

CHAPTER 9:

ENVIRONMENTAL HEALTH

Environmental health hazards include air pollution, infectious agents associated with food and water, hazardous chemicals and wastes, occupational exposures, ionizing radiation, as well as factors that produce psychological stress such as noise and urban crowding. The majority of these hazards are introduced into the environment by humans.

Several different public agencies are responsible for overseeing and ensuring environmental quality. These agencies maintain data on environmental indicators such as air and water quality and hazardous substances. The mission of the Environmental Health Division of the Seattle-King County Department of Public Health is to identify and sustain environmental conditions which promote healthy people and healthy communities in Seattle and King County. The Environmental Health Division helps to protect the quality of food and water, control or eliminate vector borne illnesses, and regulate the disposal of wastes such as sewage, hazardous waste, and garbage.

Note that certain subpopulations are more vulnerable, or are subject to increased exposure to environmental hazards. For example, children and the elderly are more at risk to environmental insults than the general population. Also, there has been an increasing awareness in recent years that low-income and minority communities tend to bear a disproportionate burden of environmental hazards. This phenomenon, referred to as environmental injustice or environmental racism, has been established scientifically through numerous studies, including studies conducted in Washington State and Seattle.^{1,2} For example, several contaminated hazardous waste sites in Seattle have polluted the sediments of the Duwamish River where many tribal and low-income people come to fish.

In this chapter, we examine available local data on exposure to environmental hazards as well as health indicators that are related to exposure to these hazards.

¹ WA State Department of Ecology. A Study on Environmental Equity in Washington State. October 1995. Olympia, WA.

² City of Seattle Planning Department. Two Case Studies of the Spatial Relationship Between Environmental Risks and Population Groups in Seattle. October 1993. Seattle, WA.

AIR QUALITY

Poor air quality, both indoor and outdoor, contributes significantly to morbidity and mortality from respiratory diseases including lung cancer, chronic

obstructive pulmonary disease (COPD), and asthma. Other health effects from air pollutants include eye, nose, and throat irritation, headaches, dizziness, and fatigue.

Outdoor Air Quality

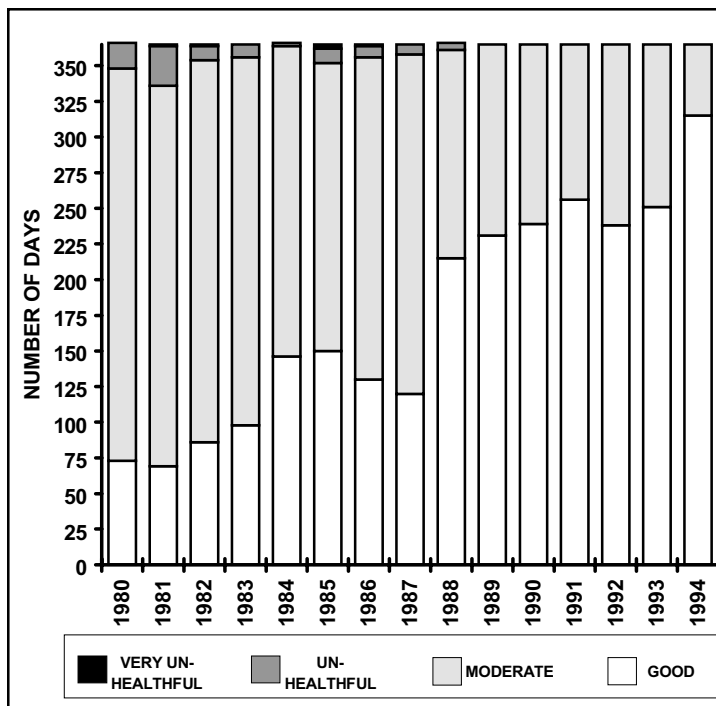
Outdoor air quality is measured by a variety of indicators, including particulate matter (PM_{2.5} and PM₁₀), carbon monoxide, ozone, sulfur dioxide, and lead. In addition to pollutants, outdoor air quality on a given day is also influenced by the weather. In King County, outdoor air quality indicators are monitored at a number of sites. The following brief summary on outdoor air quality is based on reports published by the Puget Sound Air Pollution Control

Agency (PSAPCA).^{3,4} PSAPCA is a government agency that was established by state law in 1967. The agency enforces federal, state, and local air pollution laws and regulations in King, Kitsap, Pierce, and Snohomish counties in partnership with the U.S. Environmental Protection Agency, the Washington State Department of Ecology, industry, local jurisdictions and private citizens. Please refer to reports published by PSAPCA for detailed information on outdoor air quality in the Puget Sound Region.

