in Pittsburgh. Seven chartered planes of Seaboard and Western and KLM airlines were involved in the delivery, which included 80 sections of heater tube for Ras Tanura Refinery’s crude unit No. 1. The tubes, which measured 45 feet in length, barely fit into the cabins of the planes, and could only fit into the cargo compartments after sections of the front cabin wall had been removed, resulting in tubes jutting into the cockpit.

As the Ras Tanura Refinery passes through the twilight of an era, it is expanding into petrochemicals and other valuable products of the future. These will diversify the domestic economy and provide new jobs for Saudis. Inset: Some of Ras Tanura's family homes back onto beautiful, white-sand beaches.

