As of July 2009, 17,059 municipalities were covered by a smoke-free provision (in workplaces and/or restaurants and/or bars) that collectively cover almost 71 percent of the U.S. population.[263] A substantial number of workers, however, continue to be exposed to tobacco smoke on the job. Bar and restaurant workers continue to have among the highest exposure rates. All of the issues related to tobacco-related cancers in the workplace also apply to tobacco use and tobacco smoke exposures in the home and around children.

Drinking Water Contamination

Americans' drinking water comes from groundwater and rain that fills streams, reservoirs, rivers, lakes, and ultimately, the oceans. Chemicals improperly stored and disposed of by industry and individuals alike soak into the soil and eventually leach into groundwater. As clouds and rain, water absorbs chemicals in the air. As a result, the water we drink is steeped in varying mixtures of chemicals and other substances. Some of these contaminants are not harmful to human health in trace or extremely small amounts, while others can cause or contribute to numerous diseases, including cancer.

Assessing health hazards due to drinking water contamination is difficult, since it typically is challenging to estimate the levels and timing of exposures and the specific chemicals involved. It also can be difficult to define exposed populations clearly and select the most appropriate disease endpoints or intermediate biologic markers for study. Further, it often is not possible to identify the cause of observed health effects when there are multiple exposures or to link specific health effects with individual chemicals that occur in mixtures.

Public water filtration and treatment plants remove some contaminants, but current technologies cannot remove them all.

Water treatment systems vary significantly across the country since they are tailored (to the extent practicable) to treat the water contaminants that are found in each vicinity. Arsenic, microbes, nitrates, radium, uranium, selenium, antimony, sulfate, magnesium, calcium, iron, manganese, potassium, phosphorous, and other metals are among the substances commonly removed from drinking water supplies.[264] Because of concerns about water pollution, some people use home filtration systems to further treat water from public supplies or wells and/or use bottled water for drinking and cooking.

...in a country where I work hard and I vote, I feel like I have been involuntarily exposed to things that could have made me sick and I can't make informed decisions when that's the situation.

KATRINA COOKE
BREAST CANCER SURVIVOR, INDIANA

Water Supplies

Public Systems

Most Americans rely on public systems for the water they use for drinking, cooking, irrigating crops (including feed crops) and ornamental plants, and watering livestock. As Table 4 shows, the U.S. population is served by more than 52,000 community water systems. The quality of drinking water is regulated by the Safe Drinking Water Act (SDWA) of 1974, but enforcement takes place at the state level.[180] The legislation authorizes EPA to establish standards (Maximum Contaminant Levels, or MCLs) to protect tap water and requires that owners and operators of public water systems comply with these standards. Regulated chemicals in drinking water include 53 organic chemicals (e.g., atrazine, benzene), 16 inorganic chemicals (e.g., arsenic, nitrate), 7 disinfection by-products (e.g., trihalomethanes), 6 microorganisms (e.g., *cryptosporidium*), and 4 radionuclides (e.g., alpha particles from radon, radium).

Table 4

Community Water Systems in the United States

SYSTEM SIZE	NUMBER OF SYSTEMS	PERCENT OF SYSTEMS	POPULATION SERVED (IN MILLIONS)	PERCENT OF POPULATION
Very Large (>100,000)	398	1%	129	45%
Large (10,001–100,000)	3,702	7%	105	37%
Medium (3,301–10,000)	4,822	9%	29	10%
Small (501–3,300)	13,906	27%	20	7%
Very Small (<500)	29,282	56%	5	2%
Totals	**52,110**	**100%**	**286**	**100%**

Source: U.S. Environmental Protection Agency. Factoids: drinking water and groundwater statistics for 2007. EPA Office of Water. EPA 816-K-07-004; 2007.

However, an analysis[265] of more than two million drinking water test results acquired from 42 state water offices found 260 contaminants in tap water. Of these, 141 contaminants have no safety standards. Forty (40) of the unregulated contaminants were detected in tap water consumed by at least one million people.

EPA typically sets a level that they would call safe, which is as close to zero risk as they can get, and then they say, well, we can't do that because that costs money, so let's come up with another number that allows a certain amount of risk as a trade-off for cleaning up the water… I think our public policies need to be revisited because we're trading disease for costs probably unnecessarily.

RICHARD WILES
ENVIRONMENTAL WORKING GROUP

Private Wells

It should be noted that the population distribution shown in Table 4 does not account for the 10–15 percent of the U.S. population that uses wells or other private water supplies. Water from wells is not subject to SDWA standards, but usually is regulated by state programs. In 2009, the U.S. Geologic Survey (USGS) released a report on the quality of water from about 2,100 domestic wells throughout the United States;[46] samples were collected between 1991 and 2004. The analysis found that 23 percent of sampled domestic wells contained one or more contaminants at a concentration greater than EPA MCLs for public water supplies, or USGS Health-Based Screening Levels. Contaminants most often above benchmark levels were inorganic chemicals, with all but nitrate primarily from natural sources. Higher nitrate concentrations were more common in areas with intense agricultural land use, due primarily to fertilizers, livestock, and septic systems. Man-made organic compounds were detected in 60 percent of sampled wells, but concentrations seldom were above EPA MCLs. Contaminants usually co-occurred with other contaminants as mixtures, with the most common mixture consisting of nitrate, arsenic, radon, and uranium.