The Pollutant Standards Index (PSI) provides a nationally uniform method for reporting air quality as related to health impacts. A PSI value above 100 is considered “unhealthy” and a value above 200 is “very unhealthy”.

- ◆ In the Puget Sound Region, 1996 was the sixth consecutive year with no days of “unhealthy air.”
- ◆ Between 1980 and 1996, air quality in the Puget Sound Region improved significantly, especially since 1988.

**Figure 9-1:
Unhealthy and Very Unhealthy Days In Seattle
1980-1994**



³ Puget Sound Air Pollution Control Agency. 1995 Air Quality Data Summary. December 1996. Seattle, WA.

⁴ Puget Sound Air Pollution Control Agency. Data Summary 1996. Seattle, WA.

Particulate Matter includes both fine ($PM_{2.5}$) and coarse (PM_{10}) particles. Coarse particles are generated by sources as wind blown dust and industrial crushing and grinding operations. Both coarse and fine particulate matter result from industrial fuel oil and wood combustion, exhaust from diesel and gasoline powered vehicles, wood stoves and fireplaces, and outdoor burning. Both fine and coarse particulate matter penetrate the deepest recesses of the lung where they cause structural damage, aggravate pre-existing lung ailments and deposit toxic compounds.

The federal daily standard for PM_{10} levels is 150 micrograms per cubic meter of air (ug/m^3). In 1996, 24-hour PM_{10} levels exceeded the Washington State impaired air quality trigger of $75 ug/m^3$ in February due to air stagnation. As a result of this, the Puget Sound Air Pollution Control Agency issued a first stage burning ban. In 1996, the annual PM_{10} average values in King County were all below the federal annual standard of $50 ug/m^3$. Preliminary data from 1997 suggest that PM_{10} levels at all sites in the Puget Sound region were in compliance with federal standards.

In September of 1997, the Environmental Protection Agency revised federal standards for particulate matter, based on scientific evidence of adverse health effects from current standards. PSAPCA is establishing new monitoring services to monitor $PM_{2.5}$ in the Puget Sound region according to the new federal standards. The new federal daily standard for $PM_{2.5}$ is $65 ug/m^3$.⁵ In 1997, the highest $PM_{2.5}$ daily value ($57 ug/m^3$) was measured at the Duwamish industrial site in Seattle on the 15th of January. Preliminary data on $PM_{2.5}$ suggest that the Puget Sound region will meet the new federal daily standards.

Carbon Monoxide. The main source of carbon monoxide emissions is automobiles. In 1996, none of the King County monitoring sites measured a carbon monoxide value that exceeded the primary health related standard of 9 ppm averaged over 8 hours. The highest recorded 8-hour average was measured at 8.7 ppm on October 9 at both the University District, and downtown Seattle (5th and James).

⁵ The new daily federal standard of $65 ug/m^3$ is based on a 3 year average of the 98th percentile of daily (24-hour) concentrations measured at each monitor. The new annual standard is $15 ug/m^3$ based on a 3-year average of annual mean concentrations for each area.

Indoor Air Quality⁶

Most people spend as much as 90% of their time indoors. According to the EPA, indoor air levels of many pollutants may be substantially higher than outdoor levels. Our exposure to indoor air pollutants is believed to have increased during the past several decades because of construction of more tightly sealed buildings, reduced ventilation to save energy, the use of synthetic building materials and furnishings, and the use of chemically formulated personal care products, pesticides, and household cleaners.

