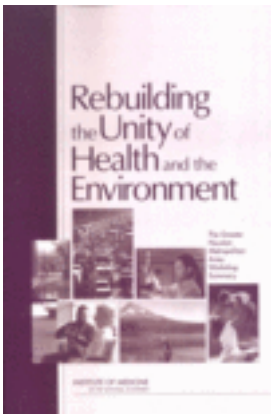


**Rebuilding the Unity of Health and the Environment: The Greater Houston Metropolitan Area: Workshop Summary**

Lovell Jones, John Porretto, and Christine M. Coussens, Editors, Roundtable on Environmental Health Sciences, Research, and Medicine

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## The Greater Houston Metropolitan Area: Workshop Summary

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Roundtable on Environmental Health Sciences, Research, and Medicine

Board on Health Sciences Policy

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*Willing is not enough; we must do."*
—Goethe



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Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the remarks made nor did they see the final draft of the report before its release. The review of this report was overseen by **Melvin Worth**, Scholar-in-Residence, Institute of Medicine, who was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

# Preface

Continuing the theme of the workshop sponsored by the Institute of Medicine's Roundtable on Environmental Health Sciences, Research, and Medicine in June 2000, *Rebuilding the Unity of Health and the Environment: A New Vision of Environmental Health for the 21st Century*, participants at the regional meeting held in Houston expressed similar views that for a long time the world of environment, environmental regulation, environmental control, and engineering had moved in one direction, while the world of health had moved in another. The importance of these views is based on the fact that Houston, Texas has already achieved the demographic composition that will reflect the predicted demographics of the United States by the mid-twenty-first century.

Named after Sam Houston, President of the Republic of Texas and general of the Texas army that won independence from Mexico, the city was founded by Augustus and John Allen. They established the city of Houston along the banks of the Buffalo Bayou to provide a needed shipping route from the Texas interior. Houston, however, did not become the port city the Allen brothers originally envisioned until two major events occurred. The Great Storm of 1900 destroyed the port of Galveston and reinforced the need for a protected port, while the dredging of the Houston Ship Channel made it possible to increase shipping.

Today, the Houston metropolitan area's population is the 10th largest in the nation with the landmass consisting of eight counties. Houston has more than 500 cultural, visual, and performing arts organizations, 90 of which are devoted to multicultural and minority arts. More than 90 languages are spoken throughout the Houston area. It is the home to the Texas Medical Center (TMC), the largest medical center in the world, 18 Fortune 500 companies, and more than 5,000 energy-related firms—making it the energy capital of the world. Additionally, the Port of Houston ranks as the nation's largest port in international tonnage and nation's second in total tonnage.

Houston is at the tail end of a large belt of natural forest continuing down through East Texas with the climate similar to coastal Louisiana and Missis-

sippi—warm and humid with ample rainfall. In undisturbed areas people will find marshy grasslands in the south and woods in the north with ample wildlife. John James Audubon, the prominent naturalist, visited Houston in 1837 studying and painting birds and other wildlife along the Gulf Coast.

Contrast the above with the fact that Houston is the only major U.S. city that doesn't have zoning, allowing the market to determine land-use instead. Houston is struggling with many of the environmental problems that most of the nation's major metropolitan areas are struggling with—transportation, water and air pollution, flooding, and major demographic changes. Therefore, Houston provided an excellent site for a regional meeting on the relationship between environment and health. The purpose of this regional meeting in Houston was to bring all the stakeholders together—the private and public sector, along with representatives of the diverse communities in Houston—to discuss the impact of the natural, built, and social environments on human health.

Prior to the workshop, members of the Roundtable, in conjunction with the Community Relations Core of the Center for Research on Minority Health, contacted representatives for the private and public sector, and for the diverse communities of Houston to participate in focus groups to determine what topics should be covered in a regional meeting. Meetings were held in a number of areas around the region, ensuring that all of the stakeholders were represented. A preworkshop meeting was then held to bring together representatives from all of the focus group meetings to determine the specific topic and suggested speakers. The result of all of these meetings and the participation of all segments of the populace was a balanced program that brought all members to the table to discuss the environmental future of the Houston region. However, it must be stated that this workshop report is an informational document that provides a summary of the regional meeting. The views expressed here do not necessarily reflect the views of the Institute of Medicine, the Roundtable, or its sponsors.

Lovell Jones, Roundtable Member
John Porretto, Roundtable Member

# Contents

# Summary

This symposium on Rebuilding the Unity of Health and the Environment: The Greater Houston Metropolitan Area focused on a region whose urbanization in recent decades, elevated pollutant emissions, and other environmental insults have taken their toll on residents' health and well-being. Famous as a great business center, Houston is also infamous as a land of seemingly endless sprawl, criss-crossed by highways, burdened with traffic congestion, and heavily punctuated by refineries and other industrial facilities that in the past were not especially reticent about exploiting the local environment for their own immediate needs. However, as the region's population has grown more sophisticated and as political and business leaders have become more aware of the practical advantages of actively protecting public health and quality of life, Houston has begun to address its environmental problems and is acting to ensure a more attractive future.

The lessons one may draw from this meeting's presentations and discussions apply to other regions that are undergoing similar changes and that must also contend, as does Houston, with the legacies of insufficient planning, environmentally deficient planning, or sometimes, no planning at all.

Rather than summarize here the symposium's proceedings in a speaker-by-speaker or subject-by-subject fashion, this summary is organized to briefly characterize the fundamental themes that emerged. Some of them were Houston specific; others, although clearly pertinent to Houston, were also typical of many other cities throughout the country. In any case, these themes should be central to the region's strategies for achieving sound environmental health and greater equity in its distribution.

## A TRUE MELTING POT

Houston is one of the most ethnically diverse cities in the United States. With Hispanics, Caucasians, African Americans, and Asians almost equally represented and none dominating, all Houstonians are minorities. Further, some

observers see Houston not only as the site of a demographic revolution, but also as a critical test bed for the state of Texas and the nation as they too move toward a "majority minority" population. Although ethnic diversity can provide a rich social environment for all residents, it can also be a source of strife as cultural misunderstandings and conflicts arise. In fact, such confrontations are presently the exception rather than the rule—given the remarkably spread-out nature of the metropolitan area, different ethnic groups tend to live in their own separate enclaves. Nevertheless, Houstonians are increasingly building social capital and showing tolerance and pride in their city's diversity; citizen groups, for example, strive to involve all local ethnicities in their deliberations.

## AIR QUALITY

Houston residents routinely list poor air quality as the region's worst pollution problem—the result of a broad array of highways, refineries, and other industrial facilities, many of them in close proximity to where people live, work, or go to school. Compounding this situation is the city's heat island effect—that is, elevated urban temperatures that in addition to being a risk in their own right enhance the formation of photochemical smog. Results of such exposures are higher levels of respiratory diseases and cancer incidence. Major air pollution problems also result from indoor allergens and irritants such as dust mites, mold, pet-derived allergens, air fresheners, cigarette smoke, and cleaning solvents. Although after-the-fact fixes can improve the situation at the margin, experts suggest that the greatest improvements will come from longer-term and supply-side solutions such as partnership with industry and regulators; smart growth in community development (with improved public transportation options); green buildings (which are energy efficient and built with more healthful materials); reflective surfaces and trees; and devices, systems, and creative economic policies for reducing emissions from cars, trucks, and stationary sources.

## TRAFFIC CONGESTION AND SPRAWL

The landscape of much of the Houston area, and indeed of so many other cities in the United States, is characterized by sprawl—poorly designed and often unchecked growth in outlying low-density areas, with little or no attention paid to the resulting social, environmental, and human health impacts. One very tangible set of outcomes is the dominance of the automobile and the near inevitability of traffic congestion, with extended times for commuting and virtually any other vehicle usage (i.e., running errands, picking-up children), enhanced risk of accidents and exposure to exhausts, and heightened stress and frustration. In many polls, traffic is listed as the region's greatest problem, ranking higher than pollution, the economy, crime, and schools.

## AN OBESITY EPIDEMIC

Another important impact of the suburban sprawl pattern is residents' reduced levels of physical activity. Where homes are built in clusters that are well removed from services—where walking or bicycling to distant destinations is inconvenient or even dangerous, sidewalks are often lacking, and a major roadway is usually part of the route—excess weight problems can occur in epic proportions. This in turn leads to greater incidence of illnesses such as diabetes, heart disease, hypertension, gall bladder disease, and several different types of cancer. Houston, like many regions of the country, is struggling with a growing obesity problem.

## HIGH-QUALITY, ABUNDANT, AND SOMETIMES OVERLY ABUNDANT SUPPLIES OF WATER

Although Houston's waterways have been troubled in the past—the Houston Ship Channel was sometimes referred to as the most polluted waterway in the United States and probably the world—the region has made considerable progress over the past few decades, with the aid of strong federal legislation, in cleaning up its water pollution. Supplies of drinking water, by contrast, have been kept safe in the past by scrupulous treatment, and it is a point of local pride that they continue to be of high quality and readily available into the foreseeable future. Water, however, can sometimes be too available in the region, given the flatness of the terrain and its regular exposure to thunderstorms and hurricanes. Thus, flooding is a frequent local phenomenon, causing major disruptions in transportation systems, businesses, and daily life in general. Solutions being pursued include systems for improved drainage, so-called peak flow attenuation (i.e., holding the water back and releasing it slowly), and dispersed systems using existing structures and wetlands, according to some participants.

## ENVIRONMENTAL JUSTICE

Degradation of the natural environment is correlated with risk to human health, although some humans—particularly the poor and the disenfranchised—endure more of it than others. Similarly, environmental regulation in general and the cleanup of hazardous waste sites in particular do not have histories of fairness to all segments of society. For example, 82 percent of Houston's waste management facilities are located in predominantly African-American neighborhoods, even though the black community comprises just 20 percent of the local population. Thus, the concept of environmental justice has evolved, triggered by a long series of injustices. Steps recently taken in the right direction include federal and state mechanisms for the safe and efficient remediation of brownfields. Meaningful community representation and involvement, however, remain a challenge.

## MULTIPLE STRESSORS AND CUMULATIVE RISKS

The analysis of one contaminant at a time generally gives an erroneous and understated expression of the effects of pollution on human health. There is rarely just one causative factor behind a particular environmental health problem, and many effects manifest themselves only after long periods of exposure. Thus, although few studies have done so in the past, combinations of pollutants, including the joint impacts of indoor and outdoor environments, should be taken into account. Similarly, because most professionals in the environmental health field have been trained to focus on the outcomes of present and future environmental health problems, they usually devote insufficient time and attention to the basic underlying causes, much less to dealing with them.

## THE NEED FOR PARTNERSHIP

Given the typical extensiveness and complexity of environmental issues, no single person, organization, or government unit, such as the leaders of a single municipality, can solve a problem alone. It is essential that collaborations be formed across traditional boundaries—social, political, and scientific—noted many participants. Communication and partnerships are needed, for example, between urban and suburban jurisdictions and between the public and private sectors. Because the issues of concern are inherently interdisciplinary in nature, they must be approached by investigators in a broad, systematic, and team-like fashion. At the very least, listening to others should become at least as important as speaking one's own mind; in that way, polarization—an increasingly critical obstacle to progress—may eventually be overcome.

## THINKING SYSTEMICALLY

The environment has three interacting aspects: the natural environment, the built environment, and the social environment. These are interconnected in such a way that policies and practices originating in one will inevitably affect the others and, ultimately, people's health, safety, and well-being. A responsible posture, therefore, should be characterized by environmental stewardship—a holistic approach that delivers progress in full, as opposed to disembodied increments that amount to marginal change or merely the illusion of progress. In this spirit, the public and its leaders should regularly remind themselves that land use and building design decisions, for example, are *de facto* public health decisions. Moreover, in trying to define environmental health in a more holistic way, they should not limit themselves to regulations designed to fix past mistakes but should look to the future in order to prevent problems in the first place.

## INVOLVING INDUSTRY IN THE SOLUTION

As environmental awareness grows and spreads, it is only a matter of time before those who have traditionally been the direct cause of environmental problems begin to conduct business in ways that are not only safer but also more economically efficient. Thus, industry in general—and the chemical industry in particular—has been adopting responsible programs aimed at curtailing pollutant emissions and supporting and employing environmentally sound practices. Companies have been emphasizing their membership in the community, and they are following through, collaboratively, as responsible neighbors. Also, while acknowledging that complete transformation can not be achieved overnight, they do claim to be committed for the "long haul."

Environmental consciousness within the Houston business community is being stimulated in large part by the area's residents and their leaders. No longer preoccupied with economic insecurity or personal safety, they may now attend to quality-of-life issues and the physical attractions of the city—assets that will add to the desirability of coming to and staying in Houston, thereby making its future economic viability more likely.

These priorities result mainly from the fact that the area's primary source of wealth now is knowledge rather than natural resources. Suddenly, or so it seems, factors such as air quality, revitalization of the city's downtown, and richness of hiking and boating areas have become critical.

Environmental health issues can be creatively addressed when stakeholders listen to each other and work together noted some participants. The mindsets of many of the region's people and institutions have changed, as have their prospects for a more healthful and vital community.

# 1

# Introduction

Members of the Roundtable on Environmental Health Sciences, Research, and Medicine come from academia, industry, and government; represent diverse perspectives; and meet to discuss both timely and sensitive environmental health issues that are of mutual interest. For example, they regularly convene workshops to help facilitate dialogue on a specific topic. One such workshop, which is the subject of this report, *Rebuilding the Unity of Health and the Environment: The Greater Houston Metropolitan Area*, was held in Houston, Texas, on January 23, 2004.

The first Roundtable workshop *Rebuilding the Unity of Health and the Environment: A New Vision of Environmental Health for the 21st Century* (IOM, 2001) defined the work of the Roundtable and guided it through ensuing discussions and workshops. During that workshop, participants discussed many of the nation's most critical environmental health issues and the need for engaging nontraditional partnerships in addressing them. Ever since then, the Roundtable has promoted a broader definition of environmental health. The workshop recognized the very important relationships between the natural environment, the built environment, and the social environment and our health.

The Roundtable followed up on the first workshop by sponsoring a series of regional meetings to understand the complex environmental health issues in various parts of the United States. The Houston workshop was the third in the series, following those in Atlanta, Georgia, and Pittsburgh, Pennsylvania. This summary report has been prepared by the workshop rapporteur to convey the essentials of that day's events. It should not be construed as a statement of the Roundtable, which can illuminate issues but cannot actually resolve them, or as a study by the Institute of Medicine (IOM).

## CHARGE TO SPEAKERS AND PARTICIPANTS

In the past several years, the IOM's Roundtable on Environmental Health Sciences, Research, and Medicine has endeavored to reach out to different re-

gions of the United States and get an in-depth understanding of local environmental issues and how they affect residents' health. When speaking of environmental health, people often refer to air and water pollution. In reality, the total environment in which we live involves many other factors as well, which is why the Roundtable defines environmental health in a very broad way to include the social environment, the built environment, and of course the natural environment, noted Lovell Jones, director of the Center for Research on Minority Health at the M.D. Anderson Cancer Center.

A goal of this workshop, then, is to bring together a variety of viewpoints including those of Houston area policy makers, planners, developers, and health care providers to discuss environmental health issues with each other and with various local communities. The meeting was put together following discussions with many stakeholders in the greater Houston metropolitan area, noted Jones. Community groups from the four quadrants of the city (Northeast, Southeast, Southwest, and Northwest), members of the academic community, industry, government officials, and environmental groups provided input to ensure broad representation on the agenda. Just the fact that this meeting was held at the Wild Cat Golf Course, showed that environmental health issues can be creatively addressed when stakeholders listen to each other and work together, noted Jones. This very site used to be one of the worst landfills in the city of Houston, but the majority of the community's residents would agree it has come a long way. Jones concluded by suggesting that the discussion of the regional meeting will help inform the debate on environmental health issues.

# 2

# Environmental Health Overview

## WHAT IS ENVIRONMENTAL HEALTH?

*Lynn Goldman*

Human health has been defined by the World Health Organization as "a state of complete physical, mental, and social well-being, and not merely the absence of illness or infirmity." Environmental health or environmental public health is one component of human health; it is concerned with those aspects of human health that are determined by interactions with physical, chemical, biological, cultural, and social factors in the environment. As the biologist René Dubos noted, "Indices of environmental health are expressions of the success or failure experienced by the [human] organism in its efforts to respond adaptively to environmental challenges" (Dubos, 1987). A complication for our own species and the many others with which we share the planet is that these challenges vary over time because we humans are constantly changing our environments. It follows, then, that environmental health isn't just about describing and understanding how aspects of the environment affect our health; it is also about correcting those problems. We want to be able to assess, control, and prevent factors in the environment that might adversely affect not only our own health but the health of future generations.

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*Lynn Goldman*

Environmental public health occurs on many levels, from the molecular and genetic to the global. At this meeting, our focus is the community and regional scales; we want to learn about the interplay between health and the environment, throughout this region and in its individual neighborhoods, and the actions that people are taking to address it.

Environmental health is very important for the overall status of health in our population. In a recent review, the Centers for Disease Control and Prevention (CDC), listed 10 public health achievements, that are largely responsible for the fact that life expectancy in our country has increased by 30 years in the last century. A number of these are environmental health measures, such as improved sanitation, better nutrition, and better housing. In fact, environmental health measures are responsible for more than three-quarters of these improvements. Medical care, although important, made a relatively modest contribution to our increased longevity (CDC, 1999).

Houston, like many local regions in the United States, is concerned with chronic disease—and for good reason. For the nation as a whole, chronic disease has become the number one killer, and it is responsible for the majority of our health care costs (Figure 2.1). At the same time, we are challenged by infectious disease—particularly from new threats such as SARS (severe acute respiratory syndrome), West Nile virus, and other pathogens that seem to be emerging from the environment. We also have the threat of terrorism and consequent demands on the public health system to address all of these concerns. I don't think there has ever been a time when people appreciated the public health system more, but I also think that there has never been a time when the public health system was more overtaxed.

