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Planning Information Sheet:

Influencing Air Quality with Comprehensive Planning and Ordinances

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Version 2.0

DESIGN FOR HEALTH is a collaboration between the University of Minnesota and Blue Cross and Blue Shield of Minnesota that serves to bridge the gap between the emerging research base on community design and healthy living with the every-day realities of local government planning.

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Overview

Design for Health's *Planning Information Sheets* series provides planners with useful information about opportunities to address important health issues through the comprehensive planning process and plan implementation. The series addresses a range of health issues that are relevant to many communities and can be efficiently and effectively integrated into local plans and policies. This information sheet provides insights for planners in understanding how air quality relates to health and the built environment, and points to innovative approaches to planning for air quality.

Key Points

- Both indoor- and outdoor-air quality are important to human health. Key pollutants include: carbon monoxide, sulfur, nitrogen oxides, carbon dioxide, lead, and other air toxins and volatile organic compounds (VOCs). For more information about specific pollutants, visit the U.S. Environmental Protection Agency (EPA) at www.epa.gov. The primary health consequences associated with air quality include mortality, respiratory and cardiovascular health, and cancer (Frumkin et al. 2004).
  - Breathing in air pollutants from ozone, particulate matter, nitrogen oxide, and sulfer dioxide can cause reduced lung function, which may trigger symptoms, such as chest pain, coughing, throat irritation, and congestion. Breathing in air pollutants can also exasperate existing health problems, such as bronchitis, emphysema and asthma. People with existing lung disease[s], children and older adults are at greater risk of being affected by air pollutants (EPA 2006a).
  - Carbon monoxide causes health problems, because it reduces the level of oxygen that is delivered to the body's organs. Any person breathing in high amounts of carbon monoxide risks damaging his or her central nervous system, which can create vision problems and reduce a person's ability to function physically and mentally. People who have existing cardiovascular diseases and are exposed to low levels of carbon monoxide may experience chest pain and reduced ability to exercise. Symptoms associated with their existing disease may increase or become exacerbated (EPA 2006b).

- When lead is absorbed, it is distributed throughout the body where it can affect organs and tissue. Exposure to lead can cause damage to the kidneys, liver, brain, and nerves; cause high blood pressure and increase heart disease. Symptoms associated with lead poisoning include muscle aches and joint pain, lung damage, difficulty breathing, and diseases, such as asthma, bronchitis and pneumonia. Children, infants and unborn fetuses are at greatest risk of being harmed by lead contamination (Yu 2005).

- Air-quality concerns are commonly associated with vehicle pollution; however, they are also associated with other human activities and climatic or topographic conditions. There are three main categories of air pollution: area sources (e.g., dry cleaners and gas stations), mobile sources (e.g., cars and trucks) and stationary sources (e.g., factories and power plants). "Area sources collectively represent individual sources that are small and numerous and that have not been inventoried as specific point, mobile or biological sources. The main reason not to treat them as point sources is that the effort required to gather data and estimate emissions for each individual facility is great, although emissions per facility are small." (EPA 2001). Weather conditions and topography can exacerbate air-quality concerns, when pollutants are trapped by mountains or moved from one area to another as a result of wind currents.

- The Clean Air Act of 1970 is the primary mechanism for regulating air pollution impacts, and has been amended to increase efforts to improve air quality. This law provides air-quality standards (NAAQS) for criteria pollutants, including carbon monoxide, lead, nitrogen oxides, ozone, particulate matter, and sulfur dioxide (EPA 2006a). These are the six most common air pollutants that put human health at risk. Regions that fail to meet the federal standards are designated as non-attainment. The

pollutants come from a variety of sources and efforts to reduce them are primarily managed at the state level. These plans specify policies, incentives, permitting, monitoring, and other programs intended to reduce the criteria pollutants. Policies and programs for addressing other air-quality impacts are provided at the federal, state, regional, and local level (Barr 2004; Reitze 2001).

- Air quality may be addressed in comprehensive planning in many ways. Approaches include: (1) creating an air-quality element, (2) integrating it into traditionally required elements, such as natural resources, land use, housing, transportation, or public services; and (3) creating supplemental plans related to climate change or public health.

- Key issue areas that planners can consider as they begin to address air quality through planning policies include: promoting buffering and landscape standards, developing ordinances with evidence-based thresholds, separating some land uses to protect certain groups, and creating ordinances and overlay districts that focus on polluting uses, such as dry cleaners and airports.

