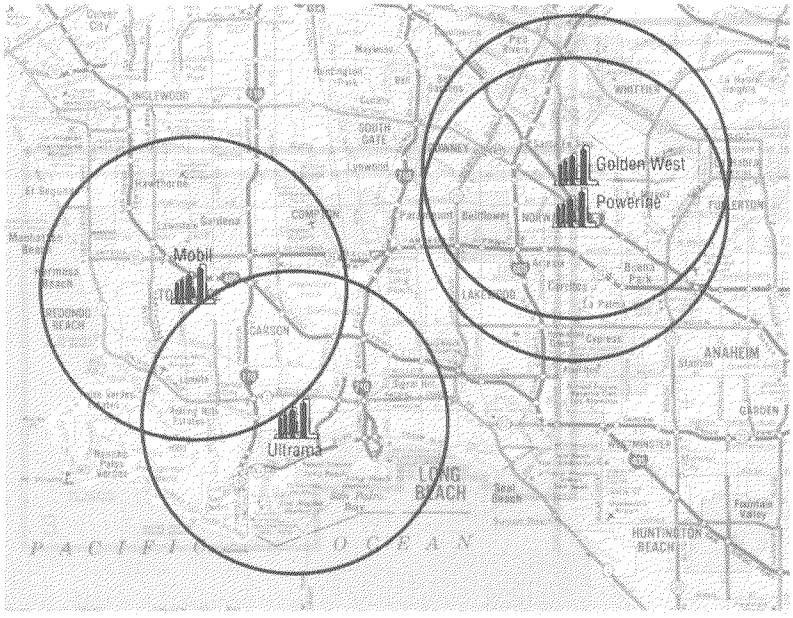
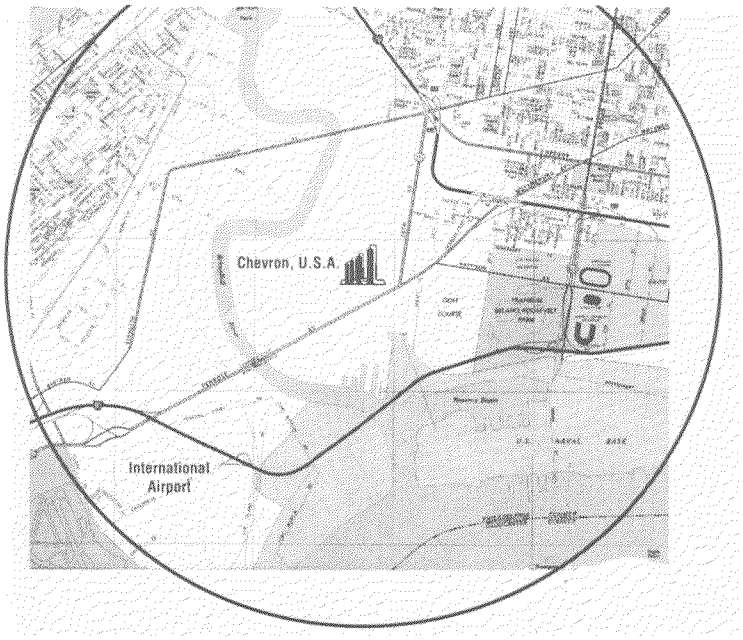