In addressing these challenges, the Roundtable believes we should think systemically. Environment, after all, has three interacting aspects—the natural

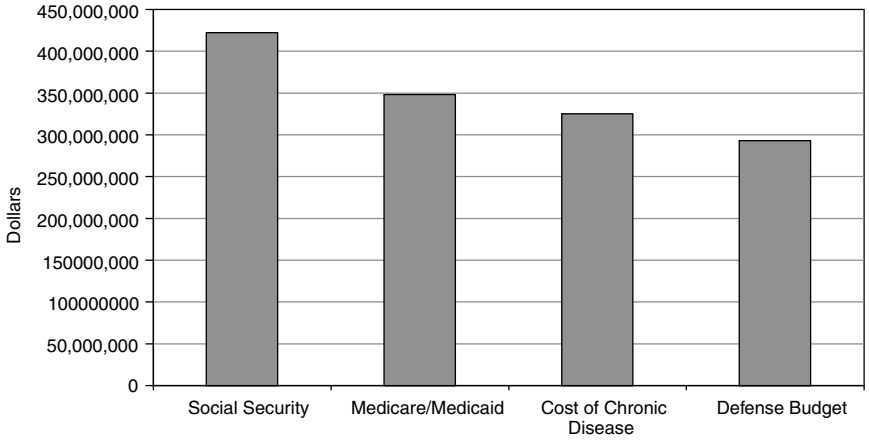



**FIGURE 2.1** The U.S. population spends as much on the burden of chronic disease as the U.S. government spends on Medicare and Medicaid and the defense budget. SOURCE: Jim O'Hara, unpublished. Reprinted with permission.

environment, the built environment, and the social environment. We know that the built environment has major impacts on our health because it contributes to sedentary life-styles, to greater automobile pollution, and to global warming. Similarly, the social environment is very important, because many social and cultural factors help produce unhealthy lifestyles and diets. Also, of course, the natural environment is critical to our health. Our basic needs of food, water, and air, and even some of our spiritual and emotional needs, come from the natural environment. There is a tremendous health benefit to the experience of being in nature.

Environmental protection laws are in essence public health laws. Over the last 30 years since the establishment of the U.S. Environmental Protection Agency (EPA), there has been significant progress in environmental protection and public health in this country. Across the nation, communities have cleaner air and water in most places, and remediation of numerous hazardous waste sites has occurred. We also see new and different measures for reducing or preventing waste as many industries are attempting to use cleaner methods for manufacturing products. We recognize from public opinion polls that most Americans now consider themselves to be environmentalists who daily pursue practices such as recycling.

Although there has been great progress, numerous challenges remain. For example, many older industrial facilities were grandfathered by the Clean Air Act, and today the government doesn't have any reasonable policies in place for addressing this problem. Additionally, we still have a long list of hazardous waste sites that need to be remediated. Meanwhile, although the Endangered Species Act has saved many species, we continue to lose the biodiversity that is important to us. I used to play with Texas horned lizards when I was growing up nearby in Galveston County. These are truly fascinating and wonderful creatures, ubiquitous in this region back then, but I would be hard pressed to find one of them today. We don't really know exactly what brought this creature to the brink, and we don't know what to do to bring it back.

Similarly, as a child I could take for granted the many indigenous pelicans and dolphins. Watching pelicans dive-bomb for fish, seeing dolphins following the Bolivar Ferry, or finding a variety of shells on the beach meant so much. These experiences are part not only of our natural landscape but also of the landscape of childhood, as well. Nowadays, we don't see as many dolphins, and bird populations have also declined. We don't yet know for sure what the environmental factors responsible for such changes in the natural environment are doing to human health, although we do know that they have diminished the quality of life for children and adults alike.

An important point to keep in mind while addressing the tasks still undone is that in these and other environmental issues, our society has become highly polarized. In my experience, the primary obstacle to achieving progress in environmental protection is the tendency to point the finger to someone else's re-

sponsibility for the environmental health issue. For example, regarding the impacts of air pollutants on our lungs, one might point to industrial plants. However, people in those industries can point to automobile pollution, the growth of automobile usage, and the lack of good public transportation. Similarly, car manufacturers may point to smoking and the harmful effects of tobacco exposure. As long as responsibility is avoided by placing the blame elsewhere, we will not step up to the plate to address our share of the problem. The only way to move forward is for everyone to come forward and contribute to the solutions. From the standpoint of a baby's lungs, it doesn't matter where the pollutant came from.

That we often learn from our mistakes is also shown by how disasters of the past have helped us devise improved emergency preparedness procedures or preventive measures. Going back again to the lore of my childhood in this region, the Texas City disaster of 1947—in which a ship full of ammonium nitrate fertilizer caught fire—was a case of responders failing to follow protocol (Figure 2.2). Not towing the ship out to sea resulted in a chain reaction of explosions involving many of the refineries in the area and a second ship as well. In the end, thousands of people died. It is certainly a reminder of the importance of prevention and being prepared for emergencies.

Another infamous event in the Houston/Galveston area was the great hurricane of 1900. Its 130-mile-per-hour (mph) winds killed at least 8,000 people and destroyed 3,500 homes and buildings. To prevent a recurrence of this type of disaster, we have invested significant resources to build a seawall, deploy weather forecasting systems, and establish emergency shelters so that people won't be harmed if there is flooding. However, this region still has more than its share of flooding and problems with disasters each year.

Appropriate ways to prevent such events or, if they do occur, to minimize their impacts have not necessarily been easy to determine or to implement. Yet some of the issues that scientists and public policymakers are addressing are far more subtle, spread out over time and place, and not readily amenable to solutions—or even to acknowledgment.

A case in point is global warming. Global temperatures have been gradually rising as carbon dioxide ($CO_2$) emissions have increased (Figure 2.3). We don't yet know when the atmosphere will be warm enough to create catastrophic conditions. However, we do know some of the likely consequences: a rise in the level of seawater (many low-lying locations in the Houston area should be of great local concern) and the probability of greater instability in weather (including more hurricanes). So while $CO_2$ buildup has to be looked at with great urgency, in my view it has not yet been adequately confronted. Because we have only one planet, we cannot experiment on multiple planets to see what is going to happen. Instead, we need to take action to stem climate change and to protect sensitive environments such as the low lying communities in the region. This means being willing to put aside our tendency to shift blame to others and in-


**FIGURE 2.2** Both human-made (a) and natural (b) disasters can have an effect on human health. Although these occur infrequently, the loss of lives and the economic impact can linger. SOURCE: (a) Texas City Library. (b) National Oceanic and Atmospheric Administration/U.S. Department of Commerce. Reprinted with permission.

stead look for some way that each of us can contribute to a healthier environment for all, now and in the future.

In the final analysis, whether the issue is local and well defined or global and subtle, an important part of achieving environmental protection is simply listening. In searching for solutions, we must make ecosystems more important than our ego systems.

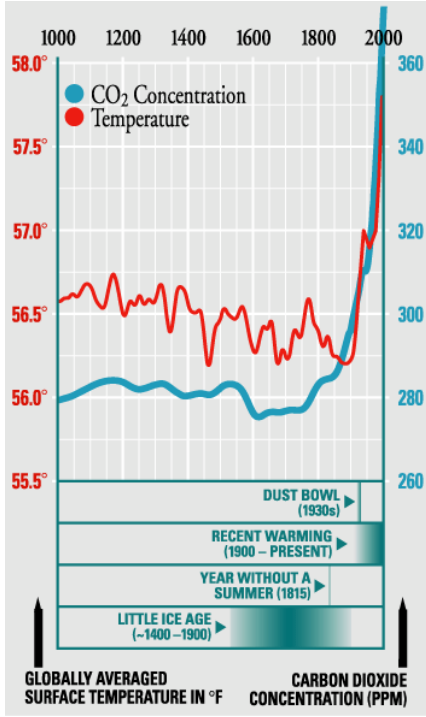



**FIGURE 2.3** There is a correlation between carbon dioxide emissions and the increase in global temperature seen since 1951. SOURCE: Marian Koshland Science Museum of the National Academy of Sciences. Reprinted with permission.

## ENVIRONMENTAL HEALTH CHALLENGES IN HOUSTON

*Ken Sexton*

Houston is a dichotomy of perception. It has been described as a model of growth and economic development; a free-market city; a place unfettered by zoning, excessive taxes, and unnecessary government regulation; and an international cosmopolitan enclave. However, it also has been called an urban environmental war zone; a poster city for urban sprawl and traffic congestion; the smog capital of the United States; and a national environmental sacrifice area.

Clearly there are differences of opinion about Houston. It is important to keep the dichotomy in mind and to understand that how one views Houston has a major impact on the perception of environmental health challenges for the region. Although these perceptions are highly subjective, they are not mutually exclusive, and there is some truth in all of them. Some of the city's greatest challenges are discussed in more detail in Box 2.1.

**Box 2.1**
**Challenges for Ensuring Environmental Health in Houston**

1. The need to understand and address the environmental health impacts of cultural, economic, demographic, and social realities.
2. The need to set priorities and make necessary trade-offs across traditional boundaries so that environmental health is adequately protected for current and future generations.
3. The need to identify and address the basic drivers of environmental health risks.
4. The need to assess and manage cumulative risks to human populations and the natural environment by taking multiple stressors and their combined effects into account.
5. The need to make better environmental health decisions by making decisions that are equitable, efficient, accountable, and sustainable.

## A GROWING DISPARITY

With a population of about 2 million, Houston is the fourth largest city in the United States (after New York, Los Angeles, and Chicago). Houston is also one of the most culturally and ethnically diverse cities in the nation. It has the fourth highest number of Hispanics, the fourth highest number of African Americans, and the eighth highest number of Asians. As many observers have noted, Houston has a "majority minority" population (see Chapter 4). In the 2000 Census, the city was about 37 percent Hispanic, 31 percent Anglo, 25 percent African American, and 7 percent Asian and other.

Perhaps one of the most dramatic features of the Census data was the rate of growth in Houston's Hispanic population, which averaged 60 percent per decade for the last 20 years. If this growth rate continues anywhere near that level, Hispanics will soon be a clear majority. Data from the 2000 Census suggested that approximately 12 percent of Houston families and almost 30 percent of single-mother families were living below the poverty level and that the disparity between people who earned the lowest incomes and those earning the highest was actually increasing. This disparity is likely to continue growing for the foreseeable future, in fact.

The overall population in Houston is getting older. More than 75 percent of people aged 60 and older are Anglos, while the younger people—18 to 29 years old—are primarily non-Anglos. Blacks and Latinos comprise almost two-thirds of Houston's younger adults (Klineberg, 2002), and their educational levels are considerably lower than those of Anglos. Without a significant closing of the educational gap between Anglos and non-Anglos, the future implications are fairly stark. For one thing, poverty and lack of education are major risk factors

for inadequate environmental health. The first challenge for the Houston metropolitan area will be to understand and address the environmental health impacts of such cultural, economic, demographic, and social realities—both at present and as they are likely to manifest themselves in the future.

## WHO'S ON FIRST? WHAT'S ON SECOND?

A related set of tasks for this city should be the setting of priorities through comparative risk assessment—a method of evaluating, comparing, and ranking very different sorts of risks—combined with the analysis of costs. This will provide a conceptual framework and, combined with cost–benefit analysis, will formalize a scientific method of setting environmental health priorities.

Some initial efforts have already been made in this region. In 1991, the Houston Advanced Research Center convened panels of experts to perform a large comparative risk assessment—prioritizing 19 environmental problems in the eight-county metropolitan area. The group focused on three major domains: health, ecosystems, and socioeconomic impacts.

During their deliberations, the panels ranked the relative risks from lowest concerns to highest concerns (Figure 2.4). In preparation for a 2001 Houston-area town hall meeting on environmental health, Winifred Hamilton of Baylor College of Medicine and her colleagues asked, using Spanish and English telephone and written surveys, 311 area residents about their concerns regarding pollution and their health. A subsequent ranking of the concerns found that the top three types of pollution of concern, in order of importance, were air pollution from petrochemical plants, air pollution from cars, and ozone smog; the top three pollution-related illnesses were asthma, cancer other than leukemia or lung cancer, and allergies (Hamilton, 2002).

Houstonians have to recognize, however, that the setting of environmental health priorities is loaded with difficulties. It can be confounded by the complexity and interconnectedness of the problems, by the scientific uncertainties involved, and by basic disagreements among stakeholders about problem definitions and the proper role of regulation. Often overlooked, moreover, is the fact that even if scientists manage to do a reasonably good job of assessing comparative risks, the discretion of decision makers is often limited by legislative and organizational fragmentation. The public may deliver a fine prioritization among air issues and water issues, for example, but often the enabling legislation doesn't allow agencies to move money from one medium or one program to another, and the elegant exercise comes to naught.

Despite such restrictions, it still makes great sense to pursue this more holistic approach and try to look across problem areas, because the results will ultimately change many of the practical constraints. The second challenge, therefore, is to set priorities and make necessary trade-offs across traditional boundaries so that environmental health is adequately protected for current and future

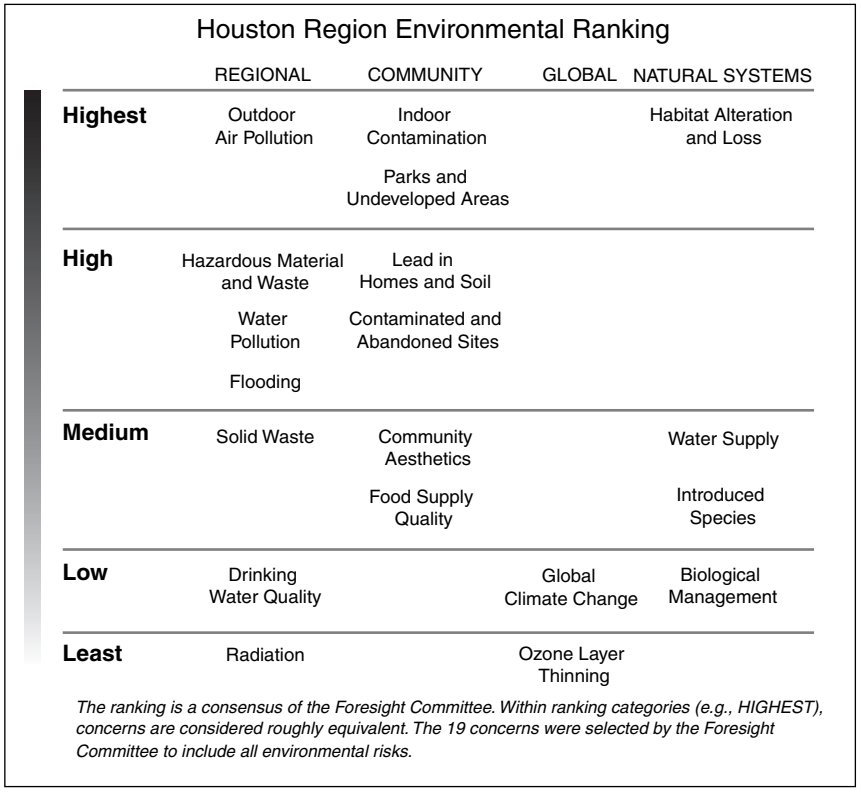



**FIGURE 2.4** Comparative risk assessment by a committee convened by the Houston Advanced Research Center to rank the levels of concern related to the environment from high to low. Indoor and outdoor air pollution and loss of habitat had the highest ranking for the level of concern. SOURCE: Houston Advanced Research Center, 1996. Reprinted with permission.

generations. I would especially emphasize the words "across traditional boundaries"—not only political and legislative boundaries, but also scientific boundaries. Environmental health issues are truly interdisciplinary in nature and must be addressed from a broad, systematic, and team-oriented perspective.

## BROADER ISSUES AND BASIC CAUSES

In the field of environmental health, more and more people are realizing that we have tended in the past to identify and define problems in overly narrow and restrictive ways. We now understand that problems are best viewed from a holis-

tic and ecological perspective, as illustrated by this definition of environmental health from *Healthy People 2010*:

> In its broadest sense, environmental health comprises those aspects of human health, disease, and injury that are determined or influenced by factors in the environment. This includes not only the study of the direct pathological effects of various chemical, physical, and biological agents but also the effects on health of the broad physical and social environment, which includes housing, urban development, land-use and transportation, industry, and agriculture.

As we try to define environmental health in a more holistic way, at the same time we must stop relying on after-the-fact regulations to fix past mistakes. It is imperative that we spend at least equal amounts of time and effort looking to the future and trying to prevent problems before they occur. Similarly, because most of us in the environmental health field have been trained to focus on the outcomes of environmental health problems, we have not devoted enough attention to understanding fundamental causes.

The third critical challenge is to identify and address the basic underlying drivers of environmental health risks, and these are not necessarily the ones we have traditionally emphasized. We must be thinking about things such as population growth, urban sprawl, economic expansion, resource consumption, technological development, modes and patterns of transportation, and environmental attitudes and perceptions, to cite just a few. This process is not always comfortable, and it is not always easy, but until we begin to focus on fundamental causes we are unlikely to make as much progress as we would wish in alleviating current problems and preventing new ones.

## MULTIPLE STRESSORS AND COMBINED EFFECTS

Because there is rarely just one causative factor behind a particular environmental health problem, Houston and many other metropolitan areas will ultimately have to take on the fourth challenge: the need to assess and manage cumulative risks to human populations and the natural environment by taking account of multiple stressors and their combined effects.

Many in the environmental health field have been talking about this concept for several years, and it was recently acknowledged in the U.S. Environmental Protection Agency's first guidelines on cumulative risk assessment. Analysis of cumulative risk is likely to be a high priority issue over the next 10 or 20 years, and it will undoubtedly serve as a catalyst to broaden our thinking about risks and vulnerable populations. However, this can happen only if we address two related issues: (1) the need to enhance scientific knowledge and understanding about combined effects of multiple stressors and (2) the need to improve associated decision-making tools and processes.