- Air Quality is not an isolated issue; rather, it is tied to many other health topics covered in the DFH materials. For more information, see the table below

Understanding Air Quality

For planners, the existing research offers insights related to addressing mobile sources of air pollution, area and stationary sources of air pollution, and specialized populations and places. Before recommending approaches for integrating air-quality considerations into local plans and ordinances, it is important to provide a few key details for thinking about how air quality relates to the built environment.

Design for Health Planning Information Sheets Addressing Air Quality

DFH Planning Information Sheet:	**Topics covered related to accessibility:**	**Link:**
Influencing **Air Quality** with Comprehensive Planning and Ordinances	▪ Mobile, stationary and area sources of air pollution ▪ Specialized populations and places ▪ Indoor Air Quality	http://www.designforhealth.net/techassistance/airqualityissue.html
Promoting **Accessibility** with Comprehensive Planning and Ordinances	▪ Multimodal transportation systems ▪ Transit planning ▪ Specialized populations	http://www.designforhealth.net/techassistance/Accessibility.html
Supporting **Physical Activity** through Comprehensive Planning and Ordinances	▪ Pedestrian and bicycle plans ▪ Community design	http://www.designforhealth.net/techassistance/physicalactivityissue.html
Building **Social Capital** with Comprehensive Planning and Plan Implementation	▪ Mixed-use development ▪ Density ▪ Transit-oriented environments ▪ Pedestrian-oriented environments	http://www.designforhealth.net/techassistance/socialcapitalissue.html

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Housing located near freeways is subject to problems with air quality, potentially leading to respiratory illness. This example is of newly constructed housing in Minneapolis

Mobile Sources of Air Pollution

Addressing pollution from mobile sources is a complex matter, with planners typically focusing on influencing land-use patterns and travel behavior. For vehicle-related air pollution: land use is linked with travel behavior (trip time, trip length, community characteristics, and speed); travel behavior is linked with vehicle emissions; and air quality is linked with health (respiratory and cardiovascular issues) (Frumkin et al. 2004). Sprawling land-use patterns contribute to increased reliance on the automobile and, thus, increased emissions (Handy 2005). Increases in trip length and trip time further contribute emissions impacts (Frumkin et al. 2004). The Texas Transportation Institute's estimates, in fact, that vehicle miles traveled on major roads have more than doubled between 1982 and 2003 (Schrank and Lomax 2005).

As the Key Question on air quality states, the Clean Air Act of 1970 is the primary mechanism for regulating air pollution impacts, and has been amended to increase efforts. In 1991, Congress adopted the Intermodal Surface Transportation Act (ISTEA) that authorized the creation of the Congestion Mitigation and Air Quality (CMAQ) Improvement Program that focused on the link between planning for transportation and health through more multimodal options (United States Department of Transportation 2007). For more information on CMAQ, visit http://www.fhwa.dot.gov/environment/cmaqpgs.

Even in central cities and higher-density areas, the U.S. Federal Highway Administration (FHWA) has concerns about the dangerous air quality, particularly for active individuals, such as cyclists and pedestrians (EPA 2006) since they often exercise outdoors and often near roadways with congestion; this leaves them susceptible to some respiratory illnesses.

There are a number of potential health impacts associated with mobile sources of air pollution. First, motor-vehicle emissions are the primary source of most fine and ultra-fine particles, which are particularly dangerous, because they can deeply embed themselves within the lungs (Hitchens et al. 2000, 52; Frumkin et al. 2004, 69). Health impacts are of particular concern for those living near major roadways. As outlined in Design for Health's Air Quality Key Questions paper, for example, a study of 5228 people found that those living within 50 m (164 ft) of a major urban road or within 100 m (328 ft) of a highway had circulatory disease mortality rates "associated with indices of ambient air pollution at the subjects' residence and with residential proximity to traffic" (Finkelstein et al. 2005, 481).

Establishing a recommended buffer distance from roadways for air-quality purposes is difficult, as results from the literature are mixed. We recommend a buffer somewhere between 200m and 500m (656-1640 ft) of major roads, since research indicates that particles drop quickly to a background level within this range. Studies, while mixed, also show that barrier walls or landscape buffers can mitigate the spread of air pollution from major roadways; while it is important to know that vegetation is capable of absorbing air pollutants, its ability to do so depends on plant species, pollutants, wind, climatic factors, etc. (Khan and Abbasi 2000).