Pollutant sources in the home include the following:

- ◆ Heating systems that burn oil, gas, kerosene, coal, and wood. Pollutants released from these sources include particulate matter, carbon monoxide, formaldehyde, and nitrogen dioxide.
- ◆ Tobacco products.
- ◆ Molds and allergens (such as dust mite and animal dander).
- ◆ Building materials and furnishings such as deteriorated asbestos-containing insulation, wet or damp carpet, and products for household cleaning, maintenance, and personal care.
- ◆ Radon in very limited areas in King County.
- ◆ Outdoor sources such as pesticides, herbicides, and outdoor air pollution.

Health effects from indoor air pollutants may be experienced soon after exposure (such as irritation of the eyes, nose, and throat, headaches, dizziness, fatigue, and asthma), or possibly be experienced years later (such as some respiratory diseases, heart disease, and cancer).

Another important exposure that can occur in the home is carbon monoxide (CO) poisoning. Carbon monoxide is a colorless, odorless gas. If inhaled, CO inhibits the ability of the blood to carry oxygen and can be fatal. Carbon monoxide accidental poisoning is often caused by unvented kerosene and gas space heaters, leaking chimneys and furnaces, gas water heaters, wood stoves, fireplaces, gas stoves, and automobile exhaust from attached garages. In 1996, there were three cases of death due to accidental carbon monoxide poisoning among King County residents.

There are many strategies for improving indoor air quality. Improving ventilation by periodically opening windows and doors. Installing and using fans in the kitchen and the bathroom can help lower concentrations of indoor pollutants and control humidity to prevent the growth of molds. It is also advisable to refrain from smoking in the home and avoid the use of toxic household products where possible. Carbon monoxide monitor/alarm may be installed in the home to detect unsafe levels of CO.

⁶ Information source: a) EPA's Indoor Air Quality Home Page. <http://www.epa.gov/iaq/>, b) Master Home Environmentalist. Volunteer Training Manual. Seattle, Washington.

ASTHMA HOSPITALIZATION

Asthma is a chronic respiratory disease that can be used as an indicator of environmental health. Asthma is characterized by acute airway obstruction triggered by allergens, pollutants, viral respiratory infection, and exercise. Asthma morbidity and mortality are closely related to indoor and outdoor air quality.

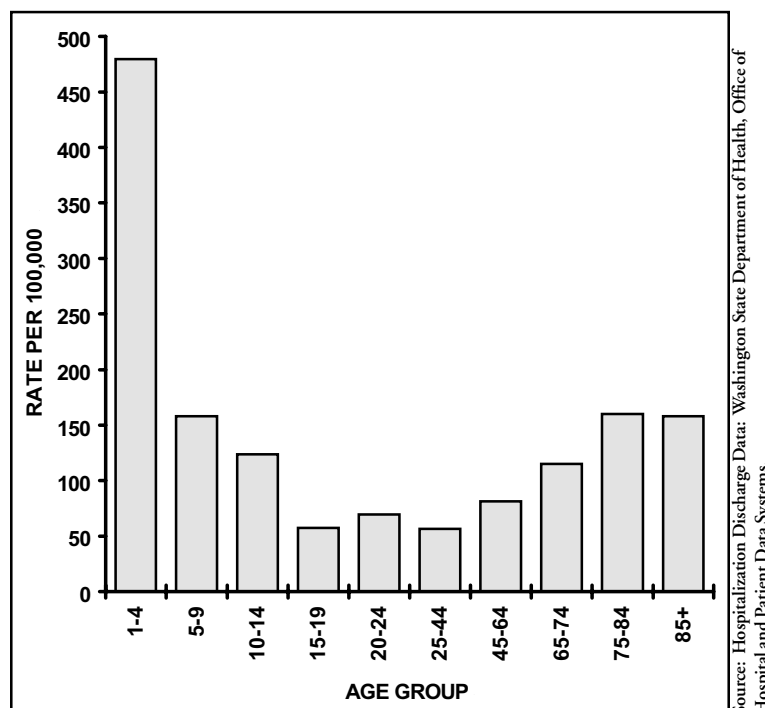
Risk factors for childhood asthma include chronic exposure to house dust mites, cat and dog dander, cockroach, various pollens, secondhand smoke, and pollutants such as PM_{2.5}, ozone, nitrogen dioxide, and sulfur dioxide. For asthma developed in adulthood, occupational exposures to particulate

organic dusts and chemicals have been linked to the disease.