In the first case, anyone who has ever attempted a cumulative risk assessment knows that when you try to evaluate aggregate effects on a population from a diversity of environmental stressors, the discussion rapidly moves away from the science because the science simply isn't there. The process necessarily becomes qualitative and attitudes, biases, and perceptions play a prominent role in the final outcome. We therefore have to strengthen the scientific underpinnings that are the foundation for realistic assessment of cumulative risks.

Equally important, though rarely talked about, is the need to develop new tools and approaches for integrating cumulative risk information into environmental decisions. Moreover, we must train risk managers to appreciate the subtleties and nuances of cumulative risk assessment and to use these new methods to make sound choices that are protective of environmental health for current and future generations.

## A QUESTION OF BALANCE

Finally, we face a fifth and overarching challenge: the need to make better environmental health decisions, where "better" means effective (actions achieve desired results), efficient (results are achieved at reasonable cost), and equitable (those who benefit also bear the costs, and vice versa). The complexity and expense of dealing with twenty first-century environmental health problems, like global climate change, make it essential that decisions are sustainable. The concept of "sustainability" accentuates simultaneous attainment of three complementary goals: environmental protection (safeguard and restore the natural environment); economic prosperity (improve the quality of human life); and social justice (ensure equitable distribution of costs and benefits). The ultimate goal of environmental health decisions must be to meet the needs of the present without compromising the ability of future generations to meet their own needs.

# 3

# Natural Environment

The natural environment is an important part of urban areas. As a region is developed commercially and its population and infrastructure grow, its natural landscape shrinks (Figure 3.1), the local waterways are altered, and the atmosphere acquires decidedly unnatural characteristics. A panel of speakers described aspects of Houston's urbanization that are largely responsible for its environmental problems—particularly with regard to air pollution, threats to drinking water supply and quality, and flooding—together with specifics about the impacts of the problems on public health. These individuals also discussed avenues for solutions, both short term and long term.

Courtesy USACE

**FIGURE 3.1** By the time the Environmental Protection Agency (EPA) was created in 1972, the pollution in the Galveston Bay and the Gulf of Mexico, and air pollution from industry in the area, were all too evident. It was harder to find brown pelicans because, by 1974, the population had dropped to only 100 (presumably due to poisoning by the pesticide DDT). SOURCE: U.S. Army Corps of Engineers Galveston, http://www.swg.usace.army.mil/.

## THE NATURAL ENVIRONMENT AND HUMAN HEALTH

Houston's corner of Texas is naturally one of the most complex and diverse ecosystems in the world. Although located in the epicenter of a vibrant ecosystem with rolling prairies, lush bayous, hardwood forests and fertile estuaries, little of this natural legacy now remains in the Houston metropolitan area, observed Winifred J. Hamilton, director of the Environmental Health Section of Baylor College of Medicine. Indeed, Houston has an average per-capita land consumption (0.259 acre per resident) that is more than twice that of Los Angeles (0.110 acre) (Kolankiewicz and Beck, 2001), and it has more paved freeway miles (6.1 miles per 1,000 persons) than any other city in the world (U.S. Department of Transportation, 2003).

The impact of increased urbanization and industrialization is evident. The greater metropolitan Houston region contains 406 Toxic Release Inventory (TRI) facilities, 17 toxic-waste incinerators, 16 National Priority List (NPL) Superfund sites, and 85 Superfund sites overall, Hamilton noted (U.S. Environmental Protection Agency, 1998). It is also the location of one of the largest coal-burning power plants in the United States. And the 2.7 million vehicles in this area are driven a total of 125 million miles each day. Per person, she said, area residents drive an average of 39 miles each day—more than any other city in the nation (with 68 miles per person projected for 2025) (U.S. Department of Transportation, 2003; Houston-Galveston Area Council, 2004).

Increased urbanization amplifies exposure to environmental health hazards and is likely to have an adverse effect on human health and well-being. For example, a study of the Los Angeles metropolitan area suggested that each year nearly a thousand new cases of cancer for every one million residents may be caused by exposure to diesel-particulate emissions (South Coast Air Quality Management District, 1999). Other studies have suggested an increased cancer incidence among people who live near refineries (Macdonald, 1976; Pekkanen et al., 1995; Wu et al., 1997), and still other studies have observed that hospital admissions are significantly higher among people who live near major roadways (Buckeridge et al., 2002; Oftedal et al., 2003). These examples suggest that environmental pollutants from many sources are a health concern for the Houston region as well.

> Increased urbanization amplifies exposure to environmental health hazards and is likely to have an adverse effect on human health and well-being.
>
> *Winifred J. Hamilton*

Further, while degradation of the natural environment generally goes hand in hand with increased risks to human health, some individuals—particularly the poor and disenfranchised—are disproportionately exposed to environmental health hazards, noted Hamilton, and may be more susceptible to their adverse

effects as well. For example, 82 percent of Houston's waste-management facilities are located in predominantly African-American neighborhoods, even though the black community comprises only about 20 percent of the local population (Bullard, 1983). Similarly, the number of freeways, TRI facilities, and Superfund sites within one mile of Houston elementary schools has a strong inverse correlation with the median income of the neighborhood (Hamilton, 2004, unpublished). Hamilton also noted that among children who live in Houston's Fifth Ward, a low-income and predominantly black area that is also home to the 36-acre many diversified interests Superfund site, screenings conducted jointly by the Texas Department of Health, the city of Houston and the Agency for Toxic Substances and Disease Registry found that approximately 22 percent of the children have significantly elevated blood lead levels, in comparison with 9 percent of Texas children in general (personal communication, Reyes, 2004).

> All humans can be adversely affected by air pollution, but the very young . . . and the elderly . . . are especially vulnerable.
>
> *Stuart Abramsom*

It doesn't have to be this way, given the academic, technological, economic, political, and social resources of the region, Hamilton said. Despite the considerable environmental degradation at present, Houston has the potential to be a green and healthy city. For example, an aggressive park and tree-planting program would remove tons of particulates and other pollutants from the city's air (Nowak, 1994), while at the same time helping to increase community pride and reduce stress and violence. Trees and green space literally and figuratively "cool the streets," she noted, encouraging civility and calm within urban neighborhoods.

## SOMETHING IN THE AIR

The natural environment affects human health not only through the water we drink but also through the air we breathe, and Houston residents (not unlike others who live in urban or industrial regions elsewhere) are exposed to a variety of airborne pollutants that degrade their health by exacerbating already existing conditions or by causing the illnesses in the first place.

Asthma, allergic reactions, and a range of irritant-produced "itis-es" (e.g., rhinitis, sinusitis, conjunctivitis) are among the more routine conditions associated with air pollution, said Stuart Abramson, associate director for clinical research at the Children's Asthma Center of Texas Children's Hospital. All humans can be adversely affected by air pollution, he pointed out, but the very young (because of developing organ systems) and the elderly (because of difficulties in recovering from environmental insults) are especially vulnerable.

For example with the criteria air pollutants (airborne compounds that are federally regulated) show that ozone ($CO_3$), sulfur dioxide ($SO_2$), nitrogen diox-

ide ($NO_2$), and particulates all stimulate bronchial reflexes and inflammation, which often manifest themselves in flare-ups of asthma symptoms. These are generally outdoor contaminants, but major air pollution problems result from indoor allergens and irritants as well, especially considering that Americans spend about 90 percent of their time indoors. Indoor agents most highly relevant for the Houston area include dust mites, mold, pet-derived allergens, air fresheners, cigarette smoke, and cleaning solvents. Studies in Houston schools to measure children's exposures to dust mites and mold, Abramson reported, showed that 30 to 50 percent of the classrooms exceeded thresholds for sensitization (Tortolero, et al., 2002).

Abramson stressed, however, that studying one contaminant at a time gives an erroneous, and usually understated, expression of the effects of air pollution on human health. Studies may report one health effect from ozone and another health effect from a different contaminant, but few studies have looked at contaminants together or at the combined impacts of indoor and outdoor environments with regard to personal exposures.

Some of the net effects are that asthma incidence among the nation's children has doubled in the past decade—about 6 million children have this disease, as do 20 million Americans overall. In Houston, a study done with the collaborative efforts of the Children's Asthma Center, the University of Texas School of Public Health, and Baylor College of Medicine surveyed some 21,000 city schoolchildren and found that about 10 percent of them had asthma (Sockrider et al., 1999; Tortolero et al., 2004).

In a 151-city study, in which Houston was included, researchers found a 4 percent increase in overall mortality, a 6 percent increase in cardiovascular mortality, and an 8 percent increase in lung cancer mortality related to particulates, which tend to be composites of numerous compounds (Pope et al., 2002). In an older, but seminal, 6-city study in which Houston was not included, overall mortality was 26 percent higher in the most polluted city of Steubenville, Ohio (Dockery et al., 1993).

Despite the extensive indications (the above represent a small sample of the results of numerous studies), direct correlations between adverse health effects and specific air pollutant exposures are difficult to come by—the obligatory epidemiologic studies require a financial commitment, extensive population, and very critical assessment of different confounding variables, noted Abramson. This gap is particularly acute in Houston, where anecdotal connections are persuasive but actual epidemiologic evidence is rare.

Still, efforts to correct the omission are under way. An assessment of information needs for research on air pollution health effects in this area was recently put together by BRIDGES to Sustainability and the Mickey Leland National Urban Air Toxics Research Center funded by the Texas Council on Environmental Technology (BRIDGES, 2003). The city of Houston has received a Health Tracking Grant from the Centers for Disease Control and Prevention and

it is currently considering particular health effects on which to focus. Asthma is being studied through a project funded by The Robert Wood Johnson Foundation and the American Academy of Allergy, Asthma, and Immunology that is looking at emergency room admissions of children at the Houston area hospitals that account for the 80 percent of all pediatric admissions. Lastly, Texas Children's Hospital is participating in a study sponsored by the Mickey Leland Center to look at all of the region's schoolchildren and their personal exposures to a variety of aldehydes, ketones, and other air pollutants. The ultimate goals of these efforts, said Abramson, are better environmental controls and conservation measures to help reduce the amount of exposure.

With the aid of federal legislation, the region had made significant progress over the past few decades in cleaning up its water pollution, hazardous waste disposal sites, and even some of its air pollution, although there is still substantial room for further improvement.

*James Blackburn*

### Learning from Water Pollution While Addressing Air Pollution

Environmental degradation, even in its more extreme forms, need not be permanent when motivated people, empowered by effective laws and policies, are persistent. Environmental attorney James Blackburn, a principal in the Houston firm of Blackburn & Carter, noted in particular that with the aid of federal legislation, the region had made significant progress over the past few decades in cleaning up its water pollution, hazardous waste disposal sites, and even some of its air pollution, although there is still substantial room for further improvement.

In the 1970s, some environmentalists dubbed the Houston Ship Channel the most polluted waterway in the United States and probably the world. However, there were significant improvements in the cleanup of the waterway and Galveston Bay (to which it connects) when the Environmental Protection Agency (EPA) enforced the Clean Water Act of 1972. That law, said Blackburn, was strong and effective, requiring a permit for all existing water pollution point sources (Figure 3.2). The result was a significant improvement in wastewater treatment systems, which mean that water quality has improved.

Similarly, the federal government has played a critical role in addressing the industrial pollution associated with solid and hazardous wastes in the Houston area, according to Blackburn. CERCLA (the Comprehensive Environmental Response, Compensation, and Liability Act)—commonly known as the Superfund Act—has been instrumental in addressing the surface manifestations of hazardous wastes. It is effective, and has resulted in Houston's hazardous waste sites being cleaned up. One might still find a 55-gallon drum somewhere, but for the most part the city has disposed of the surface manifestations. Also, although

**FIGURE 3.2** Older industrial facilities that were "grandfathered" by the Clean Air Act still emit unacceptable levels of pollution. SOURCE: U.S Coastguard, http://www.uscg.mil/vtshouston/images/morgansptpassing.jpg.

contamination of the soil and of the shallow groundwater beneath the soil is a remaining problem, this is not considered a threat to drinking water because the area has a clay layer that limits much of the chemicals' downward movement.

Another example of effective federal involvement in improving Houston's environmental quality involves air pollution. There has been a significant improvement in cleaning up the region's ozone pollution since 1970, when the Clean Air Act was passed and EPA acquired jurisdiction over, the clean up, said Blackburn. The ozone pollution levels went from approximatley 400 parts per billion down to approximately 200. However, the federal standard is 120 so there are still significant violations; Houston has failed to meet the standard for more than 30 years and there has been a history of not being as concerned about health issues as is warranted, cautioned Blackburn.

### Strategies for Addressing Air Pollution

Some approaches for addressing air pollution were offered by Ramón Alvarez, a scientist in the Texas Office of Environmental Defense. For example, trucks that are lower emitting and more fuel efficient (and therefore lower cost over the life of the vehicle) should be deployed wherever possible. FedEx is

developing such trucks for its package deliveries, and Houston's air could benefit from them in the near future.

Another way to reduce an important emissions source from diesel vehicles—the extended idling of long-haul diesel trucks at roadside truck stops which is mainly done for heating or cooling—could be eliminated by using electric-powered services (including temperature control, telephone, internet, and cable) that attach to the window of the truck cab. This technology's general use would not only eliminate unnecessary pollutant emissions (which sometimes persist as long as 12 hours at a time), but also save truckers money on fuel costs and wear and tear on their engines, noted Alvarez (Figure 3.3).

For reducing transportation-related emissions more generally—from cars as well as trucks—Alvarez pointed out the need to focus on the demand side and give people incentives to drive fewer miles. One such approach being promoted by Environmental Defense is "pay-as-you-drive" car insurance policies in which premiums are priced by the number of miles driven rather than at a fixed annual rate. Another is "parking cash out," whereby businesses offer employees the option of taking the cash equivalent of parking space fees in exchange for finding alternative ways to get to work.

Longer-term solutions clearly are needed, Alvarez said, and they tend to be

**FIGURE 3.3** Reducing engine idling by providing electrical access at truck stops is one measure to decrease emissions. SOURCE: Idle Aire. Reprinted with permission.

supply side. He suggested that the region should be increasing the pedestrian, bike, and transit options for everyone and emphasizing smart growth in the development of communities. For example, in the Dallas suburb of Frisco, new homes must be built to a high level of energy efficiency in accordance with EPA's Energy Star building standard, which reduces electricity consumption by 30 percent compared to a standard home. This not only decreases costs to homeowners over time but also reduces emissions from power plants, thus alleviating regional air pollution and global warming.

Also over the long term, he added, we need to focus on reducing industrial emissions, promoting environmental accountability, and educating legislators about the public health implications of their decisions. The public support for strong clean air measures was borne out by a recent survey of local residents (Klinenberg, 2002). The most critical challenge facing Houston, in respondents' opinions, was traffic. Environment was second—ranking ahead of economy, crime, and schools—and, within environment; the issue of air quality and its connection to health was listed as top priority.

Citing Dr. Goldman's earlier remarks about the counterproductive nature of finger pointing, Alvarez urged that the air pollution problem be approached holistically. The region's air will not be cleaned up merely by focusing on one source category, whether vehicle emissions or industrial emissions. If the region emphasizes one over the other, it runs the risk of harming the entire effort. The region must address all of the sources, he noted.

## REGIONAL FLOODS: CONTINUAL CHALLENGES

Most of Texas has a water supply problem: its communities tend to be chronically short of water. Yet Houston's corner of the Gulf Coast—characterized by frequent thunderstorms and hurricanes, coupled with the flatness of the local terrain and large flood plains—is episodically stressed with an abundance of water. Kevin Shanley, president of the SWA Group (a national landscape architecture firm) and president of Houston's Bayou Preservation Association, noted that too often when it rains in Houston, Houstonians don't know what to do with all the water. The resulting floods can be costly and severe as they disrupt local transportation systems, businesses, and daily life in general; put entire neighborhoods under water; and invade homes and automobiles. Tropical Storm Allison of 2001, for example, inundated 70,000 local homes and hundreds of thousands of cars and the basement of the Texas Medical Center.

Meanwhile, shallow wells and drinking water treatment plants get contaminated by run-off, the power system is disrupted, and many industrial operations grind to a halt. Financial impacts can be prodigious: Allison alone caused $5 billion in damages just for readily quantifiable losses. Even in quieter times, the cost of insurance for flooding poses a major economic burden to the Houston community, particularly lower-income neighborhoods.

Flooding also presents numerous risks to human safety and health. Street flooding leads to traffic accidents and drowning, people needing medical care may be isolated (or medical centers themselves be rendered inaccessible), and the mosquito population rises, which leads to increased disease risk. With sewage systems grossly overloaded, sewage comes out of manholes and out of people's properties, spewing untreated wastes across the landscape. Rising water lifts toxic materials out of the ground, making contact with humans more likely.

Such devastation, risk, and uncertainty can wreak havoc not only on the community's property, processes, and physical health but also on its spirit. Houstonians are such resilient people that even when their personal possessions are put out on the street or swept away, they rebuild, but Shanley questioned what all of this means in terms of our social fabric.

It is logical that given the long history of flooding events in this region and their vast impacts, Houstonians are now working on solutions to prevent their occurrence—or at least limit their magnitude—in the future. One set of options aims to establish better drainage systems, noted Shanley. This consists of networks of bigger and bigger collection pipes that lead to ditches and then to larger ditches. It is a very efficient process, but with a major drawback. Unlike rain in a natural watershed, where water accumulates in a stream and has considerable time to leave the watershed, these efficient drainage systems collect the rain into channels quickly, resulting in a spike in the water level (Figure 3.4), he said. Water levels may subside quickly, but it really doesn't matter whether the water was in the basement of a hospital for 10 minutes, or 2 hours, or 12 hours, the water damage is done, observed Shanley.