Other Air-quality Sources

In addition to mobile sources of air pollution, planners also should be concerned about stationary or point sources (e.g., power plants and industrial facilities) and area sources (e.g., airports, unpaved roads, agricultural feedlots, forest fires, fireplaces, and lawnmowers). Pollutants released from stationary and area sources include sulfur dioxide, nitrogen dioxides, carbon monoxide, benzene, mercury, and dioxin. Many large stationary-source emissions are required to obtain Title V permits, as regulated by the Clean Air Act (EPA 2006d). Carbon dioxide is, of concern, commonly discussed in terms of its relation to global climate change, with indirect health effects; we focus more on direct health effects, however, in this information series.

Air-quality issues with more direct health effects include ozone, according to the California Air Resources Board (CARBa) and others. This is a concern for susceptible groups, including those working or exercising outdoors; children; and persons with preexisting lung diseases, such as asthma and chronic pulmonary lung disease (CARBb 2005). Ozone is not emitted mobile or stationary sources. Rather, it is created by a chemical reaction through the mixing of hydrocarbons and nitrogen oxides, particularly on days that are sunny, hot and have calm winds (CARBa 2005).

Finally, indoor-air quality is another area of concern. While not as closely tied to land use, transportation and other decisions that planners are typically involved in, indoor-air quality can be associated with building materials and site selection. Indoor-air pollutants come from: outdoor environment, building materials, combustion of fuels, clothing and fabrics, consumer and petroleum products, soil, pesticides, herbicides, humans, animals, etc. (Cook 1991). Indoor-air pollution is primarily reduced and prevented by increasing indoor-air ventilation and circulation (Cook 1991). In terms of site selection, it is important that past uses of properties are evaluated, particularly for former industrial sites, including exploration for chemicals used at these sites through soil sampling and air-pollution measurements to ensure the site is appropriate for the planned use (Litt and Burke 2002).

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These suburban homes potentially have poor air quality.

Specialized Populations and Places

In addressing the various air-quality effects and pollution sources described above, it is important for planners to be aware of the potential for impacts on particular populations and in particular locations. Air-quality concerns are not the same for everyone. Rather, specialized populations are at greater risk, including children and the elderly (Houston et al. 2006). Concentrations of susceptible populations in locations, such as schools, daycare centers, playgrounds, long-term health-care facilities, rehabilitation centers, hospitals, and retirement homes, are of concern (Houston et al. 2006; South Coast AQMD 2005, 26).

Those living in minority and/or high-poverty neighborhoods may also be particularly sensitive to air-quality impacts, as they often have higher levels of chronic diseases, such as asthma, which make them more susceptible to the impacts of air pollution (Houston et al. 2006). These people/groups are often called "sensitive receptors." Often, their conditions can be exacerbated by exposure to poor indoor and outdoor air quality.

The issues and examples identified above point to a significant concern for planners interested in environmental justice . Environmental justice is commonly defined using the EPA's definition, which states that, "Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect

to the development, implementation, and enforcement of environmental laws, regulations, and policies" (EPA 2006c). Put more simply, environmental justice seeks to ensure that no person is disproportionately burdened with the impacts of pollution or other environmental hazards. A study conducted in 1999, for example, examined the socio-demographic characteristics of people living near industrial sources of air pollution in three different areas in the United States. This study showed that African Americans and those living in households below the poverty line are more likely to live closer to these sources of pollution (Perlin et al. 1999).

Several studies have found that poor communities and/or communities of color are more likely to live near and be exposed to environmental hazards, however, findings on whether it is race alone, class alone or both factors that determines these findings have been mixed (Mohai & Bryant 1991). Additionally, how and to what extent this effects the health of these communities has not been well documented and is complicated because it is difficult to sort out other compounding factors associated with living in poverty (e.g. access to healthy foods) that contribute to health issues (Sexton & Adgate 1999).

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While sports fields such as this provide important recreational opportunities, they are only accessible via car undermining some their health benefits.

Planning for Air Quality

Considering the information provided above, this section provides a number of approaches that communities might consider as they attempt to address the sources of air pollution and minimize health impacts for the general population as well as sensitive populations and places. This section discusses both planning and regulatory efforts that communities might consider.

