CHAPTER

A Mixed Blessing

Energy, Economic Growth, and Houston's Environment

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A cartoon in the *New Yorker* magazine shows two well-dressed men sitting and talking in a comfortable home. Yet in the midst of this picture of prosperity and comfortable satisfaction sits a miniature oil derrick spewing oil all over the room. The caption reads simply: "It's a mixed blessing." This cartoon captures the dilemma of Houston's oil-led development. Oil and related industries transformed the city into a major metropolis, but the costs included profound and long-lasting impacts on the regional environment.[1] The region benefited economically from the heavy concentration of many of the nation's oil-related industries, but it also suffered from the concentration of many of the nation's oil-related environmental problems. Much of what is unique about Houston environmental history reflects the mixed blessing of its historical role as the nation's oil capital. Oil helped make Houston a symbol of opportunity in a poor region of the nation. But as the region's oil-related industries and its population boomed, air and water pollution from oil-refining and petrochemical production combined with the exhaust fumes from the gasoline-powered cars that clogged its freeways to create serious problems that grew to threaten its future growth.[2]

The Region before Oil (1836–1901)

Houston prospered before the coming of oil. In the sixty-five years between its founding in 1836 and the Spindletop discovery in 1901, the city grew steadily

into a significant regional center of transport, trade, finance, and legal services. What began as a relatively isolated and undeveloped area gradually forged stronger ties with the industrialized Northeast. Using energy sources other than oil and natural gas, the city built a healthy economy that benefited from the trade of cotton and timber from interior regions. As Houston's economy grew, the city confronted environmental problems that seem minor only in retrospect. But more significant for modern Houston than the specific problems faced were the attitudes and institutions that developed in the years before oil and continued to shape regional approaches to pollution control far into the twentieth century.

Other than the availability of ample water and natural resources, the upper Texas Gulf Coast was not a particularly promising location for a thriving city. The terrain was flat for as far as the eye could see in all directions. Heavy rainfall often made large sections of the region impassable marshland, and frequent deluges regularly caused serious flooding along regional rivers, streams, and bayous. The threat of hurricanes loomed for six months a year, from June to November, and the same months often brought oppressive, debilitating heat and humidity. Flat, ugly, wet, and hot—no wonder Frederick Law Olmstead, who traveled through the region from Houston to New Orleans in the 1850s, remarked: "this is not a spot in which I should prefer to come to light, burn, and expire; in fact, if the nether region . . . be a boggy country, the Avernal entrance might, I should think, with good possibilities, be looked for in this region."[3]

Many of those who migrated to this boggy country often made a two-part journey. The first was a move from such states as Tennessee and Georgia to the agricultural areas in eastern Texas and western Louisiana in search of land and opportunities. The second often came a generation or two later, as the children and grandchildren of the early migrants moved to nearby cities to escape the hard lot of the small farmer. To such migrants, Houston was an island of urban opportunities in a sea of rural poverty. Those who found their way to the Houston area were a part of the general westward movement that shaped the nation's expansion in the nineteenth century. At least until the Civil War, they also were often a part of a "southern movement," as plantation owners, their enslaved labor force, and those who supplied goods and services to the plantations pushed westward from the Deep South in search of new land that could be adapted to a plantation system based on slave labor.

Early in its history, Houston benefited from its proximity to the rich bottomlands of the Brazos River, where cotton plantations flourished in the decades before the 1860s. These large plantations became a focus of economic activity in southeastern Texas, and merchants in Houston and its rival city to the south, Galveston, hustled to create profitable ties with the cotton-growing regions in the interior. This was a difficult challenge given the rudimentary

transportation system and the lack of dependable supplies of energy then available to connect the interior and the coast, and Houston's early growth resulted from its successful responses to this challenge.

One key problem was to develop efficient transportation and trade ties in an area not blessed with easily navigable rivers. Of all of the region's rivers, the Brazos came closest to being navigable from the coast to the interior, but difficulties with sandbars near its mouth hampered its use. Despite an abundance of readily available wood for wood-burning steamships, the region's waterways did not provide dependable, efficient transportation to carry cotton crops from the Brazos bottom to market. The use of wind, water, wood, and muscle power limited development in a sparsely settled region on a broad expanse of marshland and prairie.[4]

From its founding in 1836, Houston's civic and business leaders set about to find transportation improvements that could quicken the pace of development. Their top priority was the improvement of waterways, including Buffalo Bayou, the meandering stream on whose banks they had founded their new city. But they also worked to build other means of transport. The creation of better roads to the interior became a pressing concern, since travel by animal -drawn carts was almost impossible after heavy rains. Here the region went through a cycle of road building similar to that described in the northeastern United States in George Rogers Taylor's classic history of the transportation revolution.[5] One difference between the South and the Northeast was the availability of enslaved labor to work on these roads in the South, but little could be done with existing technology to protect graded dirt roads from becoming steams of mud during the frequent heavy rains that plagued the region. An effort to build and maintain a plank road between Houston and the interior failed because of the prohibitive cost and the lack of durability of planks in the harsh environment of the area.

It was thus not surprising when merchants in Houston and Galveston became strong supporters of the construction of railroads from the coast to the cotton-growing regions. Boosters in the two towns battled to find the capital and the political support needed to construct railroads that could bring cotton to their towns while shipping goods back to the plantations. By the 1850s, the first relatively short lines for wood-burning railroads had been completed. By 1860, Houston was the starting point or terminus for some 80 percent of the approximately 500 miles of track that had been laid in Texas, and its rails reached out up to 90 miles into the hinterland in several directions. In the process of building these early railroads, Houston leaders also clearly established what became a defining characteristic of the city's civic elite—the tradition of boosterism.[6]

"Opportunity" and "expansion" early on became the central tenets of Hous-

ton's religion of boosterism. Whatever it took to foster economic growth in the region would be done. Generation after generation of Houstonians understood that they could prosper individually only if their city on its unlikely location on the flatlands of the Gulf Coast also prospered. Many of the most fervent boosters were individuals who had migrated to Houston from the small towns in the interior of Texas in search of a larger stage on which to pursue their ambitions. Such adopted sons and daughters established a tradition of voluntarism in civic affairs that became an identifying characteristic of their city. In a city whose leaders trumpeted the positive and ignored the negative, pollution was not likely to be high on the civic agenda.

The coming of the Civil War changed everyone's agenda, temporarily stopping the expansion of regional rail lines and most other economic activity. At war's end, the city had to come to grips with the new world brought by the dislocation and chaos wrought by the South's defeat—and the end of slavery. Many black and white sharecroppers and subsistence farmers who before the war had fought the soil for sustenance in the Texas interior looked to Houston and other cities on the coast for a change in circumstances. Segregation and discrimination remained overpowering burdens on blacks throughout southeast Texas, but Houston afforded the freemen and women somewhat better job and educational opportunities, and even a measure of increased personal freedom in the large black communities that grew in the city.[7] Largely undamaged by the war, Houston rebounded from the defeat of the South more quickly than most other Southern cities.

The most significant change in the regional economy in the postwar years was the extension of national railroad systems through the region. In a flurry of activity in the 1880s and 1890s, national railroad systems such as the Southern Pacific completed connections into the region. While fundamentally altering the region's transportation system, the railroads also quickly became the largest employers and the most important financial entities in the region. Such railroads have been called "the nation's first big businesses" because they brought a new scale of activity and innovations in management and finance. They also assured Houston's future growth by cementing its status as the transportation hub that would connect the upper Texas Gulf Coast to the Midwest, while serving as a logical stopping point in east-west trade and travel between Florida and California. By the turn of the century, the railroads had tied the region into the national economy, allowing for the shipments of cotton, timber, and other natural resources to national and even international markets.[8]

These railroads also encouraged an important transition in energy use, the move from wind, wood, water, and muscle power to coal in the region's major industries.[9] The railroads provided an efficient way to transport coal from the

ports on the Gulf Coast into the surrounding areas in the interior. In the late nineteenth century, the railroads and other leading regional industries burned coal shipped down the Mississippi River from Pennsylvania and Alabama or brought by the railroads themselves from the same areas. Major fuel-burning industries quickly made the transition from wood to coal, a new and better-burning fuel. Railroads, steamships, breweries, sugar refineries, timber processing, and, later, production of electricity and manufactured gas led the way in the consumption of coal. A coal-led industrial revolution began to transform the region in the 1870s, and the railroads were the key agents of this change. In this sense, they were more than the first big business in the region; they also were the first business to transport large volumes of coal to markets throughout the area and the first major industry to burn the fossil fuels that ultimately transformed the area's economy and its environment.[10]

Economic opportunities spurred by the railroads attracted a growing population, which reached about 45,000 by 1900, marking Houston as a substantial regional trading center. In some ways the city's expansion before oil mirrored its subsequent growth. Both before and after oil, the transportation and processing of raw materials for export constituted the engine of growth. The strong banks, law firms, and trading capacities developed before 1901 served the oil industry well after that date.