Another set of options involves peak flow attenuation, which is designed to eliminate the spike in water runoff. This has to occur on the individual property as well as on the regional level. Whether one is a businessman, property developer, or homeowner, one needs to keep the rainfall that lands on their property confined to the property for as long as possible, said Shanley. Such retention can transcend individual solutions and grow in scale—and enjoy economies of scale. Right now in fact, regional authorities are planning and implementing large regional retention basins, he noted. These larger retention basins are part of the solution, but they cannot be the only solution, because smaller systems of different types of water management provide complementary support.

In this spirit, Shanley briefly discussed the options of dispersed systems such as drainage schemes in parking lots that feed subsurface containments, home cisterns that accumulate roof runoff, and street medians and rain gardens that not only store water but provide rich and beautiful ecological zones (Figure 3.5). Not to be overlooked on this score are the region's own natural (or augmented) wetlands, which are the big sponges of the area.

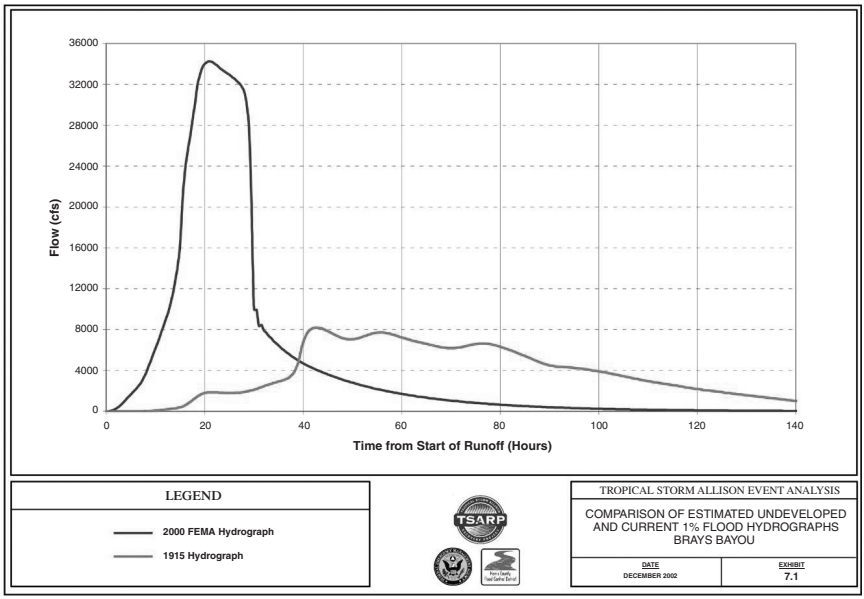



**FIGURE 3.4** Peak water runoff occurred at a significantly higher level in 2000 compared to 1915. These peaks overwhelm the current water systems and contribute to the acute flooding problem in Houston. SOURCE: © 2002-2004 Harris County Flood Control District. Reprinted with permission.

**FIGURE 3.5** Rain gardens and street medians used for water drainage not only store water but provide rich and beautiful ecological zones. SOURCE: Tom Fox, the SWA Group. Reprinted with permission.

## PROVIDING SAFE DRINKING WATER

Safe drinking water is the first line of defense in protecting public health from environmental threats. The provision of drinking water, of high quality and in adequate quantities, is the main mission universally shared by the nation's water supply professionals, noted Roger Hulbert, senior assistant director of water production for the City of Houston.

Federal authorities currently regulate 87 different contaminants in drinking water, require monitoring of (but do not regulate) an additional 26 compounds, and have established 15 secondary standards for aesthetic water quality measures such as taste and odor. Hulbert stressed that the city of Houston, together with most other public water utilities in the United States, complies with these regulatory standards. He noted, for example, that in 2002 alone, Houston conducted some 427,000 chemical, microbiological, and physical analyses of water in reservoirs, treated water, and distribution system water to confirm that fact; the city actually exceeds the requirements of EPA and the Texas Commission on Environmental Quality, Hulbert said.

With respect to quantity, the city has 1.1 billion gallons of water supply capacity—a wealth of water that enables it to be a regional provider to the eight-county area's water utilities. The city has planned not only for water rights to ensure supply, but also for adequate treatment capacity. It currently boasts 510 million gallons per day of capacity for surface water treatment and expects an additional 120 million to be online by about 2008. Also available are some 360 million gallons of groundwater, but Hulbert noted that Houston area authorities are moving away from dependence on this resource. Reasons include the natural arsenic concentrations in some local groundwater and subsidence caused by the mining of groundwater.

He cited the adage that everybody lives downstream from somebody else—and that Houston actually lives downstream from Dallas. A significant part of the Trinity River's flow at times is wastewater from Dallas, and even though it then meanders hundreds of miles and goes through the Lake Livingston Reservoir—thereby receiving natural filtration before arriving in Houston—the city nevertheless has to finish the water at its surface-water treatment plants.

Local wastewater, meanwhile, may soon serve as a water supply resource in its own right and give water conservation efforts a boost. The city is conducting a water reclamation feasibility study now, based on membrane treatment of wastewater effluent, for a capacity of up to 100 million gallons a day for industrial water uses along the Houston Ship Channel. If this approach proves feasible, the cost of distributing such water to industrial customers, who would then use it for production processes and cooling, would be much reduced. A

> A gallon saved is a gallon that does not have to be treated to drinking water standards.
>
> *Roger Hubert*

gallon saved is a gallon that does not have to be treated to drinking water standards, according to Hubert.

## LEARNING FROM NATURE

Speakers during the session on the natural environment noted the need for long-term solutions. One way would be to develop a grassroots base, think holistically in addressing environmental problems, and build greener and healthier cities, asserted Cath Conlon, founder and director of the Blackwood Educational Land Institute (Hempstead, Texas), and her colleague Jackie Hall of the Hall Group, a business development consultancy. Blackwood Educational Land Institute may bridge the gaps by providing a "living classroom" for teaching children and adults alike to explore the natural web of life and develop a healthy relationship with nature—or, according to the institute's mission statement, "a reverence for and accountability to nature." Forming such bonds between the environment and people, suggested Conlon and Hall, helps strengthen our communities—urban and otherwise—as well.

Forming such bonds between the environment and people helps strengthen our communities—urban and otherwise—as well.

*Cath Conlon and Jackie Hall*

Blackwood offers school curricula, workshops, retreats, and seminars to Houstonians (the 23-acre tract is located some 45 minutes from the city), based on the belief that the land is the true teacher. When children experience nature so directly, said Hall, they can then become ecologists. They appreciate conservation and become more aware of their surroundings. Also, although most of the city kids who learn at Blackwood don't have so much as a postage stamp of land of their own, the important thing is the state of mind they have acquired—likely, for a lifetime—about their environment, wherever and whatever it may be.

This learning is not a one-time-only affair. Consistent with its message of sustainability, Blackwood establishes relationships with students, usually when they are in middle school that last throughout their high school years. By the time they graduate, they have spent 150 days at Blackwood. The resulting legacy not only elevates environmental awareness in general but cultivates a child's own health and well-being, on into adulthood, by having profited from such practical lessons as good nutrition at the institute, said Conlon. This consciousness in interconnectedness and sustainability, Conlon suggested, may also promote preventive measures for many of the diseases and conditions bemoaned by earlier speakers—asthma, diabetes, cancer, obesity, depression—that are caused or exacerbated by degraded environments.

# 4

# Social Environment

The social environment that a community inherits, endures, improves, or creates can have a profound influence on the health of its people and the quality of its natural and built environments. Achieving a comfortable social environment is difficult enough under routine circumstances, but in a region of rapid transitions it is particularly challenging. Thus, although Houston has attained the distinction in recent years of being one of the most ethnically balanced regions in the country—at least on a city-wide basis—and the cultural and political health in many neighborhoods is growing stronger, Houstonians generally agree that they still have a lot of work to do to realize the full potential of their city's young, diverse, and ambitious population. They need to build an urban environment in which other people will want to settle and actively participate in the community—an environment that can serve as a model for a state and nation whose demographics are similarly in transition.

A panel of speakers described the dramatic changes over the past 50 years, and particularly in the last 20 years, in the size, age, and ethnic mix of Houston's population; the variability of the region's economic health during recent decades and the transformation of its industrial base; the growing environmental consciousness of individuals and local organizations (both public and private); the buildup of social capital in Houston; and the social problems that still have to be seriously addressed.

## THE DEMOGRAPHIC AND SOCIOECONOMIC TRENDS IN HOUSTON

Throughout most of its history, Houston was a bi-racial southern city dominated by Caucasian men. However, in the past 20 years, Houston has undergone a demographic revolution, becoming one of the most ethnically and culturally diverse cities in America, observed Stephen L. Klineberg of Rice University. More than 3.4 million people now live in Harris County, Texas, which com-

prises much of the city's metropolitan area, and today there is no predominant majority in the county (Figure 4.1).

Today, Houston has a more even balance among the four ethnic communities than any of the other "multiethnic melting pot" American cities. It has more African Americans than Los Angeles, more Asians than Miami, and more Hispanics than San Francisco. This is where the four communities meet in a more equal division than anywhere else, said Klineberg. In that sense, it represents a test case for the rest of the state and the country. According to the U.S. Census, by early 2005, Texas will have joined California as a "majority minority" state, and it is projected that the United States as a whole will attain that status before the middle of this century. Thus, Houston's ability to navigate its demographic transition successfully could have enormous significance not just for the city's future but for America's future as well.

Accompanying this "browning" trend is a "graying" trend: as people continue to live longer, healthier lives and baby boomers move into retirement, the U.S. population aged 65 and older will double in the next 25 years. These older individuals will be overwhelmingly Caucasian, while younger Americans will be disproportionately non-Caucasian. For 22 years, Klineberg has been conducting the annual Houston Area Survey that confirms the following trend: the Caucasian population is getting older, while there is virtually no aging trend among the African Americans or Hispanics.

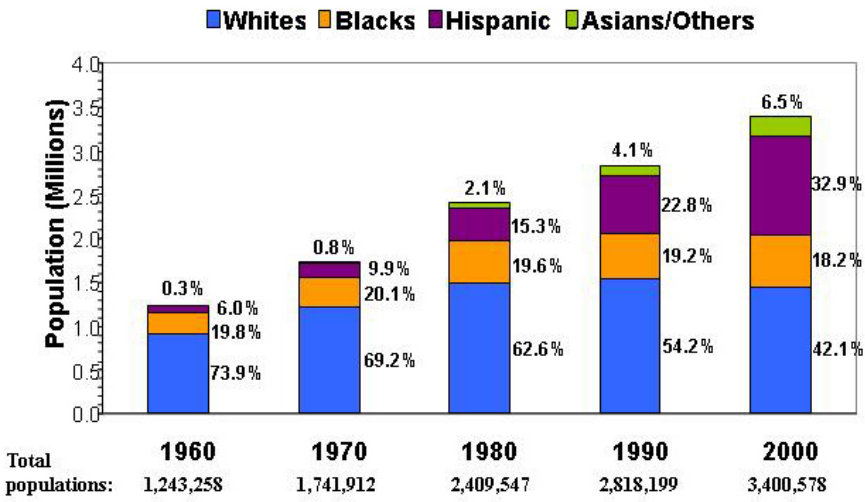



**FIGURE 4.1** The population of Harris County, Texas, has shifted from predominantly Caucasian in 1980 to culturally and ethnically diverse in 2000, such that no ethnic group is a majority in the county. SOURCE: U.S. Census. Reprinted with permission.

The trends reflect the composition, amount, and timing of migration into Houston. People tend to migrate when they are young, noted Klineberg, and whereas large numbers of young Caucasians came to Houston in the 1960s and 1970s, they stopped arriving after the oil bust in 1982. Since then, the vast majority of new arrivals have been African Americans, Hispanics, and Asians. Almost two-thirds of all Hispanics currently living in the city are first-generation immigrants, as are 90 percent of all adult Asians. The net effect on the Houston population at present is that 75 percent of all residents aged 60 years and older are Caucasian and 75 percent under 30 are non-Caucasian (Klinenberg, 2002).

Had Houston not been one of the great magnets for the new immigration of the last 20 years, this city would have suffered the same fate as Philadelphia, Pittsburgh, Cleveland, Cincinnati, St. Louis, Baltimore, and Detroit—major metropolitan areas that have lost population in the last 20 years, said Klineberg. Instead, Houston is one of the most rapidly growing and vibrant cities in America, purely because of the influx of immigrants from Asia, Latin America, Africa, and the Caribbean.

The Houston Area Survey[1], which asks respondents many of the same basic questions year after year to gauge changes in public perceptions, started out in prosperous times, but the first survey, which revealed great economic optimism, was followed just two months later, in May 1982, by the collapse of the twentieth-century oil boom, which until then had driven a period of unrelieved economic expansion. Not surprisingly, responses in surveys to the question "How would you rate job opportunities in the Houston area: excellent, good, fair, or poor" tracked the subsequent recession, as well as the later recovery into a restructured economy (Figure 4.2).

While the price of oil was $31.50 a barrel in early 1982, by 1987 it had fallen to less than $10. One out of every seven jobs in Houston in 1982 had disappeared by 1987. This was the worst regional recession in any part of the country at any time since the Great Depression, said Klineberg. Yet by 1990, Houston had recovered all of the jobs lost between 1982 and 1987; its fortunes were now much less dependent on the local oil business and were largely locked into the national and global economies. Since then, despite a short-lived recession in the early 1990s and the current recession of the past few years, Houston has experienced significant economic growth and a shift into a radically new kind of economy.

The opportunity for a young man or woman with just a high school diploma to enter the Houston workforce and expect to make a middle-class wage is gone forever, said Klineberg. From now on, what one earns depends on what one has

[1]Survey participants are selected each year through a two-stage random-digit-dialing procedure. In each household reached by randomly generated telephone numbers, the designated respondent is selected randomly from all household members aged 18 or older. In 10 of the last 11 years, the survey was expanded to include at least 450 Anglos, 450 Hispanics, and 450 African Americans.

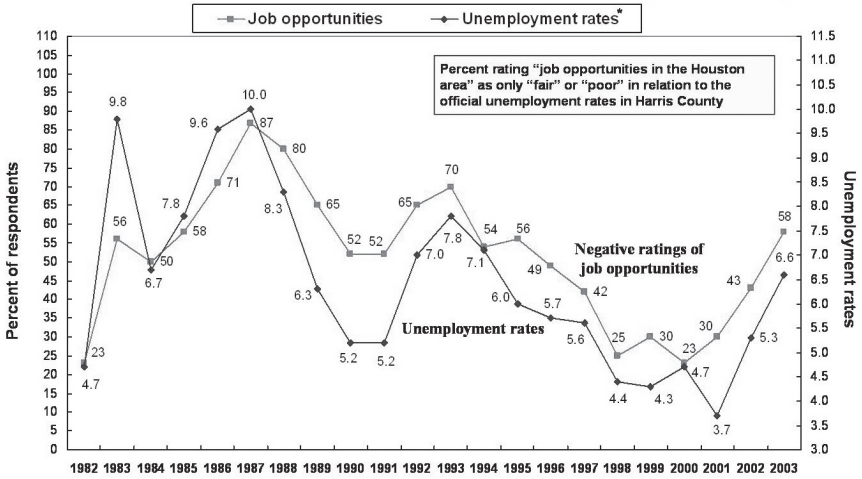



**FIGURE 4.2** The Houston Area Survey records public perceptions of job opportunities, which correlate closely with the official unemployment rates. SOURCE: Houston Area Survey and Texas Workforce Commission. Reprinted with permission.

learned. College education has become almost essential for the ability to move up in the knowledge economy.

One major consequence of this change has been a new and growing inequality in an economy that is producing numerous jobs for highly skilled technical workers and many low-paid, no-benefit service jobs for unskilled or semi-skilled workers, with fewer jobs in between. Another consequence is that when the source of wealth is knowledge rather than natural resources, quality-of-life issues and the physical attractiveness of the city become high priorities. Turning Houston into a city where people will want to live has become important for economic success in a way that was not the case during most of the twentieth century, when Houston's location near the East Texas oilfields was the guarantor of economic prosperity. Suddenly, factors such as mobility, air quality, revitalization of downtown areas, and the richness of hiking and boating areas have become critical determinants of urban prosperity.

When the source of wealth is knowledge rather than natural resources, quality-of-life issues and physical attractions of the city become high priorities.

*Stephen Klineberg*

Thus, there is a new understanding among Houston's business elite about

the importance of environmental protection. Strategies for economic success in the region now require a much broader appreciation of quality-of-life issues in a way that has not been seen before locally, and initiatives are emerging to address them, noted Klineberg. For example, members of Houston's business community, represented by the Greater Houston Partnership, has joined with organizations such as Trees for Houston and Scenic Houston into the Quality of Life Coalition, with goals such as turning bayous into linear parks, tearing down billboards, doubling the city's park space, and ultimately ensuring that up to a million trees get planted in the area during the next decade.

In a similar spirit, the partnership has formed the Center for Houston's Future, committed to the identification of emerging largely non-Caucasian leaders and bringing them together in forums to explore the nature and importance of civic leadership for Houston in the twenty-first century. The center is also working with groups such as the Greater Houston Collaborative for Children to guarantee that all children in the city between the ages of 3 and 4 get quality preschool education before starting kindergarten.

This increasingly enlightened attitude within the Houston business community is catching up with trends already evident among the area's residents, noted Klineberg. Whereas Houston Area Survey (HAS) respondents were preoccupied with the economy in the 1980s and with crime in the 1990s as the biggest problems facing the people of Houston, they are now citing issues such as mobility, air quality, health care, and education (www.houstonareasurvey.org). The population is no longer preoccupied with either economic insecurity or personal safety but has begun thinking seriously about what must be done collectively to position Houston for success in the very different world of the twenty-first century.