Asthma is a relatively common disease but is usually non-fatal. Nationally, data from the National Health Interview Survey (1990-92) indicate that 6.1% of children under age 18, 4.1% of adults age 18 to 64, 3.8% of elderly age 65-74, and 3.7% of elderly age 75 and older suffer from asthma. Hospitalizations for asthma, particularly among children, reflect not only underlying prevalence but also problems accessing primary care, finding affordable medications or home treatment equipment, and using medications correctly.

**Figure 9-2:
Asthma Hospitalization Rates
By Age, King County
1996**

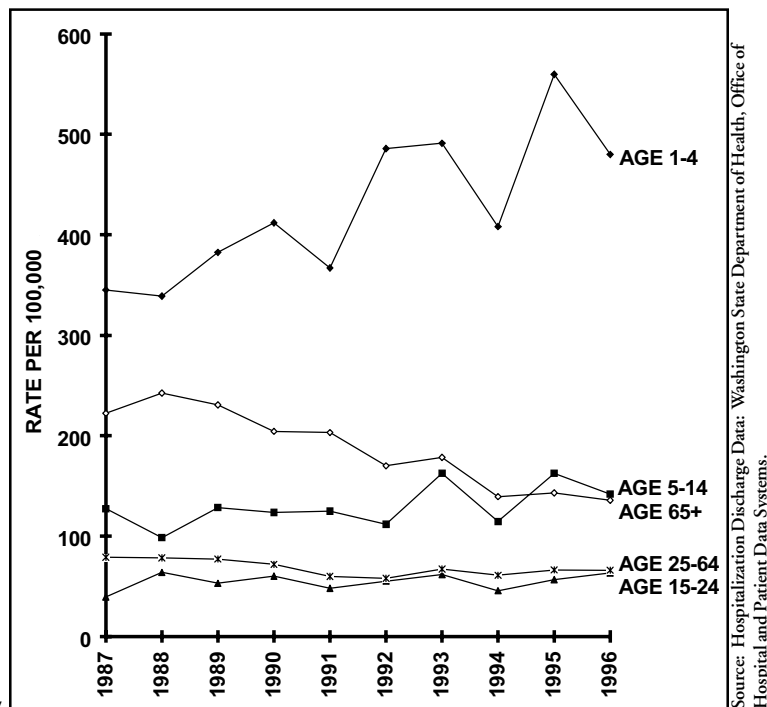
- ◆ In 1996, 41 King County residents were reported to have died from asthma,⁷ all were adults and about half (49%) aged 75 and older.
- ◆ There were 1,830 hospitalizations for asthma during the same year.
- ◆ The hospitalization rate was highest among children age 1-4⁸ and elderly age 75 and older (Figure 9-2).



⁷ Diagnosing asthma in older adults is more difficult than in children and young adults. Other chronic lung problems that are difficult to differentiate from asthma, such as chronic obstructive pulmonary disease, may be present in the older group. The accuracy of the certification of asthma as a cause of death has been the subject of several studies, with some researchers finding that death certificate data underestimate the true number of asthma deaths in adults 35 and older.

⁸ Diagnosis of asthma in children under age 2 can also be problematic. Many young children with symptoms of asthma, such as intermittent wheezing, do not go on to develop asthma in adulthood.