The environmental ethic of the preoil era reflected the attitudes of late-nineteenth-century American capitalism, with its emphasis on harvesting resources as rapidly as possible with no concern for the long-term depletion of these resources. Within a large region with relatively few people, few questioned this process. Cotton growers depleted the soil and then moved on. The rapid clear-cutting of the pines and hardwoods of East Texas for short-term profit went forward with little thought about the future. No one stopped to envision a time when companies could not just move on to previously uncut stands of timber in these giant forests. To most people in the region, the smoke produced by households burning wood and by the railroads and industries burning coal was a symbol of progress, not a warning of potential environmental problems. The attitudes of these formative years in regional development, when a vast area with a good natural resource base seemed capable of sustaining rapid growth far into the future, carried forward into the first decades of oil development.

Had oil not been discovered near Houston, the continuation of this coal-based economy would have produced a much different economic and environmental future for the region. The costs of coal imports would have posed a barrier to rapid, sustained economic growth. Large investments would have been required for manufacturing plants to convert coal to gas for a variety of uses, a

movement that had begun in Houston by the 1890s. As in many coal-burning cities, serious localized air pollution undoubtedly would have emerged as the city grew.

Beyond such general observations, the magnitude of the differences between Houston as a coal-burning regional center of trade and Houston as a national center of oil and natural gas production is strictly conjecture, although several easy generalizations are possible. First, since oil and later natural gas were superior and cleaner-burning fuels than coal, the transition to oil undoubtedly reduced the most visible air pollution from the region's railroads, its industries, and its power-generating plants. But, of course, much of the use of oil for fuel came in new markets created by the economic boom in the region after the discovery of oil. Although it is impossible to calculate the overall environmental impact of the transition away from coal, it is clear that the coming of oil pushed the region onto a new economic and environmental trajectory.[11]

Era of the Gusher (1901–1930s)

Oil came to the Gulf Coast with a roar on January 10, 1901, with the discovery of the Spindletop gusher near Beaumont, Texas, some ninety miles east of the city of Houston. The inscription on a memorial later erected near the site of the discovery immodestly claimed, "On this spot, on the tenth day of the twentieth century, a new era in civilization began." This inscription correctly describes the impact of Spindletop on the Texas Gulf Coast, where unrestricted flush production from this field and others subsequently found in the region began a fundamental economic and environmental transformation. Indeed, the coming of an oil-led economy greatly accelerated the pace of development, while redefining the boundaries of the region itself. The coastal region from southwest of Houston to south of Lake Charles, Louisiana, quickly attracted the capital, expertise, and workforce needed to develop this newfound resource, whose importance in national and international markets made the region a magnet for outside investment. In the process, control of much of the decision making about the region's future flowed into the major oil companies that came to dominate oil production and refining in the region.[12]

Amid the excitement caused by the Spindletop discovery, the upper Texas Gulf Coast followed the pattern of boomtown development common in areas near mineral deposits throughout the western United States. An orgy of oil exploration and production followed Spindletop, with oil specialists from around the nation drawn to the Gulf Coast by the promise of new fields that rivaled the unprecedented size of the Spindletop field, which was far and away the largest yet discovered in the United States. After 1901, the locus of oil production in the United States shifted sharply from the Northeast to the Southwest, heralding a new era in the scale of the oil industry and in the use of oil for fuel. As

explorers fanned out in all directions from Beaumont, they quickly found new fields throughout the surrounding sections of the Gulf Coast. Several of these fields moved the center of production closer to Houston, notably the opening in 1905 of the giant Humble field twenty miles north of the city and the Goose Creek field about the same distance to the east, which was discovered in 1908 and developed a decade later.[13]

The rush to develop the area's oil wealth created jobs and economic prosperity, but it also produced an oily mess of pollution. Brian Black's excellent study of the Pennsylvania oil boom of the late nineteenth century provides a useful backdrop for understanding the social and environmental consequences of rapid oil development.[14] But the Gulf Coast oil fields were much larger than those in Pennsylvania, and the rush to pump oil from the ground had even more extreme impacts in Texas than in Pennsylvania. Texas experienced unfettered capitalism squared, as the "normal" cutthroat competition of the era was heightened by conditions peculiar to the oil industry and to the region. Under the rule of capture, the legal doctrine governing oil production in the United States until the 1930s, any leaseholder above any underground oil reservoir had the legal right to pump oil from the field. Thus once oil was discovered, the race was on to acquire a lease over the field and pump as much oil as rapidly as possible. Extreme waste from gross overproduction, considerable evaporation from makeshift storage, dangerous fires, and abundant runoff of oil into surrounding waterways resulted.

Early oil development around Beaumont provided the most extreme portrait of production under the rule of capture, but the development of smaller fields in the region later produced similar waste. Before it could be controlled, the Spindletop gusher shot a spray of oil estimated at 100,000 barrels a day 100 feet above the derrick for nine days. Then hundreds of other wells from surrounding leaseholders quickly tapped the same reservoir. The rush to market left oil covering everything in sight. In the absence of an existing local industry capable of building the wooden or metal storage tanks used in the eastern oil fields, mule teams dug giant earthen pits that held as many as three million barrels of oil. The Texas heat encouraged the evaporation of oil fumes from these lakes of oil into the atmosphere. Massive, deadly fires plagued the southwestern oil fields; several fires destroyed much of Spindletop itself in the first years of its existence. Such extreme conditions were not, however, a matter of pressing public concern. Indeed, the gusher became a symbol of pride and of a bright oil-led future for the region. Operators at times treated excursions of tourists and potential investors to the spectacle of minigushers created by opening valves and allowing oil to spurt freely into the air.[15]

In this era of frenzied production, severe pollution was not limited to the immediate area surrounding the oil fields. Runoff from the fields into surround-

Oil workers at Goose Creek Field, 1910s. Courtesy Houston Metropolitan Research Center, Houston Public Library.

ing streams carried a wave of crude oil into the region's rivers, bays, lakes, and harbors. In this relatively undeveloped region, even serious stream or river pollution by oil went largely unchecked, at least until regional growth brought new claims on the use of these waterways by people and industries outside the oil industry.

Most of the oil produced in the region flowed through pipelines to large refineries built near the new oil fields to process crude oil and ship crude and refined products. Immediately after Spindletop, the Beaumont–Port Arthur area became the home of three major refineries of prominent oil companies: Gulf Oil, Standard Oil of New York (Mobil), and the Texas Company. These plants grew to rank among the largest in the nation throughout the twentieth century. The Houston area began to attract refinery construction in the decades after the opening of the Houston Ship Channel in 1914. With large tracks of inexpensive land, ample supplies of fresh water, abundant natural gas available for fuel, and access to the sea, the land on both sides of the ship channel remained a favored spot for refinery construction and expansion from the 1920s into the 1960s. The refining region between the Houston Ship Channel and Sabine Lake (near Port Arthur) became the location of the largest domestic refinery

of most of the major American oil companies. The 1929 *Census of Manufactures* estimated that 19,000 refinery workers resided in Harris County (Houston) and Jefferson County (Port Arthur and Beaumont). By the end of the 1930s, this region alone accounted for about one-third of the nation's refining capacity. The giant industrial plants that refined crude oil became a primary source of industrial jobs and a powerful engine of growth for the upper Texas and Louisiana coasts, with the Houston Ship Channel gradually emerging as the center of this vast refining region.[16]

In the era of the gusher, however, these plants were dirty and dangerous. Oil being heated under pressure coursed through pipes and into stills, with significant leakages throughout these early refineries. The rapid expansion of these plants, the frequent introduction of new technical processes, and the lack of good training for many of the country boys who flocked to work in them set the stage for frequent explosions and fires. The general pattern was to "learn by doing." Thus when large quantities of oil with heavy sulfur content came to the region's refineries from Mexico in the early 1920s, sulfur fumes caused serious problems for workers and even for those living near the plants until modifications in refinery processes limited the escape of emissions high in sulfur content.[17]

Fumes from all phases of refining escaped into the air. Lacking knowledge of such emissions' potential implications for health, refinery owners had little reason to worry about closing up the refining system to minimize discharges. The same was true of oil leaks that contaminated the ground and water. Heavy rains in the region washed much of this leakage into the ground and surrounding waterways. The millions of gallons of fresh water used for cooling did not escape contamination before being pumped back into the ship channel or rivers and lakes near other plants. All in all, these early regional refineries were like old cars that burned and leaked oil, producing billows of smoke from their tailpipes while continuing to move powerfully along the road.