Still, although it's encouraging that people are "talking the talk," what counts is whether they "walk the walk," said Klineberg. As indicated by HAS survey results (Figure 4.3), education levels among Houston's residents, particularly African Americans and Hispanics, show considerable room for improvement. It is a safe statement to make that, if Houston's African-American and Hispanic young people are unprepared to succeed in the knowledge economy of the twenty-first century, it is hard to imagine a prosperous future for Houston, said Klineberg.

Despite the enormous challenge, there is room for optimism because of an unprecedented set of opportunities, driven by personal and business objectives alike, for the coming together of economic, environmental, and humanitarian interests to refashion Houston for success in the new century.

## BUILDING THE CITY'S SOCIAL CAPITAL

In his book *Bowling Alone: The Collapse and Revival of American Community*, Putnam (2000) regrets the country's general loss of social capital. Americans, he observes, sign fewer petitions, belong to fewer organizations, know fewer neighbors, meet with friends less often, and even socialize with their fami-

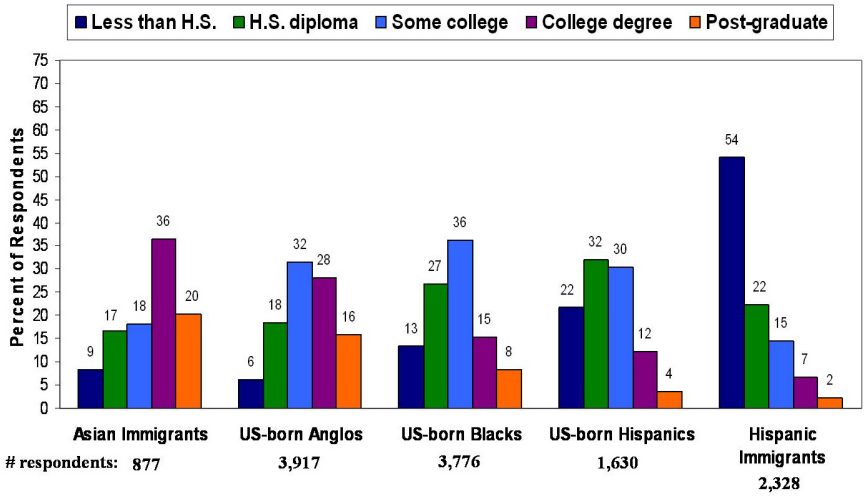



**FIGURE 4.3** There are sharp disparities among various ethnic groups in Houston in the level of education achieved. Hispanic immigrants are less likely to have a high-school diploma compared to other ethnic groups and immigrants. SOURCE: Houston Area Survey. Reprinted with permission.

lies on a diminishing basis. To cite the book's title metaphor, whereas Americans used to enjoy bowling in leagues, now they are more likely to bowl alone (Putnam, 2000). Putnam defines social capital as the collective value of all social networks, particularly regarding norms of reciprocity—the inclinations that allow people to do things for each other. The central premise of social capital is that social networks have value and lead to healthier communities (Putnam, 2000).

Houston appears to be accepting this premise while bucking the alleged national trend; although they might phrase it differently, most residents agree that the metropolitan area's stock of social capital has grown appreciably in recent years. Beverly J. Gor, of the Center for Research on Minority Health and a native Houstonian, has observed this phenomenon firsthand. She attributes the growth to the city's transformation from a sleepy white–black town to a multiculturally diverse region in which no racial or ethnic group holds the majority and to Houstonians' general tolerance and acceptance of this diversity.

Gor discussed four specific aspects of social capital and how they have fared in Houston:

*1. Information flows*. The city boasts a variety of ethnic and language-specific newspapers, radio stations, television stations, and other media outlets. The *Houston Chronicle* often publishes articles in Spanish, has sections that

report on activities in the Asian-American community, and publishes special sections celebrating events of particular importance to the African-American community. News anchors and reporters on major television stations reflect ethnic diversity, and some stations even carry special programming targeted at local ethnic communities. Public information initiatives reflect the area's diversity too; printed materials for a recent educational campaign on hepatitis B, for example, were provided in English, Chinese, Vietnamese, and Spanish.

*2. Norms of reciprocity*. According to Putnam, these norms are demonstrated in the mutual aid that builds networks between individuals who are similar and create bridges between diverse individuals. Houston has numerous organizations—professional, cultural, recreational, religious, neighborhood, and civic—that form such mutually beneficial connections. They are aided by the region's educational institutions, which not only reflect racial diversity themselves but support cross-cultural exchanges in the general community. For example, many health professionals are enrolling in medical Spanish classes to improve their communication with clients.

*3. Collective action*. Houstonians are known for their generosity and for stepping up to the plate when there is a publicized need in the community, said Gor. When there are house fires, food drives, or relief efforts under way, local people get involved in large numbers. Similarly, the Mayor's Night Out campaign encourages neighborhood people to get better acquainted. Neighbors who know one another feel more secure and they tend to watch out for each other's homes and property.

*4. Broader identities and solidarity*. Houstonians are viewing themselves as a racially mixed population, said Gor. As evidence of Houston's acceptance of diversity, she noted the mix of races, ethnic groups, and gender in city government. The city of Houston's controller is openly gay and very well accepted as a community leader; Houston has its first Pakistani City Council member; and more Hispanics and women are represented on the Council.

There is a large, vocal, and active religious community in Houston that promotes racial harmony, preferring to see the community as rich in opportunities for cross-cultural interaction, said Gor. Meanwhile, educators are trying to teach young people to become more color-blind and judge others by their character rather than the color of their skin. She acknowledged, however, that although Houston's interethnic relations are good—or at least not fraught with bitter confrontation—racial tensions do simmer under the surface, driven, for example, by alleged police brutality toward non-Caucasians, racial profiling by business owners, or more benign cultural dissonances

Although many of the city's neighborhoods are richly ethnic, they tend to be predominantly of single ethnicity and to interact minimally with each other.

*Angelina Espasza*

such as complaints in ethnically mixed communities of live chickens running around in neighbors' backyards.

In fact, ethnically mixed communities are the exception rather than the rule, said Angeline Esperza, past president of the Houston Hispanic Health Coalition. They tend to be predominantly of single ethnicity and to interact minimally with each other. Klineberg agreed, noting that the 2000 Census found Caucasians to be more segregated today than they were 10 years ago—it is less likely that a Caucasian family in Houston today will have an African American or Hispanic neighbor, than was the case in 1990.

Part of the reason is that Houston is the most spread out major city in the United States, with one-third the population density even of infamously sprawling Los Angeles (approximately 2,000 people per square mile in Houston versus 6,000 in Los Angeles). The eight-county area that the U.S. Census defines as the Houston metropolitan area covers a geographical space the size of New Jersey. The result is tremendous spread, in which people tend to live in separate little enclaves, said Klineberg.

Other factors also put constraints on the buildup of Houston's social capital, said Esparza: unsafe communities, lack of support for education, alienation of some individuals (including the elderly and newly arrived), absent or loose regulations that fail to protect public health in general, and inadequate or no access to basic medical care for some communities.

When an uninsured individual is forced to utilize the emergency room after many failed attempts at other sources, trauma emergency care for all Houston citizens is impaired. As hospital and trauma units go on drive-by status, no one can access these services. We have to focus more attention and social capital on this problem. We must promote more preventive medicine and ensure proper health care for our children in order to secure a healthier future, concluded Esparza.

# 5

# Built Environment

In recent years, the interdependence of the built environment and human health has generated considerable interest among public health professionals. The report of the Roundtable's first workshop in 2001, *Rebuilding the Unity of Health and the Environment: A New Vision for the 21st Centur*y (IOM, 2001), highlighted the need for a broader definition of environmental health, which would include the built environment. In the United States, many of our cities are experiencing rapid growth resulting in sprawl that stretches to the horizon because of the increasing reliance on automobiles. Houston is one such example, which has led some individuals to refer to the city as "the blob that ate East Texas." A panel of local and national speakers addressed the health impacts of the built environment and ways in which individuals, the city, corporations, and organizations can improve the connections.

## AN IMPACT ON HEALTH

The built environment has a significant influence on human health and well-being. It defines the spaces in which we live, work, or play, and it affects us though associated land-use strategies, natural resource consumption, and patterns of waste disposal. A poorly designed built environment consumes excessive amounts of water and energy, produces unnecessary waste, and generally degrades living conditions for human beings; a well-designed built environment, by contrast, tends to conserve resources and improve our lives.

Unfortunately, said Samuel H. Wilson, deputy director of the National Institute of Environmental Health Sciences, the typical American community is characterized by the poorly designed and often unplanned version, replete with such characteristics as traffic congestion, poor air quality, and a weak sense of community—all of which appear to be true of Houston, though it is by no means alone. This pattern of urban development is known as sprawl—growth in outly-

> The typical American community is characterized by the poorly designed and often unplanned version, replete with such characteristics as traffic congestion, poor air quality, and a weak sense of community.
>
> *Samuel H. Wilson*

ing low-density areas that often neglects the influence of the built environment on the social and natural environments, and on human health and quality of life.

Wilson illustrated the contrast between sprawl and the plan of a traditional neighborhood, on whose streets one can easily walk to a nearby school or shopping destination (Figure 5.1). Services and needs in such neighborhoods are within convenient reach of residents, who thus may often forgo the use of their cars. In the suburban sprawl pattern, by contrast, residences are built in clusters well removed from services and needs. Walking or bicycling is inconvenient—even dangerous, sidewalks are often lacking, and a major roadway is usually part of the route. Moreover, this built environment pattern, whose

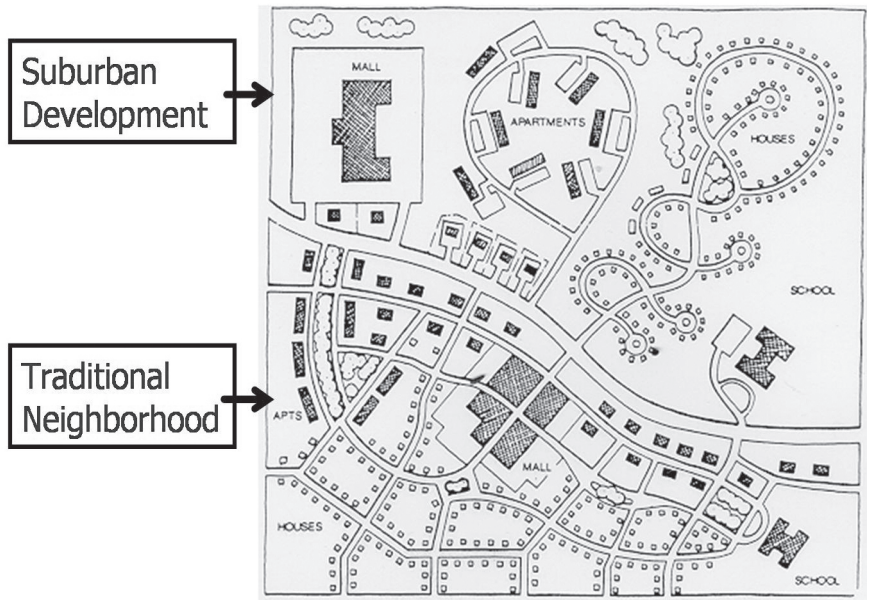



**FIGURE 5.1** As populations move, there is a shift from traditional neighborhoods to suburban areas. In traditional neighborhoods, residents can walk to nearby schools, shopping destinations, and other conveniences. By contrast, in suburban areas the emphasis is on building in clusters, often removed from necessary services. This encourages greater dependence on the automobile and often discourages walking and biking. SOURCE: Spielberg, 1989. Reprinted with permission.

separation of different land uses and low connectivity not only discourages outdoor physical activity but also restricts social interaction, is seen over and over again across the country.

## Transportation and Health

With increased dependence on the automobile, traffic congestion has increased, resulting in extended times for commuting, enhanced risk of accidents, additional exposure to exhausts, and heightened stress and frustration. When it comes to serious and severe crashes of automobiles, crashes with trucks, and crashes with rail vehicles in at-grade crossings, the Houston metropolitan area has the highest rates in Texas and ranks very close to the top in the nation, reported Catherine Pernot of the Gulf Coast Institute. In 1999, for example, the region had more than 80,000 serious crashes that caused 518 fatalities and almost 52,000 injuries (McCann and Ewing, 2003). Considering its walker-unfriendly roadways, pedestrians don't fare much better. According to the Surface Transportation Policy Project (STPP; a national, largely foundation-funded organization), Houston is the nation's seventh most dangerous place for pedestrian traffic (McCann and Ewing, 2003). Consistent with studies showing that the wider the street, the more dangerous it is for pedestrians, Pernot pointed out that the city's worst sections in this regard are its sprawling south and west, which include an abundance of wide and high-speed arterials.

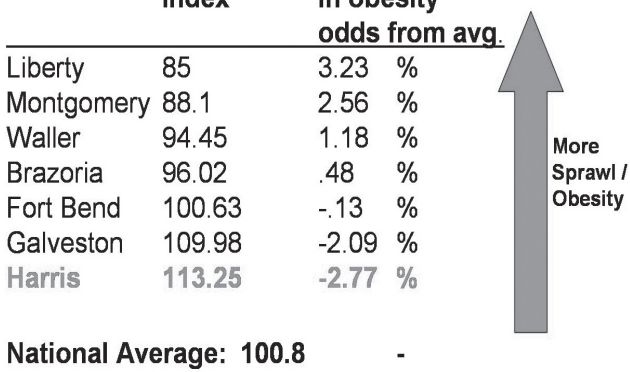
## Built Environment and Disease

The built environment contributes not only to human injury but also to human disease, as illustrated by the epidemic in obesity and overweight now manifest across the country, said Wilson. Ranking second only to tobacco-related deaths, this epidemic accounts for more than 300,000 premature deaths each year—a major human health and public health problem (Mokdad et al., 1999; Mokdad et al., 2001). By constructing communities with decreased population density and employment density, increased numbers of automobile trips, and decreased amounts of exercise, we incur higher levels of overweight and obesity. Researchers in this field target the level of physical activity, not the amount of food intake, as the primary cause, he said (Stein and Colditz, 2004).

After analyzing 400 counties around the nation, the STTP concluded that people who live in counties marked by sprawling development are likely to walk less and weigh more than people who live in less sprawling counties (Figure 5.2). Further, some areas of Houston, which have a higher sprawl index, also have greater odds of residents being obese (Figure 5.3). The STTP also found that the proportion of adults who walked or bicycled to school when they were young was 71 percent, while only 18 percent of children now walk or bicycle to school (Surface Transportation Policy Project, 2003). These numbers may have


| Sprawl Index | County | Expected Weight |
|---|---|---|
| 63.12 | Geauga, OH | 167.5 |
| 69.61 | Walton, GA | 167.3 |
| 85.67 | El Dorado, CA | 167.0 |
| 87.51 | Clay, FL | 166.9 |
| 100.08 | McHenry, IL | 166.6 |
| 113.25 | Harris, TX | 166.35 |
| 125.35 | Delaware, PA | 166.1 |
| 209.27 | San Francisco, CA | 164.2 |
| 352.07 | New York, NY | 161.1 |

**FIGURE 5.2** A relationship exists between the urban sprawl index and expected weight gain. The sprawl index used data from the U.S. Census Bureau and other federal sources to quantify development patterns. Counties with a higher degree of sprawl received a lower numerical value on the index. The sprawl indexed was compared to the body weight optained from the Behavioral Risk Factor Surveillance System, which is maintained by the Centers for Disease Control and Prevention. The comparison shows that areas in the United States with greater sprawl have a higher body weight for their citizens then regions with less sprawl. SOURCE: McCann, Ewing, 2003. Reprinted with permission.




| | Sprawl Index | % difference in obesity odds from avg. |
|---|---|---|
| Liberty | 85 | 3.23 % |
| Montgomery | 88.1 | 2.56 % |
| Waller | 94.45 | 1.18 % |
| Brazoria | 96.02 | .48 % |
| Fort Bend | 100.63 | -.13 % |
| Galveston | 109.98 | -2.09 % |
| Harris | 113.25 | -2.77 % |

**National Average: 100.8 -**

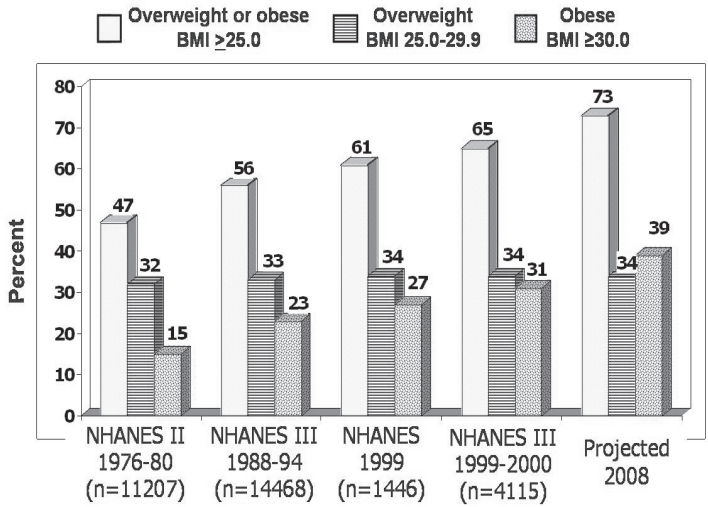
**FIGURE 5.3** Similar to national trends, the regions that encompass the greater Houston metropolitan area vary in overall obesity odds. The sprawl index used data from the U.S. Census Bureau and other federal sources to quantify development patterns. Counties with a higher degree of sprawl received a lower numerical value on the index. Regions within the Houston area that have less sprawl also have lower obesity odds compared to the national average. SOURCE: McCann, Ewing, 2003. Reprinted with permission.

something to do with the differences in each generation's built environments, noted Pernot.

At present, an estimated 70 percent of U.S. adults do not achieve the weekly recommended amount of exercise, and 25 percent are considered altogether sedentary, Wilson reported. The result is that 65 percent of individuals are overweight or obese, and one person in three is obese—the result of a worsening trend (Figure 5.4) that is projected to continue into the near future (Mokdad et al., 1999, Mokdad et al., 2001).