First, one significant approach that communities might use to address a number of aspects of air quality, is to include an air-quality element as part of their comprehensive plans. The San Francisco General Plan makes a clear connection to the health impacts of air quality, noting that air-quality standards are intended "to protect the most sensitive members of the population from chronic and acute health effects, particularly the causation or aggravation of chronic cardio-respiratory diseases, including bronchitis, emphysema, asthma and restrictive ventilatory disease" and "to protect the population at large from adverse, though often transitory, effects, including irritation of eyes and respiratory tract, headaches, chest pains and coughing, unpleasant odors, and impaired visibility" (City of San Francisco 1996). The air-quality element lists a number of objectives related to a broad range of air-quality issues, including:

- adherence to state and federal quality standards and regional programs,
- reduction of mobile sources of air pollution through implementation of the transportation element of the general plan,
- decrease in the air-quality impacts of development by coordination of land use and transportation decisions,
- improvement of air quality by increasing public awareness regarding the negative effects of pollutants generated by stationary and mobile sources,
- minimization of particulate matter emissions from road and construction sites, and
- linkage to the positive effects of energy conservation and waste management to emissions reductions

Source: City of San Francisco 1996

Each of the objectives includes multiple policies and also refers to additional relevant objectives and policies in other elements of the general plan including transportation, residence, commerce and industry, recreation and open space, and environmental protection. The air-quality element links to language related to urban-goods movement in the transportation element, for example, including the objective to "enhance access and circulation between highways, freight facilities and intermodel transfer points on the waterfront from trucks and other service vehicles" (City of San Francisco 1996). The air-quality element justifies this connection, stating that "these policies will result in improvement of traffic flow and therefore will improve air quality" (City of San Francisco 1996).

Fort Collins, Colorado, takes a similar approach. This city, located about 60 miles (97 km) north of Denver with a population of 128,000, has established an Air Quality Plan. The plan is a stand-alone document, but functions as an adopted element of the comprehensive plan, with some of its goals and policies represented in the environment element (City of Fort Collins 2004). The plan addresses a wide range of air-quality issues, including such concerns as wood smoke, ozone-depleting compounds (e.g., refrigerants), global warming, tail-pipe emissions, travel-demand management, radon, and secondhand smoke. In addition to establishing a vision, goals, principles, and policies, the plan includes a unique feature not often seen in comprehensive or other community plans— the plan lists a set of indicators to measure progress in achieving plan policies (City of Fort Collins 2004). For each indicator, the plan specifies the relevant policy and the intended objective. One example is provided below:

> A.3.4 Commercial and Industrial Emissions
> Policy basis: Continually reduce total emissions of high priority pollutants from commercial and industrial sources in the Fort Collins [Urban Growth Area] UGA, including [carbon monoxide] CO, fine [particulate matter] PM, air toxins, and VOC.
> Objective: Reduce total emissions from Commerce and Industry
> Indicator: Tons/day of CO, PM2.5, air toxics, and VOCs. Source: City of Fort Collins 2004

The current status of the indicator also is provided, typically showing changes in the indicator or proxy measures using historical data (City of Fort Collins 2004).

Addressing the Impacts of Mobile Sources of Air Pollution

Planning and plan implementation efforts specifically tailored to air-quality impacts from mobile sources include two primary approaches: minimizing the impacts created and mitigating those impacts that occur. Related to minimizing impacts, there are numerous strategies intended to decrease vehicle-related air pollution. Some try to decrease vehicle miles traveled, such as transit-oriented development, pedestrian and bike infrastructure, and mixed use development. Planning and policy efforts to support these strategies are discussed in Design for Health's Social Capital Information Sheet. This section will focus on additional strategies that communities might use to address air-quality impacts from automobiles and other mobile sources. These include making driving more efficient and less polluting. To mitigate impacts when they occur, strategies, such as buffers and landscaping, are outlined here.

The South Coast Air Quality Management District (AQMD), a regional air-management agency for four counties in the Los Angeles metropolitan area, provides significant guidance related to minimizing air-pollution impacts from mobile sources. In its Guidance Document for Addressing Air Quality Issues in General Plans and Local Planning, the South Coast AQMD suggests sample goals, objectives and policies for inclusion in local plans. Among those goals is reducing air pollution from mobile sources. One related sample objective, and policies related to transportation, is:

> Objective 2.1 Reduce motor vehicle trips and vehicle miles traveled.
> AQ 2.1.1 Seek new cooperative relationships between employers and employees to reduce vehicle miles traveled (VMT).