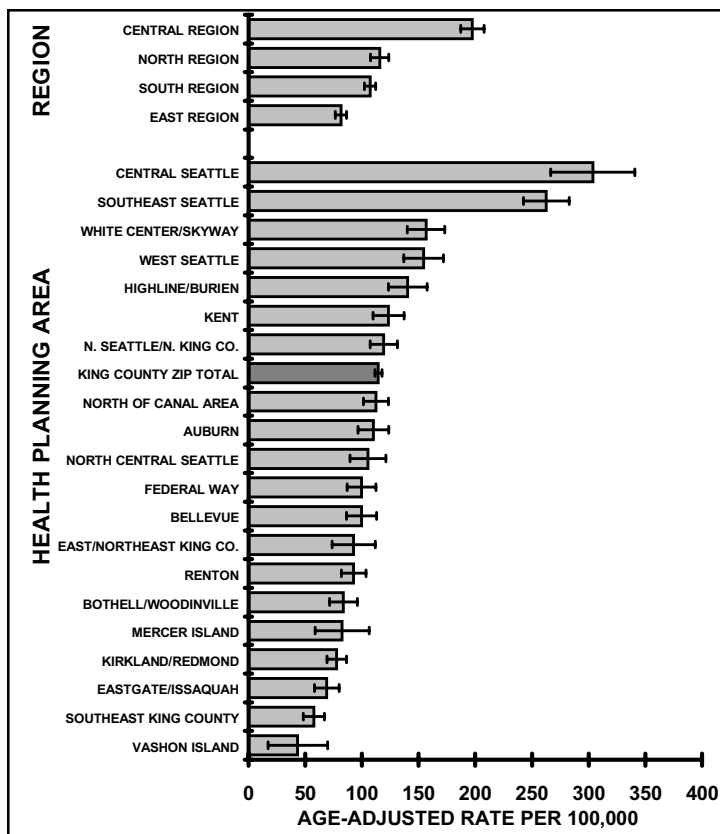
**Figure 9-3:
Asthma Hospitalization Trends
By Age, King County
1987-1996**



Source: Hospitalization Discharge Data: Washington State Department of Health, Office of Hospital and Patient Data Systems.

- ◆ Between 1987 and 1996, the hospitalization rate increased significantly among children age 1-4 and 5-14. During the same period, the rate declined significantly among adults age 25 and older especially among seniors age 65 and older. The rate was flat among youth age 15-24 (Figure 9-3).
- ◆ The age-adjusted asthma hospitalization rate in high poverty neighborhoods (231.8) was significantly higher than the rate in medium (131.7) and low poverty (81.0) neighborhoods.

**Figure 9-4:
Asthma, Age-Adjusted Total Hospitalization Rates
By Region and Health Planning Area, King County
Three Year Average, 1994-1996**



Source: Hosp. Discharge Data: WA State Department of Health, Office of Hospital and Patient Data Systems.

- ◆ Averaged over 1994-1996, residents of Central Region had the highest asthma hospitalization rate (197.3), followed by North (115.6), South (107.1), and East (81.5) regions. Among the Health Planning Areas, the hospitalization rates in Central Seattle, Southeast Seattle, White Center/Skyway, West Seattle, and Highline/Burien were significantly higher than the county average rate (Figure 9-4).

There are a number of programs in King County that target asthma prevention and control.⁹ The activities of these programs include coordinating care for children with asthma, improving indoor air quality, educational outreach, providing materials to reduce environmental exposures (e.g. bedding covers and vacuums), and screening for undiagnosed asthma.

⁹ For a description of these programs, please refer to Public Health Data Watch, Childhood Asthma Hospitalizations, King County 1987-1996. Seattle-King County Department of Public Health. February, 1998.

WATER QUALITY AND WATERBORNE ILLNESSES

King County residents enjoy generally high quality drinking water from two sources: surface sources and groundwater. The City of Seattle provides drinking water for approximately 70-75% of King County residents. This water is from protected surface water sources in the Cascade foothills. Groundwater provides drinking water for approximately 25-30% of the population. Many cities, water districts, water associations, small water systems and individual water systems rely on groundwater.

Groundwater is susceptible to pollution and depletion. Contamination can come from improper disposal of hazardous material, leaking underground fuel storage tanks, improper application of agricultural chemicals, and other sources. Depletion occurs when aquifer recharge is interrupted or removed (usually by high density development) and by using more water from an aquifer than is naturally recharged.