Being overweight is a problem in numerous ways, and a notable example is its public health burden. The condition is associated with overall mortality and particularly with enhanced risk of cardiovascular disease, diabetes, hypertension, gall bladder disease, several different types of cancer, (e.g., such as gastrointestinal tract, kidney, and breast) and other illnesses.

Similarly, the built environment contributes to greater air pollution exposure and thus to higher levels of respiratory disease and cancer. Ramon Alvarez of Environmental Defense made the point earlier about the reduced levels of ve-




BMI = body mass index.

*Age-adjusted by the direct method to the year 2000 U.S. Bureau of the Census estimates using the age groups 20-34, 35-44, 45-54, 55-64, and 65-74 years.

**FIGURE 5.4** From 1976 to 2000, the prevalence of overweight (25.0–29.9 body mass index [BMI]) and obese (≥ 30.0 BMI) individuals among U.S. adults aged 20–74 increased from 47 to 65 percent. Current projections suggest that by 2008, 73 percent of U.S. adults will be either overweight or obese. SOURCE: James O. Hill, unpublished. Reprinted with permission.

hicular traffic in Atlanta during the 1996 Olympics and the simultaneous decrease in local asthma burdens; the number of acute asthma cases at local hospitals and treatment centers went down by as much as 44 percent during that period (Figure 5.5) (Friedman et al., 2001). Medical visits for other ailments were unchanged.

Under more typical conditions, however, researchers observe increased rates of illness. Baylor College of Medicine's Winifred J. Hamilton, for example, noted that an increasing number of studies link exposure to highway-associated pollution and illness, and that—as the Atlanta study indirectly reported—the association is largely dependent on the number of daily vehicles and proximity. For example, children are nearly twice as likely to be hospitalized for asthma if they live within 200 meters of a freeway as if they live farther away (Lin et al., 2002). Similarly, several studies have found that children who attend a school near heavy traffic are more likely to exhibit more inflammatory markers and a greater frequency of respiratory infections and symptoms (Janssen et al., 2003; Mukala et al., 1996; Shima et al., 2003; Steerenberg et al., 2001).

The Gulf Coast Institute did a study of Houston's I-10 corridor and found that some 13 schools were located in the "danger zone" within 1,000 feet of that freeway, Pernot noted (Fraser, 2004). Considering that this road is now in the process of almost doubling its width to accommodate greater volumes of traffic, the respiratory risks to children in these schools will surely be heightened, she suggested.

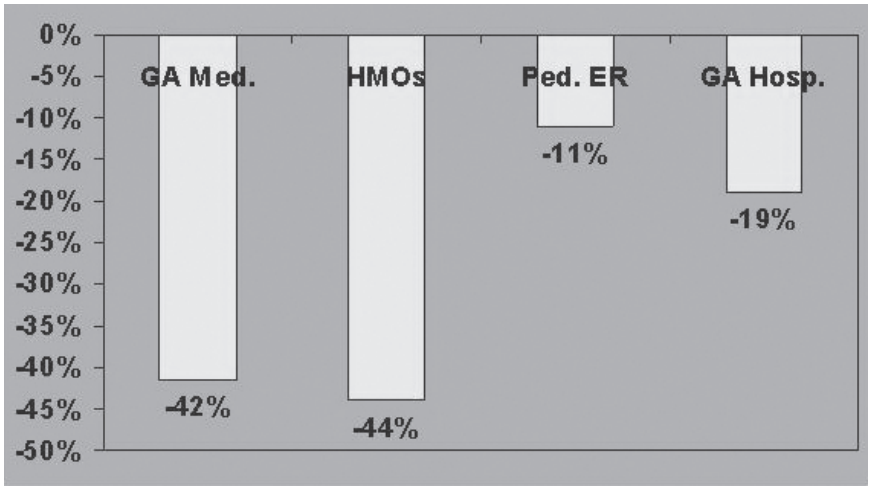



**FIGURE 5.5** During the Atlanta Olympics, citizens were encouraged to use mass transit. Compared to the times immediately before and after, the number of emergency room and doctor visits for asthma decreased during the period of the Olympics. Other medical visits were unchanged. SOURCE: Friedman et al., 2001. Reprinted with permission.

### Population Growth as a Problem of the Built Environment

Causing or exacerbating this unhealthy built environment trend, Wilson said, is population growth. With 4 million births and the arrival of 1 million immigrants per year, the U.S. population is expected to be 400 million by 2050, according to Census Bureau projections (U.S. Census, 1996). The eight fastest growing states will double their populations in less than 35 years. Although the most densely populated region of the country at present is the Northeast (with an average of 767 people per square mile), this concentration will eventually be equaled or surpassed by other regions. The population density in coastal California, for example, is expected to be 1,050 by the year 2010. Such growth overburdens the natural environment, depleting resources and increasing production of waste, he maintained. It degrades the social environment and produces built environments that are creating a veritable environmental health crisis.

What is needed for a successful response? One element, Wilson suggested, is the commitment to a responsible leadership posture, characterized by environmental stewardship and a holistic approach to the built and natural environments alike. Anthony J. DeLucia, past chair of the American Lung Association, strongly agreed that adopting the holistic approach—as opposed to facing *crises de jour* one by one and not necessarily in a coordinated way—is the wisest course.

Partnerships and collaborations between different social groups—academics, community members, the private sector, and public leaders and representatives, for example—are another element, said Wilson, as is environmentally conscious design and planning.

With regard to the built environment, specifically as it affects physical activity, DeLucia stressed the need for city planning, zoning, and sustainable design, together with appropriate incentives—for walkable and bikeable communities, for example, and for buildings configurations that encourage the use of stairs. In this spirit, Pernot noted that although authorities in the Houston area expect to increase the number of lane-miles in the region by 53 percent over the next 20 years—a gain of about 10,000 lane-miles—they also plan to bolster mass transit and implement other kinds of local development in order to reduce vehicular emissions and create more walkable neighborhoods. One serious proposal, for example, is to build a light-rail system in the heart of the city and then build an urban area around the light rail. The first 7.5-mile light- rail line was opened in January 2004, and in November 2003, voters had approved a further proposed 72 miles of light rail.

A final important element, especially for buy-in by communities, is the existence of indicators—measures of the status of local environmental health in our communities—according to Wilson. Health officials have not had much success in using general environmental pollutants as indicators, he observed, so in creating our strategies we must think outside the box.

One such approach, DeLucia noted, might be to monitor highly vulnerable groups—differentiated, say, by age, gender, or type of patient. He cited, for

example, fetuses, the elderly, people with preexisting conditions such as asthma, and those who do heavy exercise or work outdoors.

## BUILDING HEALTHIER BUILDINGS

Buildings currently consume excessive and massive amounts of water and energy; produce solid waste streams; and because of where and how we site them, create serious resource-consumption and pollutant emission problems in the transportation sector as well, said Brian Yeoman, senior research scientist at the Houston Advanced Research Center. Moreover, a vicious cycle is at work whereby individuals are spending 90 percent of their time indoors, becoming more sedentary and obese, and designing buildings to actually fit that life paradigm: we oversize heating and cooling systems in tightly sealed boxes that are notably inefficient and that actually create "sick" buildings as mold, fungus, bacteria, and viruses are recirculated through our HVAC (heating, ventilation, and air-conditioning) systems. Similarly, buildings are often made using cheap materials that encourage the growth of microorganisms, and the paints, stains, and other products applied to the walls continue to emit toxic fumes.

Overall, he estimated, the U.S. built environment accounts for 68 percent of electricity consumption (U.S. Department of Energy, 2001) and uses more then a third of all primary energy. It is responsible for 35 percent of the country's greenhouse emissions (U.S. Department of Energy, 2001) and consumes 12 percent of its potable water (U.S. Geological Service, 1998). In construction and demolition wastes alone, the built environment produces 136 million tons annually (EPA, 1998).

However, given its well-defined status, being a product of technology and therefore subject to change, the built environment is also highly amenable to solutions. It may well represent the "low hanging fruit," Yeoman said, and our greatest opportunity to address global climate change and other environmental health issues. It is possible to build healthier buildings that have drastically reduced energy consumption; because minimal disturbance to ecosystems; are sited in clustered developments so that transportation requirements are reduced; are built from materials providing long service lives and causing no adverse effects among occupants; feature renewable energy systems; and are designed for flexibility and adaptive reuse.

Green buildings do face impediments, however, because they challenge the status quo, particularly in getting the development and financial communities to seriously consider the total cost of ownership and not focus principally on first cost, Yeoman suggested. Green buildings challenge many of the preconceived notions taught in architectural and engineering curricula. They stress the long term rather than the quick turnaround. Also, they must overcome a negative image resulting from the earliest designs, which sometimes were unappealing both aesthetically and in their implied Spartan lifestyles.

> Green buildings challenge many of the preconceived notions taught in architectural and engineering curricula. They stress the long term rather than the quick turnaround.
>
> *Brian Yeoman*

A major step in the right direction, he said, is a tool called LEED (Leadership in Energy and Environmental Design). Generated by the United States Green Building Council—a consortium of industry, the design community, manufacturers, and government—LEED is now the *de facto* national standard for healthier buildings. It addresses five basic macro levels of design, construction, and operations, encompassing stringent criteria for building certification. Although it omits direct references to health, this objective is addressed indirectly by practices that are inherently more healthful, said Yeoman; however, advocates are currently working to explicitly include health in LEED.

At present, there are 1,017 registered sites of new construction conforming to LEED, and they are spread across 49 states (all but South Dakota). Texas ranks in the top 10 with 13 projects totaling about 5 million square feet, while California is in the lead (Figure 5.6).

Future steps, according to Yeoman, should include national funding of basic research that links built systems and health; good-government statements, emanating particularly from the academic sector, that strongly encourage all political subdivisions to adopt and employ LEED in the construction of public buildings; and a nationwide campaign of public education directed toward individual

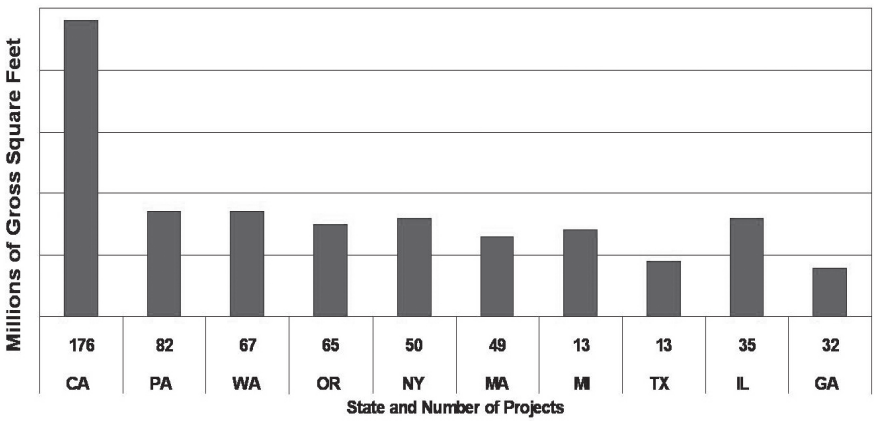



**FIGURE 5.6** Top 10 states with LEED new construction. Forty nine states have projects that meet LEED construction. Of the 1,017 registered sites, more than half (582) are in the top 10 states. SOURCE: U.S. Green Building Council. Reprinted with permission.

homeowners' options for improving the safety and health of their families. In the meantime, he offered a list of "Twelve Steps to Healthy Buildings" that may be implemented readily:

1. Properly site the building.
2. Provide maximum day lighting to occupants.
3. Provide personal control and environmental control.
4. Ensure low levels of VOCs (volatile organic compounds).
5. Provide PVC (polyvinyl chloride)-free workplace.
6. Provide efficient and effective HVAC systems.
7. Provide "superflexible" workplaces that occupants may shape to their own needs.
8. Encourage health through design—such as for walking and bicycling.
9. Provide healthy food.
10. Provide integrated pest management.
11. Provide nonfossil fuel–based cleaning products.
11. Provide public air quality monitoring systems.

## TURNING DOWN THE HEAT

Cities, in which some 80 percent of the American people live, are sometimes called "heat islands" in recognition of the fact that they are warmer than their suburbs and surrounding countryside. As a region's urbanization intensifies moreover, so does its heat island status: the temperature goes up. Hashem Akbari, leader of the Heat Island Group at the Lawrence Berkeley National Laboratory, demonstrated this phenomenon with data from Los Angeles spanning some 100 years. From 1880 to the mid-1930s, this desert-like area cooled down as irrigation and orchards arrived. However, in the ensuing decades, when an east–west migration caused farmland to be converted to city—complete with great expanses of blacktop and black roofs—the Los Angeles temperature began increasing, and by the 1980s it had risen approximately 6 to 7°F on average.

Los Angeles may be an extreme case, but it is not the only one. Akbari noted that at least a dozen other cities throughout the world, including Tokyo, Japan, and Shanghai, show the same general trend.

As the temperature goes up, there is an increased demand for power from utilities. In turn, this means an increase in emissions of air pollutants such as $SO_2$ and $NO_X$. In addition, the formation of Los Angeles–type smog—a brew of nitrogen oxides, reactive organic compounds, and other chemicals—is enhanced by increased temperature, which suggests an alternate strategy for smog reduction, said Akbari. Until now, the strategy has been to try to reduce smog by reducing the levels of its precursors. Yet because smog formation is a photochemical process that is highly temperature sensitive, when the temperature is low the oven will not cook as fast—smog formation will be lower. So what

researchers are now proposing is not only to reduce the precursor pollutants but also to cool the oven.

Heat, of course, is dangerous in its own right, as recent events have demonstrated. In the heat wave of 1980, more than 1,000 Americans died. In 1995, a heat wave killed 500 people in the city of Chicago alone. In the European heat wave of 2003, some 2,000 people died in Italy and at least 10,000 (perhaps as many as 15,000) died in France. In these and numerous other places, Akbari noted, those who suffered heat-related deaths were usually older people living in upper-floor apartments. He noted that something simple such as a cooler roof for these buildings would probably have saved many lives.

Humanity's basic way to stay cooler—use light-colored surfaces and plant trees—was actually known, pre-air conditioning, for thousands of years, and it can certainly be reinstituted with the aid of modern, technology-derived materials to improve the heat island problems in a big city such as Houston, said Akbari. This can happen at a steady, although not rapid, pace. Within the next 10 to 15 years, when the time comes to change roofs on houses, he suggested that people should consider a cooler roof. This could save approximately $100 per Houston household per year, he estimated, and the consequently reduced air-conditioning would require less power from the power plant, leading to reduced emissions of $CO_2$, $SO_2$, $NO_X$, VOCs (volatile organic compounds), and ultimately, lower ozone and smog levels.

Another aspect of heat island mitigation is the treatment of paved surfaces, particularly for a place such as Houston whose land area is covered so extensively with concrete pavement. When roadway sections or sidewalks have to be replaced, new high-reflectance types of pavements can be used to produce cooler surfaces and, as a result, lower air temperatures. As shown in a demonstration of three different asphalt types (Figure 5.7), a 35°F difference is readily achievable.

Meanwhile, planting trees throughout a metropolitan area can also reduce air temperature and smog formation, Akbari pointed out. In Los Angeles, for example, planting 11 million trees—about 3 trees per house—could lower the temperature of some sections of the city by as much as 5–6°F. These plantings (in combination with cool roofs and cool pavements) could decrease the concentration of ozone by about 30 to 40 parts per billion—an effect comparable to that of making half of the cars in the Los Angeles basin electric.

Akbari and his colleagues have computed that if all these heat island reduction steps were taken in Los Angeles, the smog level would be reduced by 12 percent, some $350 million dollars per year could be saved in health costs, and energy savings could amount to $170 million (Rosenfeld et al., 1998). Similarly, annual reductions in Houston's energy consumption for air conditioning could be about $80 million. These model-derived estimates are not numbers you can take to the bank, he acknowledged, but they do indicate huge opportunities for improving air quality that should be explored.

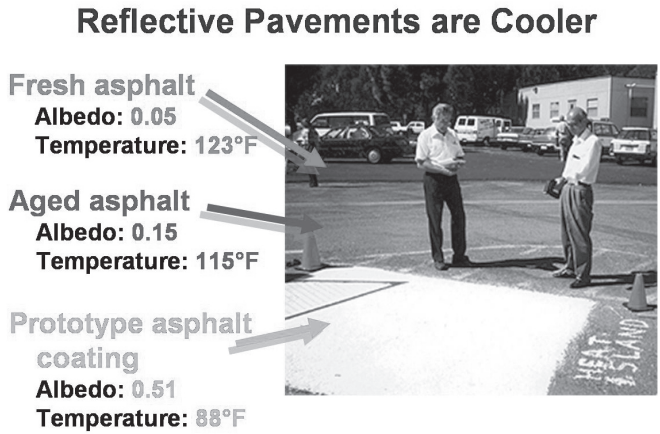



**FIGURE 5.7** Temperatures of roadways and sidewalks can vary. This can be particularly important in large cities where much of the city is built and there is a paucity of green space. Fresh asphalt can have a significantly higher temperature than highly reflective pavements. When sunlight hits a surface some fraction of its energy is reflected (albedo = â) and the remainder is absorbed ($\alpha\lambda\pi\eta\alpha = 1 - \hat{a}$). High-albedo surfaces become cooler than low-albedo surfaces and consequently lower the cooling load of a building. SOURCE: Lawrence Berkeley National Laboratory and the Heat Island Group, unpublished. Reprinted with permission.