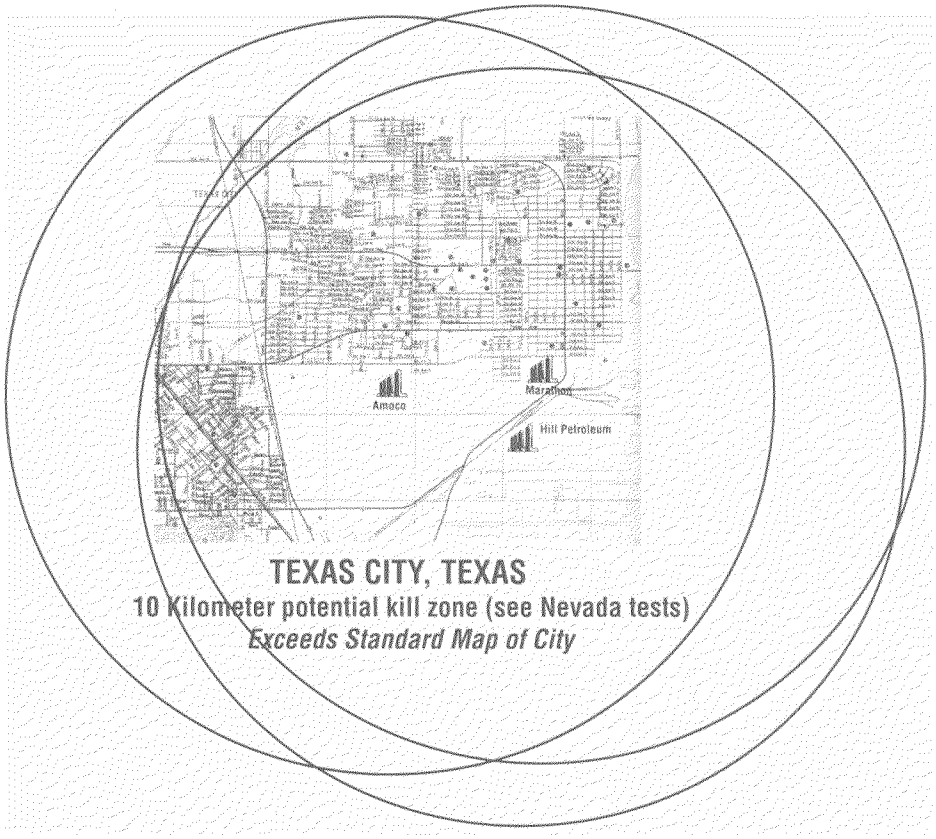
LOS ANGELES AREA

10 Kilometer potential kill zone (see Nevada tests)



PHILADELPHIA

10 Kilometer potential kill zone (see Nevada tests)



California, appointed a task force to study the HF hazard. Concluding that HF represented a "significant public health risk," the SCAQMD recommended a phase-out of HF at all refineries within its jurisdiction. Rule 1410 subsequently was adopted by the SCAQMD board on April 5, 1991, and requires a total phase-out of HF within seven years, not only at the four area refineries but also at an Allied Signal plant that uses HF to make chlorofluorocarbons (CFCs). In addition, the Rule mandates interim safety measures at the various facilities using HF.

Indeed, there seems to be little justification for continuing the use of HF as a catalyst in petroleum refining. This was the conclusion of Conrad V. Chester of Oak Ridge National Laboratory. "Safety considerations seem to lead to a preference for sulfuric acid rather than hydrofluoric," wrote Dr. Chester.[32] Dr. Chester's conclusion is echoed by Fred Millar:

> "There is a safer alternative than HF. About one-half of the oil industry's refineries already use sulfuric acid instead of HF for alkylation – indisputably a considerably safer process to workers and local citizens, in terms of occupational exposures and catastrophic potential – and these safer refineries do not seem to be going broke."[33]

By contrast to most hazardous industrial chemicals, where no alternative exists, HF can be replaced by sulfuric acid in the alkylation process. Not only would this lessen the risk of a catastrophic incident, but in most cases H_2SO_4 alkylation results in a slightly higher octane product.

While there is a strong movement to phase out HF at all refining facilities in the United States, this is not true abroad. Due to inadequate media attention and concern by public officials, even those living adjacent to HF refining facilities in many foreign countries are indifferent to, or completely in the dark about, HF's hazards. "We're absolutely, blissfully ignorant of HF and the consequences of a major release," observes a British environmental activist.[34] Moreover, the environmental movement is in embryonic stages in many parts of Western Europe, especially the southern tier of states along the Mediterranean. Occupational health and safety standards, as well as physical security precautions, also lag well behind the United States in many areas. What is more surprising, in countries where there are powerful and vocal "Green" movements, such as Germany and the Netherlands, HF alkylation technology is under consideration at several refineries, such as the Heide refinery operated by DEA in Germany. HF technology has actually been selected over H_2SO_4 at the Karlsruhe refinery in Germany.[35]

At this writing, HF technology is being considered at four refineries in Spain (Repsol's Puertollano refinery, Repsol's La Coruña refinery, Petronor's Somorrostro refinery, and CEPSA's Algeciras refinery), at Petrogal's Sines refinery in Portugal, at OMV's Schwechat refinery in Austria, and at two refineries in France (Total's Dunkerque and Gonfreville refineries). Despite the hazards associated with HF, the Atochem refinery at Lavera has selected HF technology, as has the ELF unit Feyzin, France. Finally, Fina is considering an expansion of its HF alkylation unit at Antwerp.

Accidents

Petroleum products are indispensable to modern life. From fuel to plastics, lubricants, and even medicines, we are totally dependent on the refining and chemical industries, as we are on other critical industries which use highly dangerous manufacturing processes and hazardous materials. Nevertheless, these industries are highly susceptible to disruption, either through accidents or via sabotage.

Just as the disaster at Bophal, India was an accident, so too have virtually all of the major catastrophic process-related incidents at industrial facilities employing HF been accidents. No technology is perfect. By the same token, neither are the people who operate

dangerous industrial facilities. No matter what safeguards are built into each system, and irrespective of how good the training and discipline of the operators, human factor accidents will still happen as a result of negligence, ignorance, and errors of judgment. It is well to remember that the disaster at Chernobyl, and the near disaster at Three Mile Island, were both caused by operator errors.

Indicative of such operational problems, following the 1988 and 1989 releases of HF at the Phillips Petroleum Company's Woods Cross refinery in West Bountiful, Utah, a chemical safety audit was conducted. Numerous design and operational deficiencies were discovered, including the absence of containment dikes and wastewater tanks at the time of the releases, inadequate emergency procedures, insufficient contractor safety training, and poor communications. According to the final report prepared by the auditors, "The facility has tried one emergency alert horn since the audit and found it to be unsatisfactory. Another is on order."[36]

To its credit, Phillips reportedly has corrected all of the shortcomings described in the safety audit. Nevertheless, that they existed at all is clear evidence of the many safety and security problems characteristic of hazardous industries even in the United States.