Infections which can be transmitted by drinking water include giardiasis, cryptosporidiosis, campylobacteriosis, salmonellosis, and yersiniosis; nationally, giardiasis and cryptosporidiosis are most commonly identified in waterborne outbreaks. There were 247 giardiasis cases reported in 1996 in King County, but the proportion of these attributable to small residential water systems is unknown. Cryptosporidiosis is not a reportable condition in Washington State, so the amount of morbidity in King County related to cryptosporidiosis is unknown. Although the Seattle-King County Department of Public Health (SKCDPH) watches for giardiasis or cryptosporidiosis outbreaks associated with small water systems, none have been identified. The Seattle Water Department monitors for *Giardia* and *Cryptosporidium* cysts. Very low levels of *Cryptosporidium* cysts are found in Seattle water

(around 3 per 100 liters), but whether the cysts are alive and can infect a person is unknown. Outbreaks of cryptosporidiosis in other places have been associated with much higher levels of cysts.

Water systems are regulated by the SKCDPH or by the State Department of Health (DOH). Private water systems serving one residence are required by the SKCDPH to be located away from potential contamination sources and must be tested before use. Small public water systems serving 2 to 9 connections, or less than 25 people per day (known as Group B) are regulated by the SKCDPH for location, construction, initial testing and ongoing monitoring and maintenance. Larger public water systems serving over 9 connections (some Group B, all Group A) are regulated by the State DOH.

In 1996, there were 1,272 registered small water systems (Group B) in King County. Of these systems, 416 (33%) have received final system approval and comply with all requirements. Through an enhanced notification and education process the bacterial sampling by water system operators has increased from a rate of only 10% of these systems in 1995 to a rate of 32% in 1996.

There are 230 registered Group A systems in King County (167 are community systems and 52 are non-community systems serving transient populations, e.g. restaurants, schools). The State DOH classified 42% of the community systems as GREEN (approved and adequate for service to additional connections), 11% as RED (unapproved and/or not adequate for service to additional connections without further improvement), and 47% as YELLOW (compliance status of the system is questionable). The compliance status of non-community systems is currently being evaluated by the State DOH.

FOODBORNE ILLNESSES

Improperly handled and prepared food can be a significant source of gastrointestinal illness. Food can be contaminated at the source or near the time of consumption. Ill foodhandlers can also transmit illness through food preparation. In 1996, however, less than 5% of reported outbreaks were thought to be related to ill food handlers (excluding hepatitis A).