The shipment of crude oil into the refineries and the shipment of crude and refined products out of them remained a messy business in this era. Once the large investment needed to build giant refineries had been made, economic logic dictated the construction of expensive pipelines reaching out hundreds of miles to the major oil fields in the southwestern United States. While transporting hundreds of thousands of barrels of oil each day to the refineries, these pipelines experienced substantial leakage, which was excused at the time as the best that could be done with existing technology. The tankers that moved crude oil and refined goods from the refineries to global markets also spilled very visible pollution into the major waterways and into the Gulf of Mexico. Points of transshipment—from pipeline to storage tank, from tank to refinery, from refinery to loading docks, from docks to tankers—proved especially troublesome.

By the 1920s, oil spillages attracted the attention of other industries that relied on water transport and finally of the federal government.

One result was the first national survey of oil pollution near coastal cities, and this survey noted special problems in the Houston–Port Arthur area. Around the nation, coastal cities faced rising oil pollution due to an eightfold increase in the tonnage of oil shipped by tankers from 1914 to 1922 and the rapid substitution of oil for coal in fueling ships of all sorts. The opening of the Houston Ship Channel in 1914 and the building of refineries on both sides of the channel in the 1920s heightened pollution in the region.[18] In Port Arthur, the growing shipment of products from the giant plants of Texaco and Gulf intensified the pollution of the ship channel through Sabine Lake out into the Gulf of Mexico. The survey of conditions in 1922 and 1923 conducted by the U.S. Bureau of Mines in cooperation with the American Petroleum Institute (API), the primary trade association for the nation's oil industry, found the oil pollution in the coastal waters near Port Arthur and Houston to be the worst in the nation.[19]

By this time, a steady stream of oil-burning tankers visited oil ports along the Houston Ship Channel and in Galveston, Port Arthur, Beaumont, Baton Rouge, and Lake Charles. Galveston suffered severe pollution from oil-contaminated ballast water dumped near shore as tankers and other oil-burning ships prepared to enter the port. The beach at Galveston also suffered regular oil contamination as heavy rains frequently washed oil into the Brazos River from oil fields along its banks. Although the Brazos entered the Gulf some fifty miles southwest of Galveston, the surveyors found that the prevailing current in the Gulf often brought this pollution up to Galveston's beaches within a couple of days. The survey reported significant financial losses to Galveston merchants from closures of the beach due to oil pollution.

Conditions were just as bad along the Houston Ship Channel and the bayous and streams that emptied into it. The survey found that most manufacturers in this area were careless in the handling of oil for fuel. The surveyors noted that the "comparative cheapness of fuel oil and crude renders it less imperative from a financial standpoint to recover wastes here than in the north." This made Houston "among the worst polluted places we visited."[20]

The survey said the same about the Port Arthur area, where the pace of pollution control obviously had not kept up with the increased shipments of oil needed to supply an expanding demand for crude and refined products. So bad had the oil pollution become in Sabine Lake that oil companies had begun to use crews to skim oil off the surface of the lake and return it to the refineries. Oil pollution had forced the once-thriving lumber industry in the area to move up the Sabine River to Orange, Texas.

The report gave numerous examples of the "very elementary stage" of oil

pollution control in the Houston region. Any system of pollution control that could not adequately deal with heavy rains was elementary, indeed, in a region noted for its frequent floods. Similarly, in many of the refineries the expansion of separators for removing oil from cooling water and for handling runoff had not kept pace with the growth in refining capacity, another clear sign that pollution control was not taken seriously. Often large spills at transshipment points could have been reduced dramatically simply by taking more care in the transfer of oil. In several places, the report made clear that facilities in other regions tended to be cleaner than those around Houston. After interviewing the public officials charged with maintaining the recently opened Houston Ship Channel, those making the national survey noted the absence of "the spirit of cooperation" needed to clean up oil pollution. After the publication of the Bureau of Mines–API report, oilmen with a strong interest in unfettered development along the ship channel forced the removal of local officials who had pushed for tighter control of pollution in the ship channel.[21]

The politics of pollution control were easy to understand, but difficult to change. The region had tied its economic fate to the oil industry, and those who owned the major companies—as well as the thousands of new workers who found employment in the industry—favored jobs and growth over all else. Oilmen had a strong aversion to government regulation of any kind, but they were hardly alone in their opposition to pollution controls and other regulations. Many of the region's refinery workers had migrated to their new jobs from dirt-poor conditions in nearby farming regions, and a steady paycheck more than compensated for polluted conditions. Local politicians and civic leaders sang the song of boosterism common to the emerging Sun Belt cities, and they repeated the refrain again and again: unrestrained economic expansion would put their city on the national map.

State-level government agencies had some incentives to sound the alarm over oil pollution, but very limited resources with which to work. The state attorney general's office, the Texas Fish and Oyster Commission, and the State Board of Health each had a partial mandate to address aspects of the problems caused by oil pollution. But their budgets were so small and their multiple responsibilities so great that there was little hope of a successful push to clean up the region's water. In this sense, oil pollution in the era of the gusher can be seen as an externality in search of an institution. Until at least the 1960s, no local, state, or federal agency had a clear mandate to make pollution control its top priority. When forced to allocate quite limited funds and personnel to specific issues, all of the existing agencies with limited powers over some part of the pollution problem chose to focus on issues that had a higher priority than pollution control. The State Board of Health, for example, had many more pressing demands on its resources than diseases related to oil pollution.

The politics of pollution control played out somewhat differently in the more developed regions of the nation. The survey of conditions in the early 1920s suggested that in the more-developed Northeast, oil pollution did substantial harm to fishing, to beaches, and to vacation homes on the shore. Those with economic interests threatened by the spread of oil pollution—and their insurance companies—fought back. Such interests led the call for action by the U.S. Congress on new pollution control laws, which in turn led to the national survey of oil pollution in the nation's coastal waters. But antipollution groups lacked the political clout to successfully challenge the oil industry.

By the 1920s, the oil industry had strong incentives to take control of the problem. The price of oil made some measures to stop leakages economically logical, but the drive for greater efficiency also had an engineering component that could go beyond short-term profits. The waste of the era of the gusher went against the grain of the training and experience of good engineers, who gradually moved to clean up the worst pollution in the interest of engineering efficiency. But perhaps the strongest incentive for improved self-regulation in this era was practical politics. Oilmen feared that if they did not clean up the most visible pollution, they would face government regulation. The threat of "outside" regulation was a powerful motivator for oil executives who desired to keep autonomy over their businesses.[22]

This was clear to see in the industry's response to the growing national political debate over pollution in the 1920s. After vigorous debate, in 1924 Congress passed a relatively weak law that regulated only oil pollution in coastal waters. The law contained a stipulation that Congress would reexamine this issue in 1926, with stricter regulatory measures to come in the absence of substantial progress in controlling such pollution. In response to this law, the oil industry kicked into high gear in creating an industry-wide initiative to reduce water pollution from its operations. The API led the way with a wave of studies and new recommended practices for reducing oily discharges into the nation's navigable waters.[23]

The oil industry's campaign for self-regulation proved to be a successful part of a broader campaign to block government regulation of oil pollution. By cleaning up the most visible pollution, the industry reduced the pressure for stricter government regulations. Industry representatives also proved very adept at political lobbying, especially in the southwestern states, where oil had become so economically important. One effective strategy was to appeal to southern legislators to fight federal pollution regulation on the grounds of states' rights, an argument guaranteed to get the attention of influential southern senators strongly committed to protecting their segregated social systems from federal challenges. As a well-organized interest group with clear goals, long-term time horizons, control of the data about their critical industry, and

good lawyers and lobbyists, the oil industry proved quite successful in defining the terms of the political debate about oil-related pollution throughout the mid-twentieth century.[24]

Within the Houston region, few had to be lobbied by industry representatives on the issue of oil pollution controls. Oil had been very good to the region in the first decades of the twentieth century. Oil production had brought great personal wealth to "independent" oilmen who now made the city their home and headquarters. It had also attracted to the city the headquarters of several major oil companies. Oil refining was the sturdy backbone of industrial growth, providing the sort of factory jobs that attracted thousands of new workers and their families from the growing rural poverty of the hinterlands. Houston's population increased sevenfold from 1900 to 1930, when almost 300,000 people lived in the city. Times were good, and oil promised that the city would continue to prosper.[25] Amid this oil-induced boom, few Houstonians acknowledged that oil-related pollution might become a serious problem.