AQ 2.1.2 Work with large employers and commercial/industrial complexes to create Transportation Management Associations and to implement trip/VMT reduction strategies.
AQ 2.1.3 Cooperate with surrounding jurisdictions to provide incentives, adopt regulations and develop transportation demand management programs that reduce and eliminate vehicle trips and VMT.
AQ 2.1.4 Collaborate with local transit agencies to:
- Establish mass transit mechanisms for the reduction of work-related and non-work related vehicle trips
- Promote mass transit ridership through careful planning of routes, headways, origins and destinations, and types of vehicles

Source: AQMD 2005

The City of Riverside, California, which lies in the eastern portion of the South Coast Air Basin discussed above, has an air-quality element within its general plan. Residents experience the negative effects of vehicle emissions associated with the commuter traffic that passes through the city. Riverside works to improve air quality through various strategies that target trip characteristics and the green infrastructure of its community, including: encouraging use of alternative fuels, improving the community's urban forest, promoting increased use of public transit, minimizing public transportation use, and reducing commuting, travel and vehicle-idling times. The element includes a comprehensive table with pollutant effects, federal and state standards, sources, and its health effects (City of Riverside 2005). This table is presented on the following page.

The plan also includes a historical analysis of national and regional studies followed up by a discussion of the regulatory framework (Federal Clean Air Act, California Clean Air Act, South Coast QMD), and a series of policy and implementation recommendations. This element is particularly useful since it breaks air quality into issue areas of land use, urban design, circulation, and community mobility.

In addition to addressing mobile sources of air pollution in local comprehensive plans, communities can also use a number of plan implementation tools to address air-quality impacts. Buffers, landscaping and other design tools, for example, can be used to decrease the effects of emissions, dust, dirt, and other contaminants in the air. These tools can help separate incompatible uses through screening and providing materials that absorb or filter potential pollutants. A landscaping or tree ordinance is one option that communities might consider. For additional information on tree and landscaping ordinances, see Design for Health's Mental Health Information Sheet at http://www.designforhealth.net/mentalhealthissue.html.

The Tahoe Regional Planning Agency (TRPA), which regulates development and establishes environmental regulations around Lake Tahoe, California, takes a different approach to addressing the air-quality impacts of mobile sources. While many communities require traffic impact analyses as part of development applications, TRPA goes a step further by linking traffic increases to air-quality impacts. TRPA's Code of Ordinances requires that as part of a "project application for additional or transferred development, which would result in a significant increase in daily vehicle trips at the project area, the applicant shall prepare and submit to TRPA, a technically adequate analysis of potential traffic and air-quality impacts" (TRPA 2004).

The traffic analysis must include the following items:

1. Trip generation rates of the proposed project
2. Impacts of the proposed project on the level of service at any impact intersections
3. Impacts of the proposed project on regional vehicle miles traveled (VMT)
4. Impacts of the proposed project on regional and subregional air quality
5. Ingress and egress characteristics of the proposed project, and their impacts on traffic flow adjacent to the project area
6. Measures necessary to mitigate all traffic and air-quality impacts to a level consistent with the environmental thresholds, the Goals and Policies, the Regional Transportation Plan, and the 1992 Air Quality Plan

Source: TRPA 2004

The City of Riverside's Air Pollutant Table (City of Riverside 2005):