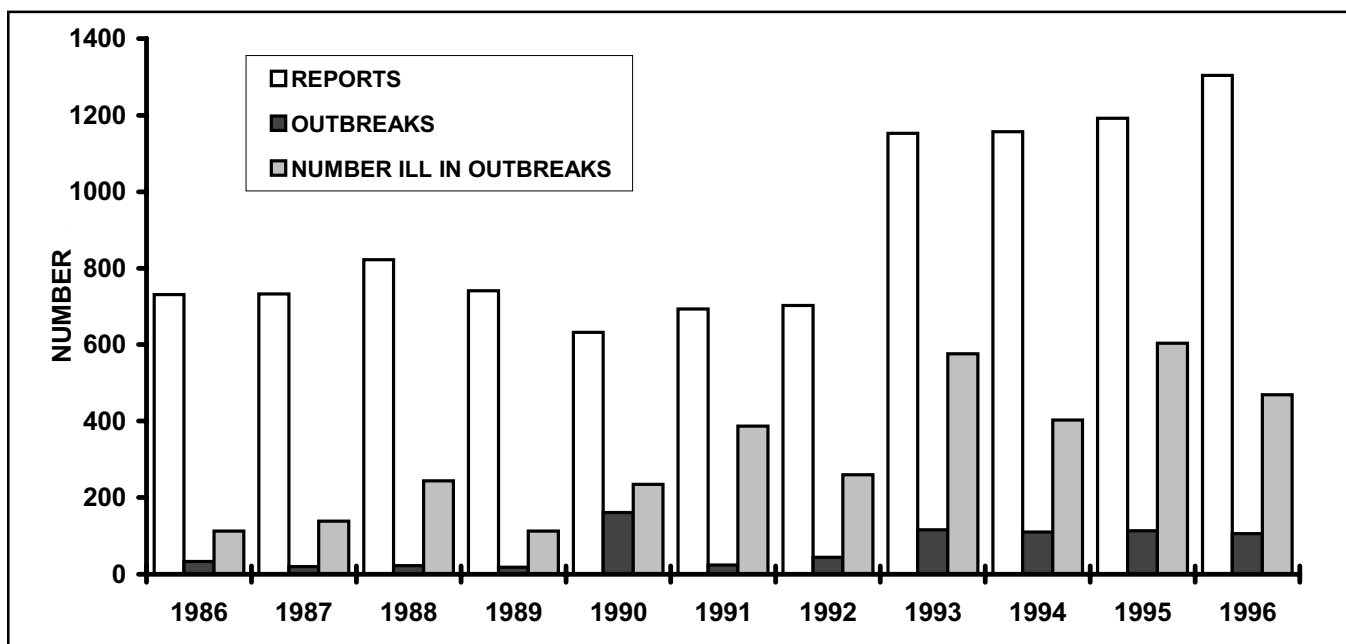
Bacteria, including bacterial toxins, are thought to be the most common cause of reported foodborne gastrointestinal illness in King County (which accounts for the majority of statewide outbreaks). The majority of outbreaks are not confirmed by laboratory testing. Most illnesses are brief and affected individuals do not seek medical attention, and food testing is only performed in large outbreaks and those related to certain chemical/toxic illnesses; even then, the ability to test for viruses, toxins and other non-bacterial agents are limited. Of those outbreaks that were laboratory confirmed in 1996, *Salmonella* was the most commonly reported cause. Histamine (Scombroid) poisoning, associated with tuna and related species, occurs infrequently but has been documented; three of six potential histamine poisonings in 1996 were

laboratory confirmed. One confirmed outbreak caused by *Clostridium perfringens* (a bacterial toxin) occurred in a homeless shelter in November 1996, affecting 120 individuals.

It is important to note that the reported statistics do not reflect the true incidence of foodborne illness because most cases, especially those occurring at home, are often unreported. In addition, a portion of those that are reported may be the result of other exposures, such as person-to-person transmission of viral gastroenteritis.

Between 1986 and 1992, the number of foodborne outbreaks (involving two or more persons from different households or more than two persons from the same household, or those related to chemical/toxic exposures) was highest in 1990. In 1993, the number of outbreaks increased sharply, with a substantially larger number of reports as well as persons ill in the reported outbreaks. This was largely due to the *E. coli* O157:H7 outbreak in January, 1993 and the publicity generated about foodborne illness. Since then, the number of complaints has remained at this higher level with 1,304 reports in 1996 (Figure 9-5).

Figure 9-5:
Foodborne Illnesses
King County, 1986-1996



Source: Foodborne Illness Report Records; Seattle-King Co. Dept. of Health, Prevention Services Division.

Prevention

Safe food handling can reduce the risk of foodborne illness. In King County environmental health specialists work with restaurant managers to teach safe food handling practices. Beginning in 1997, SKCDPH initiated an educational program for food service operators. The environmental health specialists provide separate educational visits in addition to the unannounced inspections of food establishments. An evaluation of these educational visits has shown the food establishment operators find them useful in improving the knowledge of their staff members. In addition, all food handlers in the state of Washington must have a Food and Beverage Service Workers permit. King County issues more than 55,000 permits each year.

During inspection of food establishments, food handling violations are recorded as critical or non-

critical. The critical violations are those which are most likely to lead to foodborne illness, such as improper cooling or lack of handwashing. The permit of a food establishment can be suspended for repeated critical violations or if imminent health hazards present a serious risk of foodborne illness.

In the home, risk factors for foodborne illness can be reduced by using the same safe food handling practices recommended for food service establishments such as proper hand washing, cooking meat to proper temperatures, and prompt refrigeration. The Centers for Disease Control estimates that 60% of foodborne illness cases are related to food preparation in the home. It is important that King County residents are aware that foodborne illness does not just happen in restaurants and, therefore, they also need to take precautions at home.