Mounting Pollution Under Self-Regulation (1920s–1960s)

From the 1920s through the 1960s, oil-related expansion drove the Houston economy forward, allowing the region to escape the worst of the Great Depression and fueling a sustained boom during and after World War II. Although the region became increasingly dependent on petroleum-based industries, it benefited from significant diversification within its oil-related core. As the giant refining complex continued to grow, it attracted a new generation of petrochemical plants often owned by the major oil companies and built adjacent to their existing refineries. The Houston-based natural gas industry also expanded dramatically with the coming of cross-country transmission from the Southwest to the Northeast. With the growth and the diversification of oil-related activities came more complex and diverse types of pollution.[26]

As the region prospered, Houston moved steadily up the ranks of the nation's largest cities. By 1970, the city's population was more than one million, with perhaps that many more inhabitants in a metropolitan area that spread in all directions along the flat coastal plain. An ever-expanding highway system held the city and its suburbs together, and automobile traffic steadily grew as more and more commuters drove more and more miles. By the 1960s, mounting air pollution from automobiles began to attract political attention as a serious and highly visible problem, but local officials had a most difficult time finding the political will and support to implement effective controls.

This was also true of other forms of oil-related pollution. Self-regulation by industry, put firmly in place in the 1920s, remained the norm until well into the 1960s. This generally meant that industry defined the primary approaches to pollution control, as well as the level of commitment. Various levels of gov-

ernment monitored this activity, cooperating with industry to assure more efficient handling of oil to reduce its discharge as pollution.[27]

This approach exhibited clear strengths in identifying waste and then reducing it with more efficient and less-polluting control systems and technology, but it also had inherent limits that became more apparent over time. One of the oil industry's strongest incentives to regulate itself was its desire to avoid coercive government regulations; when the threat of such regulation waned, so did the industry's commitment to stronger controls. A second weakness lay at the heart of the process of technological innovation in this era. The oil industry had very strong economic incentives to invest in new technologies of production, but few such incentives to invest in pollution controls. From the 1920s through the 1960s, techniques of pollution control failed to keep pace with techniques of production. Indeed, as practitioners of self-regulation in the industry made progress in cleaning up basic processes in the production, refining, and transportation of oil, new and more complex problems emerged as the scale and technological sophistication of oil-related activities increased.

In the refining of petroleum and the use of refined products, one telling example of this process was the introduction of tetraethyl lead (TEL) as the additive of choice for gasoline in the 1920s. The search for an additive capable of improving fuel economy reflected the perception for a brief time in the 1920s that the nation faced a shortage of crude oil. One way to address this potential shortage was to develop advanced refining technology that produced more gasoline from each barrel of crude oil; another was to develop additives to improve the burning of gasoline within cars. The industry took both paths with great short-term success. In the early 1920s, the Ethyl Corporation, a joint venture by Standard Oil of New Jersey, General Motors, and DuPont, announced a dramatic breakthrough in additive technology. An Ethyl Corporation representative hailed TEL as an "apparent gift of God" that "at small cost adds fifty percent to gasoline mileage." As the industry went forward with plans to produce and market the new additive, however, health specialists in government agencies and universities voiced fears of the possible environmental impact of an air-borne form of lead pollution that might be produced by its use.

Thus the mid-1920s witnessed an often fierce debate among health officials and executives of oil, chemical, and automobile companies about the possible regulation of TEL. Doctors who had long studied the illnesses associated with lead-based paint feared that long-term health problems might be caused by the widespread use of TEL. Those in industry countered by producing test results from studies of small samples of workers with limited exposure to TEL to argue that there were no observable health problems. When a highly publicized accident at an early TEL manufacturing plant resulted in the deaths of five workers in 1924, industry countered by instituting new safety procedures

and closing up the manufacturing process to protect workers from direct exposure to TEL. The expert opinion of industry specialists gradually overcame the doubts and the resources of their opponents, and by the 1930s TEL became the most common gasoline additive.

By this time, the perceived oil shortage had been replaced by a glut of crude oil, and TEL was used to fuel heavier and more powerful cars, not to increase gas mileage. Despite a U.S. Public Health Service study in 1926 that called for continued monitoring for possible long-term health impacts of TEL, no such monitoring took place. Indeed, a Public Health Service study conducted in 1959 lamented, "It is regrettable that the investigations recommended by the Surgeon General's Committee in 1926 were not carried through by the Public Health Service. If data were now available on body lead burdens, with 1926 as a baseline, a more objective decision would have been possible."[28] It might not have mattered, because the tests used to study possible long-term health impacts of air-borne lead could not readily identify such impacts until the 1960s and 1970s, when breakthroughs in the measurement of lead in the human body revealed that high concentrations of air-borne lead from TEL could harm the health and even lower the IQ of people who lived near highly traveled urban highways. The mandatory use of catalytic converters in the United States in the mid-1970s led to the banning of leaded gasoline for new cars, since the lead destroyed the effectiveness of the converters. Then new and more thorough studies of the health implications of TEL led to the total ban of its use in the United States, but not until after it had been used in most cars for almost forty years.[29]

Such changes in refining technology greatly affected the Houston region, which remained the center of one of the largest refining regions in the world from the 1920s through the present. The broad area from New Orleans to the Houston area grew to supply more than 35 percent of the nation's refining capacity by 1970, with the Houston Ship Channel and Port Arthur–Beaumont accounting for about two-thirds of this figure.[30] The giant plants in this region applied the latest in new refining technology, which became increasingly sophisticated in the post–World War II era. Each new technique to improve the yield and the quality of refined products introduced new questions about the resulting emissions. Although the refineries became cleaner, more efficient, and more concerned with worker safety under the self-regulation of this era, the expansion of production and the application of new technology to production processes remained the focus of attention, with much less regard for innovations that contributed to better monitoring or greater reductions in emissions.

This also was true for the large plants that sprang up near the refineries along the Texas and Louisiana Gulf Coast to supply the bulk of the nation's rapidly expanding petrochemical production during and after World War II. Lo-

cated on the Gulf Coast to take advantage of the feedstock from refineries, the abundance of natural gas, and the ready access to pipeline and water shipment, these petrochemical plants became the fastest-growing industrial facilities in the region. Combined with the refineries, they attracted tens of thousands of workers to the region while producing an array of new, petroleum-based products that found rapidly expanding markets in postwar America.

In retrospect, it is clear that this first generation of petrochemical plants held many new and poorly understood risks to human health. Those who worked in these early petrochemical plants before, during, and after World War II had secure, high-paying jobs in comparison to most other industrial jobs in the region. They also unknowingly served as human guinea pigs of sorts, with prolonged exposures over decades to largely unregulated discharges of many new, poorly understood, and potentially harmful emissions. The production of the butadiene needed to manufacture synthetic rubber in plants built in the region during and after World War II, for example, also produced emissions later linked to increased risks of leukemia. Benzene emissions, pollutants from vinyl chloride, and other potentially harmful emissions from the new plants were largely unregulated until the 1970s.[31]

Such emissions presented tricky problems for industry. Self-regulation that hoped to be effective over the long term would have required careful monitoring of the possible health impacts of pollutants from new technical processes used to produce new petrochemical products. But industry feared that the results of such studies might be used to justify stricter government regulations. Thus the safest approach for industry was that taken in the TEL case—quick studies with the promise of long-term monitoring. As long as government could not or would not assert an independent will to regulate the health impacts of such emissions, the logic of self-regulation as practiced in this era dictated a short-term, profit-oriented approach instead of a long-term, health-oriented one.