RIVERSIDE GENERAL PLAN 2025

AIR POLLUTION SOURCES, EFFECTS AND STANDARDS

Air Pollutant	State Standard	Federal Primary Standard	Sources	Primary Effects
Ozone (O_3)	0.09 ppm, 1-hour average	0.12 ppm, 1-hour average; 0.08 ppm, 8-hour average	Atmospheric reaction of organic gases with nitrogen oxides in sunlight.	Aggravation of respiratory and cardiovascular diseases; irritation of eyes; impairment of cardiopulmonary function; plant leaf injury.
Carbon Monoxide (CO)	9.0 ppm, 8-hour average; 20 ppm, 1-hour average	9.0 ppm, 8-hour average; 35 ppm, 1-hour average	Incomplete combustion of fuels and other carbon-containing substances such as motor vehicle exhaust; natural events, such as decomposition of organic matter.	Reduced tolerance for exercise; impairment of mental function; impairment of fetal development; death at high levels of exposure; aggravation of some heart diseases (angina); reduced visibility.
Nitrogen Dioxide (NO_2)	0.25 ppm, 1-hour average	0.053 ppm, annual average	Motor vehicle exhaust; high-temperature stationary combustion; atmospheric reactions.	Aggravation of respiratory illness; reduced visibility; reduced plant growth; formation of acid rain.
Sulfur Dioxide (SO_2)	0.25 ppm, 1-hour average; 0.05 ppm, 24-hour average with ozone > = 0.10 ppm, 1 hour average or TSP = 100 µg/m^3, 24-hour average	0.03 ppm, annual average; 0.14 ppm, 24-hour average	Combustion of sulfur-containing fossil fuels; smelting of sulfur-bearing metal ores; industrial processes.	Aggravation of respiratory diseases (asthma, emphysema); reduced lung function; irritation of eyes; reduced visibility; plant injury; deterioration of metals, textiles, leather, finishes, coatings, etc.
Fine Particulate Matter (PM 10)	30 µg/m^3, annual geometric mean; >50 µg/m^3, 24-hour average	50 µg/m^3, annual arithmetic mean; 150 µg/m^3, 24-hour average	Stationary combustion of solid fuels; construction activities; industrial processes; industrial chemical reactions.	Reduced lung function; aggravation of the effects of gaseous pollutants; aggravation of respiratory and cardio-respiratory diseases; increased coughing and chest discomfort; soiling; reduced visibility.
Lead	1.5 µg/m^3, 30-day average	1.5 µg/m^3, calendar quarter	Contaminated soil.	Increased body burden; impairment of blood formation and nerve conduction; behavioral and hearing problems in children.
Visibility Reducing Particles	Sufficient to reduce visual range to less than 10 miles at relative humidity less than 70%, 8-hour average (9am - 5pm)			Visibility impairment on days when relative humidity is less than seventy percent.

µg/m^3 = micrograms per cubic meter of air; ppm = parts per million parts of air, by volume.

Regional and cumulative impacts identified in the traffic and air-quality analysis are required to be offset through contributions to the air-quality mitigation fund. The fee schedule requires the following: new residential units ($270/daily vehicle trip), new tourist-accommodation units or campground or recreational-vehicle site ($270/daily vehicle trip), new commercial floor area ($30/daily vehicle trip), and all other development ($30/daily vehicle trip). Mitigation measures may be provided in lieu of payment to the mitigation fund. Optional measures must equal or exceed the required mitigation payment and can include construction of transit, bicycle or pedestrian facilities; use of alternative fuels in fleet vehicles and transfer or retirement of off-site development rights (TRPA 2004).

While not focused on emissions from mobile sources, another relevant concern is impacts from traffic on unpaved or unclean surfaces. Dust, or particulate matter, is a significant concern for health, as outlined earlier and in Design for Health's Air Quality Key Questions document. The Coachella Valley Association of Governments (CVAG), representing numerous communities in south central California, including Palm Springs, has developed a draft model dust-control ordinance. The regulations require that, "Owners of public or private unpaved roads with average daily traffic levels between 20 and 150 vehicles must take measures (signage or speed-control devices) to reduce vehicular speeds to no more than 15 miles per hour" (CVAG 2003). Owners of unpaved roads with higher levels of traffic are required to pave the road or apply chemical dust suppressants (CVAG 2003).

Clark County, Nevada, which is home to Las Vegas and has had problems meeting air-quality standards for particulate matter in the past, has similar regulations and also addresses unpaved parking lots, requiring that they be paved or that dust palliatives (suppressants) be used (County of Clark 2004). Clark County also has standards for paved roadways, requiring that the shoulders be paved or stabilized with dust palliatives. The County also requires that street-sweeping equipment used on paved roadways and parking lots be PM10-efficient, applying sufficient moisture to the surface, to minimize dust (County of Clark 2004).

Other Air-quality Issues and Sources

As illustrated above, communities can undertake numerous approaches to addressing mobile sources of pollution. There are a number of other air-quality issues and sources, however, that concern communities. Stationary and area sources are two areas of concern. Increasingly, however, communities are addressing a wider range of issues, including carbon dioxide, ozone and indoor-air quality. Each of these air-quality issues has potential implications for health and can be addressed in local plans and ordinances. A number of examples are provided below.

Stationary and Area Sources:
As mentioned earlier, the City of Riverside, California, has an air-quality element in its comprehensive plan. A portion of the element is focused on stationary sources, specifying the following objective: "Prevent and reduce pollution from stationary sources, including point sources (such as power plants and refinery boilers) and area sources (including small emission sources such as residential water heaters and architectural coatings)." It recommends strategies, such as assisting small businesses by developing training programs related to clean, innovative technologies to reduce air pollution (e.g., wet cleaning or CO2 cleaning in lieu of perchloroethylene), and providing incentives to those businesses that use clean-air technologies.