HAZARDOUS SUBSTANCES

Hazardous chemicals are widespread in our modern society. Many hazardous substances are constituents of consumer products used around the house, garage, garden or hobby shop, or are used by local businesses in manufacturing or providing services. They are as common as gasoline, paints, batteries, printing inks, degreasers, and dry cleaning solvents. When any of these hazardous substances are no longer needed, they become hazardous wastes. If carelessly handled or mismanaged, hazardous chemicals and wastes pose a significant threat to public health, individual and worker safety, and the environment.

The Local Hazardous Waste Management Program Plan, adopted in 1990, provides for a regionally coordinated program to manage all household hazardous waste (HHW) and most business hazardous waste generated in King County. It is

implemented jointly by the SKCDPH, the City of Seattle Public Utilities, the King County Solid Waste Division, the King County Water and Land Resources Division, and the suburban cities. As part of this program, the Environmental Health Division of the SKCDPH was given authority to inspect small businesses generating up to 220 pounds of hazardous waste per month. Hazardous waste specialists on the Health Department Audit Team conducted 1,650 site visits to businesses in 1996. During these visits, technical assistance on hazardous waste management was given to each shop. Of the sites inspected, most businesses were attempting to properly manage their hazardous wastes. Information about how to comply with regulations was provided to all those who were not properly managing their waste. Evaluation data for return visits to priority industries indicate that 87% of the businesses made at least one improvement in their hazardous waste management.

Household Hazardous Waste

Primary sources of household hazardous waste include used motor oil, pesticides, and cleaning products. Although households only generate a small proportion of the total hazardous wastes, these wastes end up in municipal waste streams – in the trash or down the sewer or storm drain. An important concern is the potential effects from many small amounts of waste from all households and small businesses in the region added together. For example, a small amount of paint thinner poured down a drain may seem insignificant, but if every household in the county discarded a cup of thinner, more than 37,000 gallons

of the hazardous solvent would enter the area's waters.

Since 1986, residents of King County have had periodic opportunities to safely dispose of household hazardous wastes. Two permanent collection facilities, one mobile facility (the "Wastemobile"), and numerous suburban city sponsored special events were used to collect over 33,000 tons of household hazardous wastes in 1997. In 1997, nearly 21,000 individuals called the Hazards Line for information on alternatives to household toxics and the proper disposal of household hazardous wastes.

Used Oil

Used oil from do-it yourself car mechanics has typically been the highest volume waste delivered to the collection facility and one-day special events. To enhance opportunities for residents to properly

dispose of used motor oil, 150 new oil collection sites were opened in King County by private businesses since 1993. The average amount of oil collected per month was 22,500 gallons.

Pesticides

Pesticide poisoning is a reportable condition in Washington State. Any suspected or confirmed case of pesticide related illness must be reported to the Washington State Department of Health (DOH) and subsequently investigated by DOH staff. The DOH Pesticide Incident Response Tracing Program staff investigated 94 pesticide exposure incidents involving 116 people in King County between January, 1995

and December, 1996. Of the 116 cases, 54 were considered to be related to pesticide exposure. Twenty-three of the 54 cases came from household use and 24 originated from persons exposed on the job. Exposure to pesticides can cause serious short and long term health effects, and can be avoided by using less toxic alternatives when possible or by properly using, handling, and disposing these chemicals.

Lead

Public Health concerns about exposure to lead and high concentrations of lead in blood has increased in recent years. Prolonged exposure to lead, especially for children, increases the risk of learning disabilities and brain damage. Risk of exposure can be minimized by following safe practices when remodeling older homes and by preventing exposure to lead through water, food, soil, and dust. In 1993 the

Washington State Department of Health instituted a screening and reporting system for blood lead levels exceeding established minimums. King County data developed during that screening process showed very low rates of elevated blood levels compared to Washington State. There were no elevated blood-lead cases reported to the SKCDPH in 1997 that required a follow-up environmental investigation.