As early as 1922, British officials concerned about a high cancer rate among workers in the Scottish shale oil industry had written to the U.S. Bureau of Mines seeking any available information about the incidence of cancer among U.S. refinery workers. When the bureau forwarded the request to the medical director at Standard of New Jersey, which operated one refinery in Baytown near Houston and one in Baton Rouge, Louisiana, he responded that the cancer rate among refinery workers was probably lower than that among the general population because of the company's rigorous physical exams of new employees. He did, however, add that "this does not apply of course to the older men . . . and it is among this latter group that we have found the few cases that [we have] had under treatment." When the bureau wrote back asking for further clarification about these older employees, the company doctor abruptly ended

the discussion, asserting, "I have known of no case of cancer that could be attributed, even remotely, to exposure to paraffin or petroleum products."[32] For the next half a century, the industry generally took this "don't ask, don't tell" approach toward potential health problems associated with emissions from refineries and petrochemical plants.

In this era, companies in the oil and petrochemical industries applied the same general approach to the dumping of toxic wastes. Unwanted by-products from production processes could often be disposed of by contactors at dump sites far removed from residential areas. But "far removed" changed over time, as Houston's suburbs stretched out into the coastal plain. Decades after the dump sites had been used for toxic wastes, the city might encompass them, raising problems for those who at times unknowingly moved into neighborhoods near abandoned toxic waste sites.

In several areas, self-regulation proved more successful. To its credit, the industry made good progress in addressing the major sources of pollution inherited from the era of the gusher. In the refineries, oil fields, and pipeline and shipping terminals, this meant "closing up" the system to prevent the escape of oil. The major companies also learned to take much greater care in preventing oil from refineries and shipping facilities from washing off during heavy rains. They made use of industry trade associations such as the API to define and promulgate best practices for the industry in limiting pollution from a variety of aspects of their operations. Although the API stopped short of agreeing to serve as an "industry policeman" with coercive authority to inspect facilities and force those who did not comply with best practices to do so, it did build a solid reputation within the industry as an organization that could help companies help themselves on the difficult problems presented by pollution.[33]

As the industry made progress in cleaning up its operations, it faced new challenges such as pollution from offshore drilling and production. The industry's initial move "offshore" involved drilling in lakes and rivers. In the Houston area, production in the years between 1910 and 1920 from the Goose Creek field east of the city required Humble Oil and other companies to learn the best methods for preventing oil from escaping into the water. The same conditions prevailed in the 1930s in drilling in Galveston Bay and off of a trestle into the Gulf of Mexico near High Island. After World War II, the industry moved aggressively out into the Gulf of Mexico.[34] Although most of the major finds were in Louisiana waters, sufficient production came from wells offshore the northeast coast of Texas to threaten area beaches with severe oil pollution. This was a demanding environment, complete with hurricanes and the realities of blowouts and accidents that could place workers in life-threatening situations while presenting new challenges for the control of pollution. In the early decades of offshore development, area residents came to accept clots of oil on

local beaches as a necessary evil. As with the smell of the air in the refinery towns, such pollution of beaches was either shrugged off by most as inevitable or accepted as a symbol of oil-led prosperity. Oil pollution more directly threatened the prosperity of those who made their living fishing and shrimping and harvesting oysters in the Gulf and Galveston Bay, and they led largely unsuccessful protests against the harmful impact of oil pollution on their industries.

A variety of government agencies found themselves in the middle of the growing tensions between the industries that produced oil pollution and those directly harmed by it. The U.S. Coast Guard had responsibilities to regulate pollution from offshore oil production and shipment, and it entered into a generally cooperative partnership with offshore companies to monitor and control oil pollution. Several different state agencies in Texas and Louisiana that had jurisdiction over issues involving fish and game, pollution control, and health also had occasion to monitor oil pollution and to seek to mediate disputes between the oil industry and other industries. They could do little else, given their lack of resources and technical expertise.[35] Even when officials effectively addressed specific problems from pollution, other new and often more difficult problems were arising from the growth in scale of transportation and production of petrochemicals and the applications of new technologies in the production process.

One energy-related development that had a positive impact on regional pollution was the coming of natural gas as a primary fuel source in the region. Natural gas was found in abundance near Houston in the first decades of the twentieth century. Initially, it was seen as a nuisance and eliminated through flaring (burning off into the atmosphere), but in the 1920s the completion of pipelines into the city from surrounding gas fields allowed this gas to be used in and around the city. Natural gas quickly became the fuel of choice for the region's major industrial plants, including those plants that generated electricity. The use of natural gas to produce electricity made a significant contribution to cleaner air, particularly after the coming of air-conditioning greatly expanded the demand for electricity. Natural gas was cleaner burning than oil, which itself was cleaner burning than the coal it had displaced. In the postwar years, natural gas was not yet touted as a "green fuel." Its use grew because it was cheaper and easier to use than other fuels, not because it was cleaner burning. Yet acknowledged or not, easy access to abundant natural gas for fuel reduced pollution that would have been produced by coal or oil, the available competing sources of fuel.[36]

The region greatly needed any such reductions it could find, since rapid industrialization and suburbanization combined in midcentury to create mounting pollution. The most obvious result of suburban growth was the increased use of the automobile. The number of cars, the miles driven, and the network

of paved roads grew steadily over time, as did the amount of pollution coming out of the tailpipes of cars. Little thought was given to auto-related pollution until the 1950s, when Houston officials followed the debate in the Los Angeles area over the sources of smog. Both regions had growing traffic and a large cluster of oil refineries. Both had air pollution that could often be smelled and at times seen. But Californians placed a greater emphasis on air pollution control than did Texans, and most of the early debate about the causes and effects of smog remained in California.[37]

The era of self-regulation by the oil industry ended earlier in California than in Texas for a variety of reasons, including the physical beauty of California, its more diversified economy, and its two-party political system. The state of Texas and the Houston region had what might be best described as "oil-friendly" politics. The oil industry was well organized at the local, state, and national levels, with expert lawyers and lobbyists and access to authoritative data on most industry-related issues. In the one-party South, the ruling Democratic Party held firmly to the concept of states' rights, which could be used to oppose new federal government powers over pollution as well as civil rights. Until the 1960s, few well-organized public interest groups or labor unions registered effective opposition to oil-related pollution. But the political clout of "big oil" in Texas went far beyond interest-group politics or campaign contributions. In this state—and particularly in and around Houston—the oil industry was the largest employer, the most significant taxpayer, and the fundamental engine of growth. In the politics of this era, jobs trumped cleaner air and water.

By cleaning up the most visible pollution of the 1920s and putting in place cleaner operating procedures, the industry contained serious challenges on the pollution front until the 1960s. The external political environment helped deflect attention from pollution. The Great Depression of the 1930s focused politics on economic recovery while concentrating on cleaning up municipal waste, which was a good target for public works programs. The progress made by several levels of government in treating municipal wastes helped clean the nation's waterways. According to one waste-reduction specialist in the oil industry, such progress made oil pollution in rivers and streams more visible, assuring that it would become a bigger target for those seeking stricter pollution controls.

World War II suspended concern for pollution control, and the postwar boom in the nation and in Houston encouraged returning veterans to move ahead in pursuit of their personal ambitions. Almost half a century passed from the World War I era until the strong environmental movement of the late 1960s, and in this long period the oil industry retained central control of the ability to define and address the issues raised by petroleum-related pollution. This not only reflected the industry's success in removing much visible pollution but also the combination of the industry's strong political clout and

the political focus on other, more pressing issues. It also reflected the lack of well-organized groups capable of asserting the demand for stronger pollution controls in Texas and Houston.