## BROWNFIELDS AND ENVIRONMENTAL JUSTICE

Environmental regulation in general—and the cleanup of hazardous waste sites in particular—does not have a history of fairness to all segments of society; some segments of the population have had to suffer pollution's adverse effects more than others. Thus, the concept of environmental justice has evolved, triggered by a long series of injustices. Martina E. Cartwright, director of the Environmental Law and Justice Center of the Thurgood Marshall School of Law, offered a definition of environmental justice that she said is now widely accepted by community groups and environmental professionals: "the fair treatment and meaningful involvement of all people of color, national origin, or income with respect to development, implementation, and enforcement of environmental laws, regulations, and policies."

The environmental justice movement began in earnest in 1982, she said, when the State of North Carolina tried to locate a PCB (polychlorinated biphenyl) landfill in a predominantly minority community. As citizens endeavored to stop this project, civil rights activists linked arms with environmentalists for the first time. Although they were not successful in realizing their primary goal—ultimately, the landfill was sited there—they did make clear to the general public

and its leaders that low-income and minority communities were disproportionately affected not only by toxic wastes during routine industrial operations but also by the location of the wastes' final disposal sites.

More evidence soon followed. A 1983 study by the U.S. General Accounting Office concluded that in the Environmental Protection Agency (EPA) Region IV, which includes Georgia and the Carolinas, three out of every four hazardous waste landfills was sited near a community of color (U.S. General Accounting Office, 1995). In 1987, a national study by the United Church of Christ's Commission on Racial Justice found that nearly three out of five African Americans or Hispanics live near an unregulated hazardous waste site (United Church of Christ Commission for Social Justice, 1987). Even solutions to such problems, it appears, were inequitably applied. A 1992 study by the *National Law Journal* found that the EPA took 20 percent longer to remediate sites near minority communities and levied smaller penalties against the polluters involved (LaVelle et al., 1992).

Thus, a traditional violation of environmental justice has been in the administration, or lack thereof, of brownfields—which Cartwright defined as abandoned, idled, or underutilized industrial and commercial facilities, where expansion or redevelopment is complicated by real or perceived environmental contamination, that often cause a nuisance and health threat to the surrounding community. It has been estimated that 223 American cities contain more than 19,000 brownfield sites comprising more than 178,000 acres and that returning them to productive use could generate tax revenues of as much as $2.7 billion annually and provide more than 675,000 jobs (U.S. Conference of Mayors, 1999).

A seeming step in the right direction, she said, was the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) of 1980, which mandated a mechanism for the safe and efficient remediation of brownfields. Yet given its potential widespread liability—anyone with some tie to a particular contaminated site could potentially be assessed for its clean-up costs—CERCLA may have actually contributed to urban blight and flight. Business people often opted to move away from inner cities to the outlying areas, where they could enjoy green fields with no question of any type of potential liability, noted Cartwright. However, new initiatives at the federal and state levels (including Texas) have been addressing these concerns. For instance, voluntary compliance programs (VCPs) offer a streamlined administrative process, relaxed remediation standards, financing through low-interest loans and grants, and liability protection—"SMOAs" (Superfund Memoranda of Agreements) encourage businesses to remediate long-abandoned industrial sites and to create community-safe and friendly business endeavors, by limiting their potential liability.

Still, brownfield redevelopment continues to have some problems, Cartwright noted. These include the potential for re-pollution of the site through its new use; autonomy of developers (who are usually not obliged to communicate with impacted communities, much less involve them in the redevelopment pro-

cess); frequent exclusion of pertinent state agencies and city development entities; gentrification and cultural displacement; loss of affordable housing; and failure to maintain historical cultural characteristics of the community.

The integration of environmental justice into brownfield redevelopment, Cartwright maintained, should observe the "Three E's":

1. *Educate*. Outreach efforts to local communities should include publications, community meetings and seminars, and partnerships with civic associations, nonprofits, churches, and chambers of commerce.

2. *Enable*. Tools and technical assistance should be provided to communities, allowing them to actively participate in decision making.

3. *Empower*. Participation of community residents in the developmental process should be encouraged and invited, perhaps through the mechanism of neighborhood advisory groups that would assist in reviewing potential local projects and development proposals. Another way to involve the community is through training residents to work in the new businesses created by redeveloped brownfields.

## ENVIRONMENTAL HEALTH IN INDUSTRY: PARTNERSHIPS AND RESPONSIBLE CARE

In the spirit of dialogue and mutual respect among diverse stakeholders that has been engendered by the Roundtable on Environmental Health Sciences, Research, and Medicine, Carol J. Henry, American Chemistry Council (ACC), described the progress of the chemical industry toward the environmental health goals discussed by previous speakers.

The chemical industry is a critical element of the nation's economy: it has revenues of about $450 billion dollars a year, is the largest exporter in the United States, invests more in research and development than any other industrial sector, and is responsible for about a million jobs. Moreover, the chemical industry is important to developing many of the innovative products and building the green systems that most analysts believe are needed to ensure improved environmental health in the future.

The ACC's members, some 140 firms that are among the leading companies in the industry, she said, are committed to improvements in environmental health and safety performance through their own spending in these areas—some $8 billion a year—and through their involvement in several major ACC activities. Support of two of the ACC's projects—in particular, its Responsible Care® program and Long-Range Research Initiative—is in fact a requirement for membership.

Responsible Care® has a relatively simple but highly ambitious vision—"No accidents, injuries, or harm to the environment"—toward which the ACC's members have made great progress since the program was launched in 1988,

said Henry. This program, which aims to achieve continuous improvement beyond levels required by the U.S. government, has resulted in significant reductions in releases of chemicals to air, land, and water and has provided major improvements in the workplace and community safety. Based on statistics gathered by the federal government, workplaces at ACC companies in 2001 were four times safer (in terms of injury and illness rates) than the combined average of all U.S. manufacturing industries, and ACC members were twice as safe as the chemical industry overall—whose emissions have actually been reduced by 71 percent since 1988 even as volume has increased 26 percent (EPA, 2003).

These achievements have been made possible by developing the vision into a set of explicit guiding principles and pursued through member companies' commitment to an Enhanced Responsible Care® Management System. This system, Henry explained, includes policy and leadership; planning; implementation, operation, and accountability; performance measures and corrective action; and management systems review.

ACC has committed that these systems will be verified and certified by external third parties—groups such as the fire department or a respected auditing organization—that do not work for the chemical industry. ACC has endorsed third-party verification because it will improve performance, responds to expectations, promotes cross-functional integration of programs, enhances external credibility, and meets customer expectations. ACC members will be measuring their own year-to-year progress, beginning in 2004, through the 11 standardized performance metrics shown in Table 5.1. These metrics reflect Responsible Care® environmental, health, safety, and security performance as well as efforts to safeguard reputation, sustainable development, products, and other initiatives.

This means that the companies are opening themselves up to public review and scrutiny and that the data will be public, she said. The ACC and its members believe that this will enhance their external transparency and increase their credibility.

Such an approach reflects the fact that, consistent with their guiding principles, ACC companies are already reaching out to the public and to the communities in which they operate. The Responsible Care® companies view themselves as members of their communities, said Henry, and have formed some 250 to 300 Community Advisory Panels, 10 of which are in the Houston area, to communicate with neighbors about company operations in progress. These are independent bodies that are not controlled by the plant or industry, she said. Members are individuals who live near or around a chemical facility, and they use the Panel as a forum to regularly meet with management to discuss issues of mutual interest.

The ACC is also doing outreach to the scientific and regulatory communities, in large part through its Long-Range Research Initiative (LRI) that aims to extend knowledge worldwide through research on health, safety, and environmental impacts of the chemical industry's products and processes; support in-

**TABLE 5.1** Examples of Performance Measures to Benchmark Industrial Progress

| Performance Metric | Collection of Information by Company or ACC | Information to Be Reported on Company or Industry Basis | Public Reporting Begins |
|---|---|---|---|
| Metrics Reflecting Responsible Care Environmental, Health, Safety, and Security Performance | | | |
| 1. Pounds of TRI-air, land, and water releases (reported separately) | Company | Company | 2004 |
| 2. Number of reportable distribution incidents | Company | Company | 2004 |
| 3. Number of process safety incidents | Company | Company | 2004 |
| 4a. OSHA recordable incident—rate-employees | Company | Company | 2004 |
| 4b. OSHA recordable incident—rate-contractors | Company | Company | 2005 |
| 5a. Percent facilities completing security assessments based on Security Code schedule (%) | Company | Industry | 2004 |
| 5b. Facilities completing security enhancements or verifications based on Security Code schedule (%) | Company | Industry | 2005 |
| 6. Certification of Responsible Care® Management System (yes/no) | Company | Company | 2004 (companies will have from 2004 to 2007 to complete certification) |
| Metrics Reflecting Reputation, Sustainable Development, Products, and Other Initiatives | | | |
| 7. Greenhouse gas emissions (pounds of C02 equivalent net emissions per pound of production) indexed to base year | Company | Industry | 2005 |
| 8. Energy efficiency (BTUs consumed per pound of production) indexed to base year | Company | Industry | 2005 |
| 9. Industry economic performance: | ACC | Industry | 2004 |
| 9a. Total industry R&D investment | | | |
| 9b. Total number of industry employees | | | |
| 9c. Total value of industry payroll | | | |
| 9d. Total value of U.S. industry net exports | | | |

**TABLE 5.1** continued

| Performance Metric | Collection of Information by Company or ACC | Information to Be Reported on Company or Industry Basis | Public Reporting Begins |
|---|---|---|---|
| 10. Company has in place a documented process for characterizing and managing product risk, and a summary of the process is available to the public ("yes"/"no") | Company | Company | 2005 |
| 11. Company has in place a process to communicate results of the risk characterization and management process in an effort to facilitate public knowledge ("yes"/"no") | Company | Company | 2005 |

SOURCE: OSHA.

formed decision making by providing scientific data and understanding; and develop new tools to assess chemicals—especially as questions emerge about potential health and environmental impacts, Henry said. As in other ACC activities, results of research will be made public. The investigators own their own data, and they are completely free to publish or conclude whatever they have been working on without prior editing or review by the ACC or its members.

Encouraging listeners and readers to acquire more information on the Council's LRI (www.uslri.org) and its Responsible Care® program and other activities (www.americanchemistry.com) to convince themselves of ACC's sincerity, Henry acknowledged that changing and impacting public opinion, scientific standards, and the industry's reputation can't be achieved overnight. But the companies are in this for the long haul, she added. They are committed to realizing ACC's objectives through prolonged and coordinated research and outreach efforts.

## COMING TOGETHER

Commitments by government—whether national, state, or local— won't be achieved overnight either, but officials from all branches report heightened understanding of the public-health impacts of the built environment, together with steady progress.

Victor Ayres of Houston Mayor Bill White's Office of Environmental Policy noted that the city has become aggressive in addressing its air pollution prob-

lems—for example, it has been retrofitting its vehicle fleet to reduce diesel and other fuel-based emissions. But a constraint is that pollution comes from different areas, moves around, and knows no boundaries, he noted. The city of Houston occupies only 617 square miles in an 8,000-square-mile ozone nonattainment region. Although the city can't do it by itself, said Ayres, it is going to do what it can to serve as a catalyst to encourage local governments and other entities to get involved as well. There's a great need for communication and partnership—between urban and suburban, and between the public and private sectors.

Jane Laping, executive director of Mothers for Clean Air, took Ayres's expression of environmental reality to its logical conclusion. This is a global community, she said. We don't just live in Houston, and we don't just live in Texas or the United States. We live on the planet Earth. People in Texas know that we get dust from the Sahara here, and we get smoke from fires in Central America. We all depend on each other, and we have to help other communities learn from what we have learned.

Similarly, Laping suggested that in the human-centric vision and preoccupation with modern technology that enhances our power even more, we seem to forget that other forms of life also occupy this planet and that we in fact depend on them for life. Humans cannot continue to degrade the environment, push out animals and plants, and use their space, she said. We need them for our own survival.

Another need for survival, suggested a participant, centers on the spiritual. It is very difficult to come together to care about something if what is there has been done carelessly, he said. Because values such as beauty, proportion, scale, and harmony have great meaning to people, the degradation of the physical environment and the loss of quality in architectural social capital have an accumulating effect on the spiritual and mental health of the community. Public health would therefore be well advised to spend a lot more time and effort in trying to understand what community mental health really is and what role it plays in social cohesion.

# References

BRIDGES (BRIDGES to Sustainability and Mickey Leland National Urban Air Toxics Research Center funded by the Texas Council on Environmental Technology). 2003. Assessment of Information Needs for Air Pollution Health Effects Research in Houston, Texas. Available on line at: www.bridgestos.org.

Buckeridge DL, Glazier R, Harvey BJ, Escobar M, Amrhein C, Frank J. 2002. Effect of motor vehicle emissions on respiratory health in an urban area. *Environmental Health Perspectives* 110:293–300.

Bullard RD. 1983. Solid waste sites and the black Houston community. *Sociological Inquiry* 53:273–288.

CDC (Centers for Disease Control and Prevention). Morbidity and Mortality Weekly Report. 1999. Framework for Program Evaluation in Public Health**.** September 17, 48:RR–11**.**

Dockery DW, Pope CA, Xu X, Spengler JD, Ware JH, Fay ME, Ferris BG, and Speizer FE. 1993. An association between air pollution and mortality in six U.S. cities. *New England Journal of Medicine* 329:1753–1759.

Dubos R. 1987. Mirage of Health: Utopias, Progress, and Biological Change. Piscataway, NJ: Rutgers University Press.

Fraser MP. 2004. Fine Particle Dispersion Modeling from the Katy Freeway (IH-10). Available on line at: http://www.katycorridor.org/Docs/Katy_Report_1-04.pdf

Friedman MS, Powell KE, Hutwagner L, Graham LM, Teague WG. 2001. Impact of changes in transportation and commuting behaviors during the 1996 Summer Olympic Games in Atlanta on air quality and childhood asthma. *JAMA* 285:897–905.

Hamilton WJ. 2002. Environmental Health Concerns of Houston-Galveston Area Residents: Preliminary Results of a Regional Town Meeting Ranking of Concerns Identified by a Pilot Telephone Survey. Houston, TX: Baylor College of Medicine. Available on line at: http://www.envirohealthhouston.org/Files/Survey_and_ranking.pdf.

Healthy People 2010: Understanding and Improving Health. Available on line at: http://www.healthypeople.gov/Document/pdf/uih/2010uih.pdf.

Houston Advanced Research Center (HARC). 1996. Seeking Environmental Improvement. Report of Houston Environmental Foresight Committee. Woodlands, TX: HARC.

Houston-Galveston Area Council. 2004. Houston-Galveston Area Draft 2025 Regional Transportation Plan. Houston, TX: Houston-Galveston Area Council. Available on line at: http://www.hgac.com/NR/rdonlyres/ebhlg3ytiz7im3wlq7u3vrjmhmxchg3opz3lwuq3wxitckirxpi7hq6tc6pm7ksek3qhnlvea25gdd77df2inryi2yc/RTP+2025+06-23-04.pdf.

Institute of Medicine. 2001. Rebuilding the Unity of Health and the Environment: A New Vision for the 21st Century. Washington, DC: National Academy Press.

Janssen NA, Brunekreef B, van Vliet P, Aarts F, Meliefste K, Harssema H, Fischer P. 2003. The relationship between air pollution from heavy traffic and allergic sensitization, bronchial hyperresponsiveness, and respiratory symptoms in Dutch schoolchildren. *Environmental Health Perspectives* 111:1512–1518.

Klineberg S. 2002. Houston Area Survey (1982-2002). Houston's Economic and Demographic Transformation: Findings from the Expanded 2002 Survey of Houston's Ethnic Communities. Available on line at: http://cohesion.rice.edu/centersandinst/has/ethnicreport.cfm?doc_id=4738.

Kolankewicz L, Beck R. 2001. Weighing Sprawl Factors in Large U.S. Cities: Analysis of U.S. Bureau of the Census Data on the 100 Largest Urbanized Areas of the United States. Available on line at: http://www.sprawlcity.org/studyUSA/USAsprawlz.pdf.

Lavelle M, Coyle M, MacLachlan C. 1992. Unequal protection: The racial divide in environmental law. *National Law Journal* September 21:S2-S6.

Lin S, Munsie JP, Hwang SA, Fitzgerald E, Cayo MR. 2002. Childhood asthma hospitalization and residential exposure to state route traffic. *Environmental Research* 88:73–81.

Macdonald EJ. 1976. Demographic variation in cancer in relation to industrial and environmental influence. *Environmental Health Perspectives* 17:153–166.

McCann BA, Ewing R. 2003. Measuring the Health Effects of Sprawl: A National Analysis of Physical Activity, Obesity and Chronic Disease. Smart Growth America. Surface Transportation Policy Project. Available on line at: http://www.smartgrowthamerica.org/healthreport.html.

Mokdad AH, Serdula MK, Dietz WH, Bowman BA, Marks JS, Koplan JP. 1999. The spread of the obesity epidemic in the United States, 1991-1998. *Journal of American Medical Association* 282:1519–1522.

Mokdad AH, Bowman BA, Ford ES, Vinicor F, Marks JS, Koplan JP. 2001. The continuing epidemics of obesity and diabetes in the United States. *Journal of American Medical Association* 286:1195–1200.

Mukala K, Pekkanen J, Tiittanen P, Alm S, Salonen RO, Jantunen M, Tuomisto J. 1996. Seasonal exposure to $NO_2$ and respiratory symptoms in preschool children. *Journal of Exposure Analysis and Environmental Epidemiology* 6:197–210.

Nowak DJ. 1994. Air pollution removal by Chicago's urban forest. In: Chicago's Urban Forest Ecosystem: Results of the Chicago Urban Forest Climate Project. McPherson EG, Nowak DJ, Rowntree RA, eds. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.

Oftedal B, Nafstad P, Magnus P, Bjorkly S, Skrondal A. 2003. Traffic related air pollution and acute hospital admission for respiratory diseases in Drammen, Norway 1995-2000. *European Journal of Epidemiol*ogy18:671–675.

Pekkanen J, Pukkala E, Vahteristo M, Vartiainen T. 1995. Cancer incidence around an oil refinery as an example of a small area study based on map coordinates. *Environmental Research* 71:128–134.