The comprehensive plan also recommends that communities map their sources of toxic-air contaminants (TACs) through various computer programs. CARB, for example, has an Internet-based mapping tool that allows local planners to view maps showing the locations of air-pollution sources. The plan also recommends that land-use/zoning maps be utilized to identify the location of facilities and transit corridors that are potential sources of TACs and the locations of sensitive receptors (City of Riverside 2005).

One area source that communities are often concerned about is dry-cleaning businesses. As discussed in the Air Quality Key Questions, there are significant air-quality and health concerns associated with these facilities. There are a variety of approaches that zoning ordinances take to help deal with this particular issue. The Department of Environmental Protection for the State of Maine, for example, passed a dry-cleaner ordinance that all communities in Maine must use, entitle the "Perchloroethylene Dry Cleaner Regulation" (EPA 2006d). The ordinance includes emission limitations, performance standards, control-technology requirements for new sources, and compliance methods and monitoring requirements.

Ozone:

As described earlier, ozone is not a pollutant in itself, but is created through the interaction of other pollutants, particularly under warm, calm weather conditions. There are a number of efforts that communities can take to address ozone production and its impacts. The Sacramento Metropolitan AQMD, currently a non-attainment area for ozone, has developed three model ordinances intended to help the region attain the NAAQS for ozone. Each of the model ordinances includes a different purpose statement, but there is some consistent language related to linking air pollution, ozone and public health. The model ordinance states:

"Air pollution is a major public-health concern in California. The Sacramento Region is currently designated as non-attainment for the one-hour Federal ozone standard, as well as the more stringent State ozone standard. Air pollution can cause or aggravate lung illnesses, such as acute respiratory infections, asthma, chronic bronchitis, emphysema, and lung cancer. In addition to health impacts, air pollution imposes significant economic costs and negative impacts on our quality of life" (Sacramento Metropolitan AQMD 2003).

The AQMD's first model ordinance related to idling vehicles, including all diesel vehicles, heavy-duty vehicles and off-road equipment. In light of studies showing the relationship between air pollution and fuel use from idling vehicles, the ordinance requires that vehicles and equipment not be allowed to idle for more than five minutes and cannot operate within 1000 ft (304 m) of a school or residential area, unless the cargo will be unloaded within 30 minutes (Sacramento Metropolitan AQMD 2003).

A second model ordinance considers green contracting, which empowers communities to encourage their contractors to operate low-emission vehicles and equipment, and promote ride-sharing programs. The ordinance calls for use or modification of a point system in


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Central city areas are ideal locations for biking and walking but also have much traffic exposing those on bikes and on foot to polluted air. These examples are from Stockholm, Sweden

contracting that assigns additional points to contractors that use low-emission vehicles and equipment, and facilitate ride-sharing programs, including membership in a transportation-management association and achieving a 20 percent employee alternative-commute mode shift (Sacramento Metropolitan AQMD 2004a).

The third model ordinance addresses low-emission vehicles in government fleets, facilitating the establishment of a Low-Emission Vehicle and Fleet Program. The program is intended to develop a plan for the acquisition of low-emission vehicles by all departments, installation of retrofit devices on existing vehicles, staff training for the use of new and retrofitted vehicles, and development of a maintenance plan (Sacramento Metropolitan AQMD 2004b).

Indoor-air Quality:

Another element that planners tend to pay less attention to is indoor-air quality, particularly since many do not see the relationship between the built environment and indoor-air quality. The City of Portland, Oregon, has taken a different stance and, in 2002, it released Greening Portland's Affordable Housing, which created policies designed to improve indoor-air quality for housing projects that use City money. The three keys to healthier indoor air are (2002): eliminating or reducing sources of pollution, providing fresh air ventilation and filtering the air to remove fine particulates. This manual targets affordable-housing developers, designers and builders with information about local products, building materials, construction practices, vendors, and services needed to successfully execute a green project. Goals relevant to air quality in this context include the reduction of building footprints, support for transportation alternatives and implementation of maintenance and operational practices that reduce or eliminate harmful effects on people and the natural environment. The plan lists a series of thresholds, including specifying solvent-free, no-VOC (volatile organic compound) or low-VOC (below 50 g/liter) paints and primers and properly ventilating the building prior to occupancy (City of Portland 2002).