Yet by the 1950s, there was a growing sense that oil pollution was reaching levels unacceptable to some outside the oil industry. A few government officials at the local level began to make at least an implicit argument that oil-related pollution was a potential barrier to regional growth. Walter A. Quebedeaux, who in 1954 became the head of the newly created air and water quality control section of the Harris County Health Department, was one of the first officials to tackle the problems head on. Quebedeaux had a good background for this job, having previously served as air and stream pollution director for the Champion Paper Company. In a series of initiatives, he directly and very publicly challenged the oil industry to clean up its pollution in the Houston Ship Channel. Despite his lack of sufficient staff and funding to effectively challenge the oil and petrochemical industries, he did not go down without a fight. By collecting data on oil and water pollution and publicizing the results in local media, he grabbed the attention of many in the Houston area. For a time in the 1960s, the major union for workers in the refineries and petrochemical plants, the Oil, Chemical, and Atomic Workers (OCAW), also conducted a campaign aimed at addressing issues of air emissions as a threat to the health and safety of workers in the plants and of those who lived near the plants.[38]

The era of relatively quiet acceptance of oil pollution was ending. Self-regulation by individual companies could not identify and address the cumulative impact of the expansion of the refining complex and the growing use of automobiles in the region. Nor did self-regulation tend to look aggressively for new problems associated with new types of emissions from technical advances in refining or from the new plants that produced a myriad of complex petrochemical products. W. B. Hart, one of the leading industry voices for self-regulation in the mid-twentieth century, acknowledged a final weakness of this approach. Self-regulation was a strategy to remove the prospect of government "compulsion"; yet the industry's success in using political lobbying to contain stricter government regulation removed some of its incentive to aggressively pursue efforts to monitor and control its emissions.[39] Not until mounting pollution in the 1950s and 1960s focused intense renewed public scrutiny on oil pollution did the industry have strong political incentive to respond with its own new wave of more effective regulations. By then it was too late for industry to retain control of this increasingly charged issue.

The need for change in the Houston area was symbolized by the return in the 1960s of the very visible water pollution of the 1920s and by the city's first serious air pollution "crisis" in the late 1960s. In 1967, federal investigators called the problem with pollution in the Houston Ship Channel "overwhelm-

ing," labeling conditions there as "by far the worst example of water pollution observed . . . in Texas." A survey of the region's air quality carried out by local authorities in 1965 concluded that "the most significant change [since the city's original survey in 1956–1957] . . . is the occurrence of the type of chemical reactions in the atmosphere which are characteristic of the well-known Los Angeles smog situation."[40]

Those living in the region did not need this report to note the coming of a smog problem to their city; they had only to look outside on an increasing number of days each year to see the fouled air. A series of very bad air days in the late 1960s and early 1970s brought indignant headlines in local newspapers, complete with photos of the smog-filled air hovering over the city. Television and newspaper coverage of pollution heightened awareness of the problem; well-organized environmental activist groups pointed to the need for change; and the growing wealth of the nation meant that more people could look beyond short-term economic considerations to issues involving the quality of life. But a fundamental reason for the coming of an era of stronger environmental regulations should not be ignored. Pollution was getting worse—especially highly visible air and water pollution.[41]

Yet even considering the mounting and increasingly visible oil pollution in the region, it is doubtful if significant new regulations would have been forthcoming without the national environmental movement. The federal government finally responded to the political pressures for stricter pollution controls with a wave of new laws in the 1960s and 1970s. Ultimately, the Gulf Coast refining region did not abandon its long-standing commitment to jobs over environmental quality; it was forced to assert stronger controls over pollution by the intervention of regulators from outside the region.[42]

Federal Regulation and Regional Pollution (1960s–2000)

The transition from industry self-regulation of pollution to command and control regulations, in which the federal government enforced strict new standards on the discharge of pollutants, moved forward quickly after the mid-1960s. The passage of strong new laws, the implementation of the requirement for environmental impact statements, and the creation of the federal Environmental Protection Agency (EPA) dramatically altered the legal and environmental framework of pollution control. Since the operations of oil refineries and petrochemical plants and automobile emissions attracted special scrutiny in the new generation of environmental regulations, the region witnessed considerable tensions between its traditional commitment to economic growth and the federal government's strengthened efforts to clean up air and water pollution.[43]

The post–World War II boom in the regional economy intensified after 1973, when the assertion of power by the Organization of Petroleum Export-

ing Countries (OPEC) over both the level of oil production and the price of oil led to a sudden quadrupling of oil prices. At the end of the decade, the hostage crisis in Iran then doubled prices. Although higher energy prices harmed much of the rest of the American economy, the nation's energy capital enjoyed an exhilarating period of prosperity from the early 1970s through the early 1980s. But as suddenly as the energy roller coaster had climbed up to new heights, it plunged down toward earth as real oil prices fell in the mid-1980s back to near pre-1973 levels. Houston's economy staggered, with conditions resembling those in the city in the early years of the Great Depression. As it slowly recovered, the region gradually moved toward greater diversification of its economy, with space, medicine, high-tech industries, and education taking up some of the slack created by the devastating blow to the oil industry. Even after oil-related activities rebounded to reclaim a central role in the economy, representatives of other industries also claimed seats at the table in the ongoing discussion about the direction the city should take, including the need to find more effective ways to control oil-related pollution.

From the mid-1960s forward, however, the table itself moved to Washington, D.C., as the federal government dramatically altered the process of environmental regulation. National politics shaped the process of change, driven by growing discontent with the results of industry-led initiatives to control pollution. The oil and automobile industries came in for harsh criticism in the face of mounting and highly visible smog, which became a symbol of the need to do something different. The oil industry also became the focus of political discontent in 1969, when the much-publicized Santa Barbara oil spill became a symbol of the industry's inability to control pollution. Such events and issues fueled the growth of increasingly active public interest groups that pushed for stronger controls and a new way to regulate pollution. Although the national environmental movement initially was not particularly active or influential in Texas, it ultimately had a significant impact on the region as it helped forced Congress to rewrite the nation's fundamental laws on pollution control.[44]

Stronger national legislation poured forth from the mid-1960s through the 1970s, with another surge of legislation after the Exxon Valdez oil spill in 1989.[45] In general, these laws embodied an approach aptly characterized as "command and control." Although some room remained for industry influence in the writing and in the implementation of these regulations, the new laws embodied attitudes and procedures markedly different than those of the long era of self-regulation. Indeed, this wave of environmental regulations contained an element of the affirmative action impulse that characterized the civil rights laws of the same era. The regulators who enforced the new laws had a difficult dual task: to clean up pollution inherited from the past while also implementing

new standards and processes capable of reducing the contamination of the air, water, and land in the present and future.

Nowhere was the need for such affirmative action clearer than in dealing with potential deadly pollution from toxic waste sites. (For a case study of this process, see Kimberly Youngblood's essay in this volume.) Environmental regulators at all levels of government faced daunting challenges under the new Superfund laws. Toxic wastes presented particularly vexing problems in the Houston area, with its high concentration of refineries and petrochemical plants. Those who sought to clean up toxic waste disposal sites in the region had to grapple with the historical problems caused by the rapid spread of the city out into suburban areas previously used as dump sites while at the same time creating new procedures to regulate the ongoing disposal of wastes from regional plants. This process often pitted local, state, and federal regulators against each other while also calling forth waves of lawsuits aimed at deflecting blame for past abuses.

Although a measure of discretion for the states remained in some of the new laws, most relied heavily on national standards defined in federal legislation and interpreted and enforced by the EPA, a strong new federal regulatory agency created in 1970. Command and control generally involved strict new standards or requirements backed by harsh punishment for those who did not meet the standards. Thus when Congress originally decided to mandate dramatic reductions in automobile emissions in 1970, it passed a law with a tight timetable for phasing in cleaner-burning car engines. This timetable dictated the addition of catalytic converters to new automobiles. Carmakers faced prohibitive fines if they did not or could not meet the schedule to comply with these new standards. As with many of the command and control regulations, those charged with enforcing the law retreated from the original timetable for compliance by granting extensions, but they did not back away from the final goal of dramatic and rapid reductions in harmful emissions.

Air and water standards, regulations of toxic wastes, and requirements for safer oil tankers all contained elements of the command and control approach. The political message to the oil and petrochemical industries was clear: you had a chance to take care of these problems, and you failed to do so. Now angry and well-organized activists demanded immediate action, with little regard for the cost or the inconvenience to industry.