Pope CA III, Burnett RT, Thun MJ, Calle EE, Krewski D, Ito K, Thurston GD. 2002. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *Journal of American Medicine Association* 287:1132–1141.

Putnam RD. 2000. Bowling Alone: The Collapse and Revival of American Community by New York: Simon & Schuster.

Rosenfeld AH, Romm JJ, Akbari H, Pomerantz M. 1998. Cool communities: Strategies for heat islands mitigation and smog reduction. *Energy and Buildings* 28:51–62.

Shima M, Nitta Y, Adachi M. 2003. Traffic-related air pollution and respiratory symptoms in children living along trunk roads in Chiba Prefecture, Japan. *American Journal of Epidemiology* 13:108–119.

Sockrider MM, Bartholomew LK, Tortolero SR, Markham CM, Abramson SL, Fernandez M, Parcel GS. 1999. Development and validation of an asthma screening tool for elementary school children. *American Journal of Respiratory and Critical Care Medicine* 159:A265.

South Coast Air Quality Management District. 1999. Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES-II). Diamond Bar, CA. Available on line at: http://www.aqmd.gov/matesiidf/matestoc.htm.

Spielberg F. 1989. The traditional neighborhood development: How will traffic engineers respond? *ITE Journal* 59:17–18.

Steerenberg PA, Nierkens S, Fischer PH, van Loveren H, Opperhuizen A, Vos JG, van Amsterdam JG. 2001. Traffic-related air pollution affects peak expiratory flow, exhaled nitric oxide, and inflammatory nasal markers. *Archives of Environmental Health* 56:167–174.

Stein CJ, Colditz GA. 2004. The epidemic of obesity. *Journal of Clinical Endocrinology and Metabolism* 89:2522–2525.

Surface Transportation Policy Project. 2003. American Attitudes Toward Walking and Creating Better Walking Communities. Available on line at: http://www.transact.org/.

Tortolero S, Bartholomew LK, Tyrell S, Abramson SL, Sockrider MM, Markham C, Whitehead L, and Parcel GS. 2002. environmental characteristics of urban elementary schools: A focus on asthma. *The Journal of School Health* 72:33–38.

Tortolero SR, Bartholomew LK, Sockrider MM, Abramson SL, Jones JL, Tyrell S, Freimanis L, and Markham CM. 2004. Prevalence of Asthma Symptoms in an Urban School-Age Population. Submitted for publication.

United Church of Christ Commission for Racial Justice. 1987. Toxic Wastes and Race in the United States: A National Report on the Racial and Socio-Economic Characteristics of Communities with Hazardous Waste Sites. New York: United Church of Christ Commission for Racial Justice.

U.S. Bureau of the Census. 1996. Current Population Reports. Series P25–1130 Population Projections of the United States by Age, Sex, Race, and Hispanic Origin: 1995 to 2050. Available on line at: http://www.census.gov/prod/1/pop/p25-1130/p251130a.pdf.

U.S. Conference of Mayors. 1999. Recycling America's Land: A National Report on Brownfields Redevelopment, Volume II. Available on-line at: http://www.usmayors.org/uscm/brownfields/RecycleAmerica2003.pdf.

U.S. Department of Energy. Energy Information Administration. *Monthly Energy Review,* March 2001. Available on line at: http://tonto.eia.doe.gov/FTPROOT/multifuel/mer/00350103.pdf.

U.S. Department of Energy. 2004. Center for Excellence for Sustainable Development. Green Buildings Introduction. Available on line at: http://www.sustainable.doe.gov/buildings/gbintro.shtml.

U.S. Department of Transportation. Federal Highway Administration. 2003. Highway Statistics 2002: Urbanized Areas—2002. Miles and Daily Vehicle—Miles of Travel. Available on line at: http://www.fhwa.dot.gov/policy/ohim/hs02/hm71.htm.

U.S. Environmental Protection Agency. 1998. Characterization of building-related construction and demolition debris in the United States. Available on line at: http://www.epa.gov/epaoswer/hazwaste/sqg/c&d-rpt.pdf.

U.S. Environmental Protection Agency. 2003. The Toxics Release Inventory (TRI) and Factors to Consider when Using TRI Data. Available on line at: http://www.epa.gov/tri/tridata/tri00/press/overview.pdf.

U.S. General Accounting Office. 1995. Hazardous and Non-Hazardous Waste: Demographics of People Living Near Waste Facilities. Available on line at: http://www.lib.umich.edu/govdocs/text/rced9584.txt.

U.S. Geological Survey. 1998. Estimated Use of Water in the United States in 1995. Available on line at: http://water.usgs.gov/watuse/pdf1995/html.

Wu MT, Pan BJ, Christiani DC. 1997. Association between cancer mortality and residence near petrochemical industries in Taiwan. *Journal of Toxicology and Environmental Health* 50:265–273.

# Appendix A

# Workshop Agenda

**REBUILDING THE UNITY OF HEALTH AND THE ENVIRONMENT: THE GREATER HOUSTON METROPOLITAN AREA**

Sponsored by

The Roundtable on Environmental Health Sciences, Research, and Medicine
National Academy of Sciences Auditorium
2101 Constitution Avenue, N.W., Washington, D.C.

Friday, January 23, 2004

8:00 a.m **Registration**

8:30 a.m **Welcome**
The Honorable Paul Rogers, J.D.
Chair, Roundtable on Environmental Health Sciences, Research, and Medicine
Partner, Hogan and Hartson

8:35 a.m. **Goals and Objectives**
Lovell Jones, Ph.D.
Roundtable Member
Professor, M.D. Anderson Medical Center

8:45 a.m. **What Is Environmental Health?**
Lynn Goldman, M.D., M.P.H.
Professor, Johns Hopkins University School of Public Health

9:10 a.m. **Environmental Health Challenges in Houston**
Ken Sexton, Sc.D., M.B.A.
Professor, Environmental Sciences
The University of Texas School of Public Health, Brownsville Regional Campus

9:35 a.m. **General Discussion**

9:50 a.m. **Break**

**Panel 1: The Natural Environment**

**Moderator:** Jim Lester, Ph.D., Director of Environmental Group, Houston Advance Research Center

10:05 a.m. **The Natural Environment and Human Health: An Urban, Particularly Houstonian, Perspective**
Winifred J. Hamilton, Ph.D., S.M.
Director, Environmental Health Section
Chronic Disease Prevention and Control Research Center
Baylor College of Medicine

10:20 a.m. **The Natural Environment: Planning for the Future, Looking at the Past**
James Blackburn, J.D.
Partner, Blackburn and Carter, LLP

10:35 a.m. **Public Policy and Flooding: Impact on Health**
Kevin Shanley
President, Bayou Preservation Association

10:50 a.m. **Drinking Water: Quality and Quantity**
Roger Hulbert
Senior Assistant Director, Water Production, City of Houston

11:05 a.m. **Effects of Indoor and Outdoor Air Quality on Upper and Lower Airway Diseases and Comorbidities**
Stuart Abramson, M.D.
Associate Director for Clinical Research, Children's Asthma Center, Texas Children's Hospital

11:20 a.m. **Air Quality, Particulate Matter, and Environmental Health**
Ramon Alvarez, Ph.D.
Environmental Defense

11:35 a.m. **It's Time to Retreat**
Cath A. Conlon
Founder and Executive Director, Blackwood Educational Land Institute
*and*
Jackie Hall
The Hall Group

11:50 a.m. **Respondent: What Are the Next Steps?**
LaNell Anderson
Director, Texas Bucket Brigade

12:00 p.m. **General Discussion**

12:20 p.m. **Lunch**

**Panel 2: Social Environment**

**Moderator:** Nestor Rodriguez, Professor, University of Houston

12:50 p.m. **Social Environment: Challenges for the City of Houston**
Stephen Klineberg, Ph.D.
Professor of Sociology, Rice University

1:15 p.m. **Cultural Diversity: What Houston's Communities Say About the Environment**
Beverly Gor, Ed.D., R.D.
President of the Asian American Health Coalition
Associate Director of Community Relations, M.D. Anderson Cancer Center

1:30 p.m. **Respondent: Addressing the Emerging Social Needs in Houston**
Angelina Esparza, R.N., B.A., B.S.N.
Past President, Houston Hispanic Health Coalition

1:40 p.m. **General Discussion**

2:00 p.m. **Break**

**Panel 3: Built Environment**

**Moderator:** John Porretto, Roundtable Member, President, Sustainable Building Solutions, Inc.

2:15 p.m. **Overview of the Built Environment and Its Impact on Health**
Samuel Wilson, M.D.
Roundtable Member
Deputy Director, National Institute of Environmental Health Sciences

2:35 p.m. **Brownfields and Environmental Justice**
Martina Cartwright, Esq.
Environmental Health Law Clinic, Texas Southern University

2:50 p.m. **From Neighborhoods to the National Scene: Air Pollution, Exercise, and Vulnerable Populations**
Anthony J. DeLucia, Ph.D.
Past Chair, American Lung Association

3:05 p.m. **Transportation: Urban Sprawl, Public Transportation, and Health**
Catherine Pernot
Associate, Gulf Coast Institute

3:20 p.m. **Reducing Urban Temperature, Improving Outdoor Air Quality, and Reducing Heat-Related Mortality**
Hashem Akbari, Ph.D.
Staff Scientist
Leader, Heat Island Group, Lawrence Berkeley National Laboratory

3:40 p.m. **Environmental Health in Industry: Partnerships and Responsible Care**
Carol Henry, Ph.D., D.A.B.T.
Vice President for Science and Research, American Chemistry Council

3:55 p.m. **Green Buildings and Environmental Health: Building Healthier Buildings**
Brian Yeoman, M.A.
Senior Research Scientist, Houston Advance Research Center

4:10 p.m. **Respondent: Are We Making Progress or Are These Isolated Cases?**
Jane Laping, M.P.H.
Executive Director, Mothers for Clean Air

4:20 p.m. **General Discussion**

4:40 p.m. **Summation**

4:45 p.m. **Adjourn**

# Appendix B

# Speakers and Panelists

**Stuart Abramson, M.D.**
Associate Director for Clinical Research
Children's Asthma Center
Texas Children's Hospital

**Hashem Akbari, Ph.D.**
Lawrence Berkeley National Labatory

**Ramón Alvarez, Ph.D.**
Director
Environmental Defense Energy Program

**LaNell Anderson**
Director
Texas Bucket Brigade

**James Blackburn, J.D.**
Blackburn and Carter, LLP

**Martina Cartwright, J.D.**
Director
Texas Southern University
Environmental Health Law Clinic

**Cath Conlon**
Founder and Executive Director
Blackwood Educational Land Institute

**Tony DeLucia, Ph.D.**
Past Chair
American Lung Association

**Lynn R. Goldman, M.P.H., M.D.**
Professor
Johns Hopkins University
Department of Environmental Health

**Beverly Gor, Ed.D., R.D.**
Associate Director of Community Relations
Center for Research on Minority Health
M.D. Anderson Cancer Center
University of Texas

**Jackie Hall**
Founder and Executive Director
The Hall Group

**Winifred J. Hamilton, Ph.D., S.M.**
Assistant Professor
Departments of Neurosurgery and Medicine
Baylor College of Medicine

**Carol Henry, Ph.D.**
Vice President for Science and Research
American Chemistry Council

**Roger Hulbert**
Senior Assistant Director
Public Works and Engineering Division
City of Houston

**Lovell A. Jones, Ph.D.**
Director
Center for Research on Minority Health
Professor, Gynecologic Oncology
M.D. Anderson Cancer Center
University of Texas

**Steven Klineberg, Ph.D.**
Professor
Rice University

**Jane Laping, M.P.H.**
Executive Director
Mothers for Clean Air

**Jim Lester, Ph.D.**
Director
Houston Advanced Research Center

**Catherine Pernot**
Associate
Gulf Coast Institute

**John Porretto, B.S.**
Chief Business Officer
University of Texas Houston Health Science Center

**Nestor Rodriguez**
Professor
The University of Houston

**Paul Grant Rogers, J.D.**
Partner
Hogan and Hartson

**Kenneth Sexton, Sc.D., M.B.A.**
Professor, Environmental Sciences
School of Public Health
University of Texas

**Kevin Shanley**
President
Bayou Preservation Association

**Samuel H. Wilson, M.D.**
Deputy Director
National Institute of Environmental Health Sciences
National Institutes of Health

**Bryan Yeoman, M.A.**
Senior Research Scientist
Houston Advanced Research Center

# Appendix C

# Workshop Participants

**Bob Anderson**

**Latrice Babin**
Harris County Pollution Control Division

**Domingo Barrios**
Houston Endowment Inc.

**Clarissa Bauer**
Harris County Attorney's Office

**Craig Bauer**

**Craig Beskid**
Mickey Leland National Urban Air Toxics Research Center

**Taft Blake**
Weed and Seed

**Arturo Blanco**
City of Houston

**Archie Bleyer**
University of Texas M.D. Anderson Cancer Center

**Andrew Brown**
University of Texas

**Marilyn Byrd**
City of Houston

**Dina Cappiello**
Houston Chronicle

**Edward Carter**
American Lung Association of Texas

**Evelyn Chorush**

**Jim Coody**

**Don Cook**
University of Texas M.D. Anderson Cancer Center

**Martee Engel**
City of Houston

**Isabel Estudillo**
University of Texas M.D. Anderson Cancer Center

**Anna Zakos Feliberti**
University of Texas School of Public Health

**Laura Gabelsberg**

**Armond Goldman**
University of Texas Medical Branch

**Barbara Goldman**

**Paul Goldman**

**Lisa Gossett**
University of Houston, Clear Lake

**Richard Hajek**
University of Texas M.D. Anderson Cancer Center

**Ann Hamilton**
Houston Endowment Inc.

**Janice Harper**
University of Houston

**Cassandra Harris**
University of Texas M.D. Anderson Cancer Center

**Douglas Hayward**
Center for Food Safety and Applied Nutrition U.S. Food and Drug Administration

**Meg Healy**
University of Houston Law Center

**James Heggie**
University of Texas M.D. Anderson Cancer Center

**J. Pat Herlihy**
St. Luke's Lung Institute

**Maria Hernandez-Valero**
University of Texas M.D. Anderson Cancer Center

**Son Hoang**
University of Texas M.D. Anderson Cancer Center

**Terrell Holiday**
Ella Park Terrance Civic Club

**Steve Hupp**
Harris County

**Anne Marie Johnson**
Environmental Defense

**Consandra Jones**
Koinonia Publishing

**Mamta Kalidas**
Baylor College of Medicine

**Kelvin Kemp**
University of Texas School of Public Health

**Denae King**
University of Texas M.D. Anderson Cancer Center

**Lester King**
Texas State University

**Trish King**
American Lung Association of Texas

**Polly Ledvina**
Katy Corridor Coalition

**Jacqueline Lentz**
City of Houston

**Anissa Lewis**
University of Texas M.D. Anderson Cancer Center

**Jan Liang**
University of Texas M.D. Anderson Cancer Center

**Faye Liu**
Texas Commission on Environmental Quality

**Barbara S. Loggins**
Families Under Urban and Social Attack, Inc.

**Martin Lorin**
Texas Children's Hospital

**Elena Marks**
City of Houston

**Shawn McFarland**
The Cherokee Group

**Pat McLeod**

**Laura Mitchell**
Texas A&M University

**Sheila Mitchell**

**Dawn Moses**
City of Houston

**Bonnie New**
Beacon Medical Management for Industry

**Paul Newman**
Harris County Pollution Control

**Feliciano Olivero**
Natural Source

**Rock Owens**
Harris County Attorney's Office

**Brett Perkison**
Baylor College of Medicine

**Charles Perlitz**
Nature Conservancy

**Jane Prestigomo**
Childhood Lead Poisoning Prevention Program

**Patricia Priego**
Harris County Public Health and Environmental Services

**Kathleen Ramsey**
Houston-Galveston Area Council

**Martin Reiner**
Texans for Alternatives to Pesticides

**Brenda Reyes**
Lead-Based Paint and Childhood Lead Poisoning Prevention Program

**Tom Reynolds**
University of Texas School of Public Health

**Peggy J. Rogers**
City of Houston

**Deborah Rogers-Barr**
Center for Research and Minority Health

**Alan Rosas**
University of Texas M.D. Anderson Cancer Center

**Eileen Sampanes**
CHRISTUS Health

**Paul Sanders**
Texas Medical Center

**Lady Savoy**
Ella Park Terrance Civic Club

**Ima Scarlett**
Ella Park Terrance Civic Club

**Maria Schettino**
University of Texas M.D. Anderson Cancer Center

**Rebecca Seabrook**
McGovern Museum of Health and Medical Science

**Charles Andrea Simmons**
University of Texas Health Science Center—Houston

**James Smith**
Ella Park Terrance Civic Club

**Cynthia Spiker**
Baylor College of Medicine

**Sherry Sterling**
University of Texas M.D. Anderson Cancer Center

**Charles Stillman**
Citizens' League for Environmental Action Now

**Thomas Stock**
University of Texas School of Public Health

**Robert Stokes**
Harris County Attorney's Office

**Dicksen Tanzil**
BRIDGES to Sustainability

**Terri Thomas**
Memorial Mothers for Clean Air and Katy Corridor Coalition

**Taylor Tran**
University of Texas M.D. Anderson Cancer Center

**Mary Lou Warren**
St. Luke's Episcopal Health System

**Michael Weininger**
University of Texas School of Public Health

**Jennifer Wheeler**
Harris County Public Health and Environmental Services

**Lawrence Whitehead**
University of Texas School of Public Health

**Mary Ellen Whitworth**
Bayou Preservation Association

**John Williams**
Harris County Health Department

**Ursula Williams**
Houston-Galveston Area Council

**John Wilson**
Galveston-Houston Association for Smog Prevention

**Frederick Zuber**
City of Houston