Specialized Populations and Places

As with other aspects of health, there are specialized populations and places that are more susceptible to certain negative health outcomes; these include: children, people with asthma, pregnant women, the elderly, those living in poverty and/or minority neighborhoods, schools, playgrounds, long-term health care facilities, rehabilitation centers, hospitals, retirement homes, rehabilitation centers (South Coast AQMD 2005, 26). These specialized populations are often referred to as sensitive receptors and given special consideration when planning for the built environment. This section outlines options that communities might consider in addressing the impacts of sensitive populations and places in their community.

One plan that formally addresses specialized populations and places is the City of Riverside, California, located on the fast-growing western edge of the Los Angeles region. The Riverside General Plan 2025 includes an air-quality element in its comprehensive plan. It includes many of the features identified in the previously discussed examples, but this plan goes a bit further in addressing the health impacts of air pollution on particular populations and in certain locations. In a manner atypical of local comprehensive plans, the element makes this link through a discussion of key studies, citing relevant research.

The air-quality element cites specific studies pointing to concerns about impacts on pregnant women and young children, including those with asthma. The element also highlights research that points to air-quality concerns for those attending schools and living near freeways, and areas with high traffic, including truck traffic (City of Riverside 2005).

In response to the cited research, the plan provides a number of specific objectives and policies, including the following:

Objective AQ-1: Adopt land-use policies that site polluting facilities away from sensitive receptors and vice versa; improve job-housing balance; reduce vehicle miles traveled and length of work trips; and improve the flow of traffic.
Policy AQ-1.1: Ensure that all land-use decisions, including enforcement actions, are made in an equitable fashion to protect residents, regardless of age, culture, ethnicity, gender, race, socioeconomic status or geographic location, from the health effects of air pollution.
Policy AQ-1.3: Separate, buffer and protect sensitive receptors from significant sources of pollution to the greatest extent possible.
Policy AQ-1.8: Promote "Job/Housing Opportunity Zones" and incentives to support housing in job-rich areas and jobs in housing-rich areas, where the jobs are located at non-polluting or extremely low-polluting entities.
Policy AQ-1.12: Support mixed-land use patterns, but avoid placing residential and other sensitive receptors in close proximity to businesses that emit toxic air contaminants to the greatest extent possible. Encourage community centers that promote community self-sufficiency and containment and discourage automobile dependency.
Policy AQ-1.13: Encourage employment centers that are non-polluting or extremely low-polluting and do not draw large numbers of vehicles in proximity to residential uses.
Policy AQ-1.17: Avoid locating multiple-family developments close to commercial areas that emit harmful air contaminants.
Source: City of Riverside 2005

One tool that the City of Riverside uses, to implement the policies noted above, is an infill-development incentive for single-family residential-infill developments of five parcels or fewer in designated low-income areas. One key program objective is to provide housing in close proximity to existing business and employment areas, reducing the need for extensive vehicle trips. Developers and owner/builders can be reimbursed up to $5000 per lot for actual expenses incurred for grading and soft costs (City of Riverside 2005).

Beyond what can be accomplished at the community level, the State of California passed air-quality legislation that prohibits new schools from being constructed within 500 ft (152 m) of the edge of the closest traffic lane of a freeway or other busy traffic corridor. This provision is tied to local planning, since the primary authority for siting public schools rests with local school districts, and the California Education Code requires public-school districts to notify the local planning agency when siting new public schools and to determine if the proposed site conforms to the General Plan. The law states that, "If the proposed school is within 500 ft (152 m) of the edge of a freeway or traffic corridor that has specified minimum average daily traffic counts, the school district is required to determine through specified risk assessment and air dispersion modeling that neither short-term nor long-term exposure poses significant heath risks to pupils." The school district must also work with the regional AQMD when preparing the environmental assessment, so that the AQMD can verify that all permitted and non-permitted sources of air pollution that might significantly affect health have been identified and evaluated (CARBb 2006).

Final Thoughts

This information sheet helps planners make connections between air-quality concerns, health and the built environment. The sheet focuses on major sources of pollutants, mobile sources and other air-quality issues and sources, including stationary and area sources, climate change, ozone, and indoor-air quality. This document is intended to help communities understand how they can reduce air pollution and also minimize adverse air-quality impacts when they occur. It also points to concerns about specialized populations and places, and the issues that they face in dealing with air-quality impacts. This information sheet provides specific examples of plan language, ordinances and programs that communities can use to address a range of air-quality issues.

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