The oil-refining industry was particularly hard hit by these regulations. Several of the major regulatory initiatives issued by the federal government required substantial investments by refiners. Especially demanding were two laws aimed at reducing harmful auto emissions: the requirement for catalytic converters after 1975 and the requirement for reformulated gasoline after 1990.

Both of these government mandates forced petroleum refiners to make fundamental adjustments in the refining process. The use of catalytic converters required the phasing out of TEL from gasoline over a relatively short period. This meant that refiners had to find new ways to create the high octane levels in gasoline used by automobiles since the 1920s. Investment dollars previously available for other endeavors now went toward meeting the government-mandated challenge of lead removal on a short timetable.[46]

The process repeated itself in the 1990s, when amendments to the Clean Air Act in 1990 mandated cleaner-burning gasoline for regions that did not meet the EPA's ambient air standards. This meant that Houston and other major cities in America would require new types of gasoline "reformulated" to burn more completely, leaving fewer, cleaner emissions. Again, the law mandated the phasing in of such gasoline on a relatively short timetable, forcing refiners to make large investments in the fundamental technology of petroleum refining. Some companies based in the region also undertook to supply MTBE, the gasoline additive of choice for refiners seeking to comply with the new law. These companies faced additional difficulties after questions about the environmental impact of leaks of MTBE into the water table demanded further investments while entangling industry in litigation to sort out responsibilities for absorbing the variety of costs associated with the detour into MTBE's production and use in reformulated gasoline.[47]

As the refining industry adapted to such government mandates, it also had to meet stricter standards for air and water emissions. Best practices became much more demanding in the decades after the 1960s, as government standards forced the industry to move beyond what it had done previously under self-regulation. Meeting the new standards required additional investments while creating uncertainties for the refining industry. This encouraged much greater caution in building new plants, as did the difficulties of siting new plants under the requirement of an environmental impact statement open to public input.

New environmental constraints—combined with economic factors such as the chronic overcapacity in refining and relatively low profit margins in refining compared to those in other parts of the operations of vertically integrated oil companies—effectively stopped the construction of new refineries in the United States after the mid-1970s.[48] The refining region surrounding Houston thus faced a fundamental transition from boom years of growth in capacity through new plant construction to what might be called "expansion in place," which involved expanding and improving existing plants by installing new processes in old plants. During the late twentieth century, refineries, like most other large manufacturing plants, also underwent a revolution in computerization, with new applications of computing power to manage and monitor the refin-

ing process more efficiently, in the process allowing for better measurement and control of potential emissions. Such initiatives were expensive, as were the development and application of new refining technologies, and they competed within companies for funds required to meet the demands of new environmental laws.

As refiners struggled to remain competitive and innovative while meeting new environmental requirements, they also began to face growing questions about the long-term health impacts of their refineries' emissions. Such questions had been raised since at least the 1920s, and the basic answer of the refining and petrochemical industries remained roughly the same throughout the century: No medical research establishes definitive links between our emissions and significant health problems for our workers or those living near our plants. Until such research can sort through the complexities of the varied causes, including smoking, of the many forms of cancer and of severe respiratory diseases such as asthma and show direct links between the operations of our plants and public health, we will continue to try to be good neighbors and employers by monitoring our emissions and the health of our employees. In the late twentieth century, union representatives, public interest groups, newspapers, and even local officials in Harris County (Houston) and Jefferson County (Port Arthur and Beaumont) periodically demanded actions to address concerns that the emissions of benzene, butadiene, and other toxics produced along with refined goods and petrochemicals might increase the incidence of some forms of cancer. But government at all levels proved reluctant to venture into the gray area of the causes of variations in the cancer rates. By default, such issues seem likely to be addressed in future class-action court cases.[49]

More immediately troubling to the industry and the government during the years after the energy crisis of the 1970s, however, was the growing shipment of oil around the world, as the industrialized nations became more dependent on ever-larger shipments of oil in tankers. The extraordinary growth in tanker shipments placed a premium on preventing giant oil spills, and the political fallout from the *Exxon Valdez* oil spill in Prince William Sound, Alaska, in April 1989 forced all involved to place a greater emphasis on spill prevention and containment. The Oil Pollution Act of 1990 responded to the *Exxon Valdez* spill with new mandates phasing in double-hulled tankers for all oil shipments to U.S. ports and establishing strong incentives for industry groups to organize and operate emergency response teams capable of reacting quickly to regional oil spills. Although such measures have not and cannot eliminate major oil spills from the region's waters, they have encouraged increased safeguards against spills and better industry preparation and training to contain such spills. As with many other environmental laws passed since the 1960s, this new law,

which greatly affected a region with large tanker shipments in and out of its ports, came in response to events outside the region and was put in place at the federal level.[50]

The greatest tension between the federal government and state and local officials in this era came over the controversial issues of smog and ozone depletion. In response to problems within the Houston area in attaining air pollution standards set forth by the federal government, federal regulators urged serious restrictions that fundamentally challenged existing attitudes and institutions in the region. The effort to contain air pollution brought federal, state, and local governments into conflict while also raising questions about the basic patterns of gasoline use in sprawling postwar Houston.

The number of cars in the metropolitan area grew spectacularly from the 1920s forward, with individual cars often carrying one passenger and fueled by inexpensive gasoline serving as the region's de facto "mass transit" system. Throughout its existence, the city steadily reached out and encompassed much of the surrounding countryside, and by the 1970s urban sprawl had produced a giant metropolitan area that relied on an ever-expanding system of highways, whose construction had become a central part of the regional economy. By the late twentieth century, the practical definition of "Houston" had come to mean the very broad system of city and suburbs that stretched out for thirty to forty miles in every direction. Such sprawl had played an important role in Houston's sustained growth. The availability of jobs attracted new immigrants, while relatively inexpensive housing made possible by ever-expanding suburbs kept housing costs low. Inexpensive gasoline and an excellent system of roads completed the equation for the region's expansion into a major city.[51]

When the implications of this pattern of home building and commuting for the region's air became impossible to ignore, federal authorities proposed drastic measures that challenged the historical pattern of regional commuting. In the early 1970s, after it became clear that Houston and other cities could not meet recently promulgated air standards, federal regulators called for a variety of measures to reduce gasoline consumption. Their seven-point plan in 1973 included the creation of carpool lanes on major highways and streets, a ban on construction of new parking facilities, possible gas rationing, and plans to force a 10 percent reduction in miles driven. Even the introduction of such measures for discussion called forth a wave of angry responses from political, civic, and industrial leaders in the region, who claimed that such restrictive policies would have a devastating impact on the area economy. In the face of such strong criticisms, which seemed to reflect the attitudes of many Houstonians, the EPA backed away from its proposals in 1975. A headline in the *Houston Chronicle* on May 29, 1975, captured the sense of a battle that was far from over: "EPA Apparently Abandoning Its Auto Cut Plans Here."[52]

The pattern developed in this initial skirmish repeated itself in several subsequent battles over the proper response to recurring problems with the region's air pollution. In the late 1970s and the early 1990s, the EPA once again proposed various restrictions on driving after the region failed to meet existing air quality standards. Each time, many of the region's political and civic leaders manned the barricades against the EPA, making politically effective arguments that its policies would be ineffective in Houston. The fundamental point was simple: the region's well-being should not be sacrificed to air pollution controls so strict that they would debilitate the regional economy. As one concession to the new realities of severe ozone problems, high-occupancy vehicle lanes began to be constructed in the center of the region's freeways, while existing freeways continued to be widened and new ones extended into the suburbs. The best indication of the attitudes of Houston's commuters toward these EPA initiatives was their continued movement out into the suburbs, despite air pollution and growing gasoline prices.