Bottled Water

Many bottled water users assume that it is cleaner than tap water. Bottled water is regulated by the FDA, and while standards for lead content are more stringent than Federal public water standards, other quality

standards are the same as Federal limits for public supplies. Bottlers, however, are not required to disclose either the content or the source of their water, as is the case for public supplies. Some bottled water is simply drawn from municipal supplies and receives no additional filtration or other treatment.

One study[266] has shown that the contaminant levels in bottled waters vary widely. Some of the 10 brands tested were found to be of no better quality, and in some cases were worse, than water available from municipal water systems. The testing found an average of eight contaminants in each brand. Half of the brands tested contained bacterial contamination. Two carcinogens were found in some of the samples at levels exceeding California and/or industry standards. Also detected were caffeine, the pharmaceutical acetaminophen, arsenic, radioactive isotopes, nitrates and ammonia from fertilizer residue, and industrial chemicals including solvents, degreasing agents, and propellants. Trace amounts of acetaldehyde, isobutane, and toluene also were found, but the investigators could not ascertain health effects at the low levels detected.

In addition to the contaminants indicated above, plastics such as BPA can leach from the bottle itself into the water it contains.

Wherever you chlorinate water, you have chlorination by-products... there is strong evidence that disinfection by-products are carcinogenic for bladder cancer.

KENNETH CANTOR
NATIONAL CANCER INSTITUTE

Water Disinfection By-Products (DBP)

Disinfection of public water supplies has dramatically reduced the incidence of waterborne illnesses and related mortality in the United States, with unquestionable public health benefit. However, chemical by-products are formed when disinfectants such as chlorine react with organic matter, and long-term exposure to these chemicals may increase cancer risk.

Hundreds of disinfection by-products have been identified; the most common of these are trihalomethanes (THMs, including chloroform, bromoform, and others) and haloacetic acid. Only a small percentage of identified DBPs have been tested for carcinogenicity. Some rodent studies have been positive for cancer, and some DBP components have shown mutagenic effects in *in vitro* testing, suggesting carcinogenicity.[267]

The Federal standard for disinfection by-products in public water supplies is 80 parts per billion of THM as an annual average.[268] THMs are measured because they generally reflect levels of other chemicals in DBP mixtures. If not controlled, DBPs in water systems can range up to several hundred parts per billion. In addition, a recent study[269] suggests that THM levels vary within a water system, with the highest levels found in water that stays in the system the

longest after disinfection. In this study, rectal (bromoform THM only) and bladder cancer risks were highest among those who consumed the greatest amount of water at points within the distribution system with the oldest post-disinfection tap water.

People are exposed to DBPs through consumption and through inhalation and absorption through the skin during bathing, showering, and swimming in chlorinated pools.[267] Relatively little research has been done on DBPs and cancer; the strongest data show increased bladder cancer risk with long-term (up to 40 years) exposure to DBPs, particularly among men.[270] In addition, several metabolic pathways and key genes have been identified that may increase bladder cancer risk among individuals with common variants in these genetic factors. Other very limited research suggests possible DBP associations with colon and rectal cancer, renal cell carcinoma, and glioma.[271,272] One speaker underscored the need for further research on DBPs and cancer, noting that exposure assessments should account for at least 35 years of exposure prior to a cancer diagnosis. DBPs represent a situation in which observed relative risks are modest, but because of the high numbers of people exposed, such risks may translate into potentially significant public health problems.

Metals such as beryllium, cadmium, and lead from industrial sources are found in U.S. water supplies, usually under 100 micrograms per liter (µg/L), but can increase or decrease due to water treatment. Little research has been conducted on possible cancer risks associated with these trace minerals in drinking water.

Landscaping Use of Agricultural Chemicals

Fertilizers, herbicides, and pesticides used for residential and other landscaping purposes (e.g., parks, golf courses), in some cases the same as those used on farms, represent a considerable component of water contamination because they seep into groundwater and run off into streams, rivers, and other drinking water supplies. About a quarter of the pesticides used annually in the U.S. are for landscaping purposes.[273]

Landscaping workers who apply these chemicals to lawns and other non-agricultural sites can sustain high levels of exposure, with cancer risks similar to those of farm workers. Homeowners can be exposed to fertilizers, herbicides, and insecticides when mowing residential lawns after chemicals have been recently applied and by handling and applying chemicals themselves. Children may be exposed when playing in areas where chemicals have been applied. In addition, individuals can be exposed to these chemicals by swimming in or eating seafood from contaminated bodies of water.

Electromagnetic Energy

Electromagnetic fields (EMF), also referred to as electromagnetic radiation (EMR), is the non-ionizing energy generated by the growing multitude of wired and wireless technologies that are so much a part of life in developed countries and, increasingly, worldwide. There are two types of EMF/EMR: radiofrequency radiation (RF) and extremely low frequency electromagnetic fields (ELF). RF is emitted by cellular and cordless telephones, cellular antennas and towers, radar, and broadcast transmission towers. ELF comes from electric power lines and from electrical and electronic appliances. Table 5 provides definitions and conversions for units of measure used to describe non-ionizing radiation.

Cellular Telephones and Other Wireless Devices

As Figure 6 illustrates, cellular (mobile) telephone use in the United States has grown rapidly since the mid-1980s, with especially large annual increases in