These problems are now beginning to receive attention. The recent actions by the South Coast Air Quality Management District and Congress (the 1990 Clean Air Act Amendments) are indicative of the growing concern in the United States over HF's hazards. Similarly, the European Community's (EC) 1982 Sevaso Directive was adopted after two serious HF accidents in Europe. However, the national regulations implementing the Directive are still being developed in some EC countries.

The situation is even more serious in the developing world, where operators often are not as well trained as in more technologically-advanced nations, and where industrial facilities often lack many of the safeguards taken for granted elsewhere. Thus, accidents will happen in the future – both in the advanced industrial countries as well as the developing world – no matter what pains are taken to prevent them.

An even more serious potential problem is that of deliberate industrial sabotage.

It was the third time they had circled the refinery in the rental car.

The driver, Adwan Jamali, a Circassian Arab with watery blue eyes and light skin, shook his head in amazement.

"It's too good to be true," he rasped in Arabic to his swarthy partner, a Palestinian terrorist by the name of Tarfiq Sabbagh. "There's no security whatsoever. Not even a fence all the way around the refinery."

"It's a lot different than Baghdad, eh?"

"True, my friend. How true."

They had arrived in the United States ten days earlier on forged Egyptian passports, posing as executives of a small oil drilling supply firm located in the Emirates. Both men were well-tailored, spoke fluent English, and had previously lived underground in the United States as part of their training by the Iraqi secret police.

Using a circuitous route to throw any surveillance off their tail, they traveled first from Detroit to Lincoln, Nebraska, then to Denver, before ultimately renting a car and driving to the east coast.

While in Denver, they rendezvoused with another Palestinian terrorist, who had slipped over the Mexican border with several explosive devices. The devices had been disguised in accordance with reports from the surveillance team in the target city. They were painted with company markings and were the same color as the aklylation unit at the refinery they were going to hit.

"OK," Jamali said at last. "Let's do it."

Both men donned hard hats and clipped plastic name plates to the breast pockets of their coveralls. Jamali used the name "Donatello," which he'd borrowed from the Italian restaurant where they'd eaten dinner in Denver, and Sabbagh's name plate read "Rodriguez."

As they came back around by the main gate, Jamali put on his signal light and turned into the plant. He stopped at the guard shack, but there didn't appear to be anyone around.

Something's wrong, he told himself. Where is everyone? Maybe it's a trap?

"I don't like it," he said softly.

But Sabbagh tapped him lightly on the shoulder and pointed to a large sign near the window of the gatehouse. "Visitors are requested to sign in at the Administration Building (Building K)," it read, and there was a map of how to get there.

"I don't believe it," sighed Jamali. "The United States is at war and there is no security at its industrial facilities?"

"Don't complain, my friend," responded Sabbagh. "Let us just give thanks that the Americans are so foolish."

"You're right. It's like my father used to say, 'Trust in Allah, but

tie up your camel.'"

None of the refinery workers paid any attention to the cream-colored sedan as it threaded its way through the complex. Finally, Jamali pulled over and parked in a lot near a row of storage tanks. They removed a tool box containing the two explosive devices from the trunk and walked casually in the direction of cracking towers. The grey-blue tank containing hydrofluoric acid was on a low platform, nearly at ground level, in the shadow of the cracking towers.

As the two saboteurs approached the HF tank, another plant worker greeted them as he passed by.

Jamali, in his best West-Texas accent, responded, "Hey, how's it goin'?"

No one evinced the slightest interest in their activities as they affixed the two explosive devices to the side of the HF tank. Jamali then opened each box, set the timer, closed it up, and rolled the tumblers on the combination locks. It all took less than a minute. When they were finished, Jamali and Sabbagh returned to the car and left the plant, passing through the unguarded main gate. They drove directly to the city's nearby international airport, and two hours later boarded separate flights for Europe.

Late that afternoon, as Jamali's flight approached Rome's Fiumicino Airport, and more than an hour after Sabbagh's flight had landed in Frankfurt, explosions tore through the HF tank, producing a dense fog-like cloud of toxic vapor that quickly overwhelmed the facility's water mitigation system. The cloud drifted rapidly in the direction of the airport, where ground workers began choking and gagging, and soon dropping on the tarmac like flies, to the horror of those in the terminal and passengers aboard aircraft waiting to depart.

Airport operations rapidly were suspended and a makeshift evacuation initiated. However, there was not enough transport for the thousands of people trapped at the airport, and the buses and trucks that did try to flee rapidly became ensnarled in a massive traffic jam on the narrow access roads. Many died in their vehicles.

From the airport the cloud passed over a working-class residential area, searing the lawns and trees and turning them brown. Although the concentration of HF had begun to dissipate, thousands of people experienced serious respiratory difficulties and damage to their eyes. Hospitals as far away as New York and Washington were enlisted to treat the injured.

The following day, an anonymous caller to the *International Herald-Tribune* office in Paris claimed credit for the attack on behalf