At the same time, civic and industrial leaders, two categories that consistently overlapped, made strong and repeated arguments about the need to avoid new regulations that imposed unnecessary burdens on the region's industrial core. Tensions between industry and government regulators remained high throughout much of the United States in the years after the 1960s, but they were particularly pronounced in a region containing a large share of the nation's petroleum refining and petrochemical production. Command and control regulations placed demanding and expensive new burdens on these industries. Their leaders perceived themselves as under siege, and they fought back with all the considerable weapons at their disposal. When political lobbying could not temper federal regulations, they lobbied more successfully at the state and local levels to moderate the implementation of standards. Political influence, good lawyers, control of technology and basic data about their industries, and a long-term time horizon all helped them establish a measure of elbow room with regulators. They lobbied for relief from new environmental laws, arguing for looser enforcement of environmental standards in the interest of job creation and energy independence. They made some headway, especially during periods of intense political concern about energy prices and supplies. All in all, however, they had only limited success in moderating the early wave of regulations or preventing the passage of new, stricter regulations of pollution.

Such regulatory give-and-take between energy industry groups and environmental groups remained a source of often intense political dispute. From the point of view of those who favored stronger pollution controls, industry seemed to own the Texas state government, dictating a series of grandfather clauses and exceptions that seemed to gut effective enforcement of much-

needed restrictions on emissions. Houston's civic leaders, on the other hand, usually joined the effort to block stronger regulations. These leaders, including many representatives of the oil and petrochemical industries, believed that vital regional industries were too often made whipping boys for broader problems, including the difficulty of enforcing regulations that limited "lifestyle choices" such as commuting distances. Industry leaders knew firsthand that meeting environmental regulations was very costly, and they voiced fears that the high price of compliance was making them less competitive in global markets. When they spoke to each other and not to a broader audience, a common complaint was that people who did not understand the inner workings of markets and the complex technology of their industries too often made unrealistic demands that unnecessarily restricted their capacity to find cheaper, more efficient solutions.

Such conflicting interpretations of reality proved particularly sharp in one of the most controversial areas of pollution control, the effort to understand the long-term health costs of pollution and to fashion public policies that could balance these costs against other competing social and economic demands. As early as the 1970s, pioneering health studies suggested that the region had an unusually high concentration of certain cancers related to environmental causes. During and after the 1990s, additional studies began to receive greater publicity in the region's media, leading to heightened fears by those who worked in or lived around the industrial complex that remained an important regional employer. Those who suffered from respiratory diseases such as asthma did not have to be warned of the dangers of air pollution; they felt its sting when they exercised outside or even worked in their gardens. Those who contracted various forms of cancer looked with suspicion at a variety of chemicals spewing forth from local industrial plants. The debate over environmental causes of cancer could not produce definitive answers, since the existence of many possible causes of "excess" cancer rates made it impossible to pinpoint the impact of industrial pollution. Individual critics of industry could only fall back on personal observations of people all around them who had certain types of cancer. Spokespeople for the industries could not cite studies that "proved" the lack of links between their activities and the region's high cancer rates, but they could argue that no studies conclusively proved the counterargument.[53]

Amid such uncertainties, the companies that operated the refineries and petrochemical plants found several ways to limit the impact of such debates on their current and future operations. One approach was to buy out residential neighborhoods near their plants, thus removing some of the worst complaints by relocating the people who made them. This could be expensive, but many companies found the resulting gains in public relations worth the price.

Broader efforts by some of the region's major companies to take a more

proactive approach to pollution control came to be labeled "green oil." All of these companies did not, of course, take the same stance on these issues, but several of the major international oil and chemical companies with large plants in the region led the way in the search for changes in behavior that might gain for them a better reputation on environmental issues, thereby perhaps giving them a louder voice in the debates over pollution control. Green policies became especially apparent in companies such as Amoco (absorbed into BP in 1998), which operated a large refinery and several large petrochemical plants in the region. In chemical production, Amoco joined a more general "green crusade," Responsible Care, which sought to find solutions to safety and health problems associated with its industry before being forced to do so by government regulations. Included were initiatives to identify and correct problems and to become better, more communicative neighbors in areas around their plants. This process became more pressing within the industry after the 1980s, when the federal government began to publish reports on the quantities of potentially dangerous chemicals released into the air by manufacturing plants. Companies such as Amoco responded by making the reductions of these numbers a matter of corporate strategy; environmental activists used the same numbers to rally political sentiment for stronger government enforcement of regulations.[54]

In historical perspective, the movement toward greener policies by some regional companies can be seen as an effort to reassert a measure of self-regulation by taking greater responsibility in improving the process of pollution control in their own operations. Unlike the process of self-regulation before the 1960s, however, such recent efforts go forward under the umbrella of strong government regulations and under the gaze of a highly skeptical public. The green initiatives by individual companies and by industry groups are a part of a broader change in business opinion that has emerged in Houston only in the very recent past.

In the early twenty-first century, the primary organization for the region's business community, the Greater Houston Partnership, has begun to voice greater concern for improved pollution control as an important part of an overall strategy for making Houston more attractive to new businesses. As discussed in Robert Fisher's essay in this volume, this new stance can be interpreted in several different ways, but it should not be ignored. The partnership stands at the end of a long line of Houston civic and business leaders who have pushed hard to create what they consider a "healthy business climate" that encourages regional economic growth. These individuals are the descendents of the people who first brought railroads to Houston, who helped finance the Houston Ship Channel, and who found ways to attract the Lyndon B. Johnson Space Center to the Houston area. It is good news when such an organization becomes more aggressive in searching for ways to improve the quality of life

in Houston by advocating the reduction of pollution. This does not mean, of course, that other Houstonians will necessarily agree with the pace and timing of changes advocated by the Greater Houston Partnership, but it perhaps heralds a shift in the focus of debate over air pollution controls.

This change in business leadership's traditional view that stricter pollution controls might harm the area's economy rests on the simple proposition that severe pollution threatens the quality of life in the region, which might in turn block future business expansion. It is possible that a new consensus could emerge in the region that cleaner air and water further the long-term commitment to economic growth—that traditional boosterism might in the future begin to include the assertion that Houston is both the city of economic opportunity and a city committed to cleaning up pollution.

Conclusion

This restatement of the traditional argument about the possible impact of pollution on jobs has particular significance for the nation's oil capital. It reflects in part the changing reality that industries other than oil and petrochemicals now have a greater presence in the region. But it also reflects changes within the oil-related complex that has dominated the region's economy. A wave of mergers over the last twenty years has produced a greater dominance of the giant companies that historically have been most capable of absorbing the new costs of pollution control. These companies have almost forty years of experience in complying with command and control regulations, and they are increasingly eager to move beyond the old tensions on these divisive issues and concentrate more fully on the broader issues of global competition. The top priority of the general population in the region no doubt remains jobs and economic security, but a generation of improvements in pollution control has raised the bar on the level of pollution that is socially and politically acceptable.

Despite somewhat cleaner air and water, the struggle for cleaner air and water is far from over in Houston. Sustained growth in an ever-broader Houston metropolitan area means that pollution control in the region is a moving target. As progress is made in reducing pollution from individual automobiles or industrial plants, the addition of more cars and more industrial output creates more pollution in more diverse forms. Ongoing efforts to expand the region's freeway system illustrate this difficult dilemma. Once completed, more lanes of freeway inevitably carry more cars farther and farther out from the city, encouraging urban sprawl. Congestion ultimately returns, bringing with it additional pollution and renewed calls for stricter controls on auto emissions and for more freeways.

Although the regional economy continues to diversify, it remains dependent on the oil-related core of industries that historically have produced both

good jobs and industrial pollution. The trend toward less reliance on petroleum refining and petrochemical production will continue, with significant long-term implications for the region's environment. But far into the future, the giant industrial complex that stretches from the Houston Ship Channel to Port Arthur will remain central to the region's economy. In terms of jobs and prosperity, the region could do much worse than remain the oil capital of the nation as it continues to diversify into other economic activities.

How the regional environment fares in the coming decades will depend on the choices of those who live in the region, those who have influence over business and civic decisions, and those who manage the vast structure of environmental regulations at the local, state, and federal levels. If the past is a guide to the future, it will be a daunting challenge to keep pace with the cumulative impact of a century of oil-related pollution. It will also be difficult and expensive to adapt the transportation system built during eras of low gasoline prices and little concern over air pollution to the demands of a new era. One key variable shaping future efforts to improve environmental quality will be the attitudes of the general population and their elected leaders. In a region built on the promise of economic opportunity, a stronger commitment to pollution control is likely only when poor air and water quality are widely viewed as significant threats to jobs and public health.