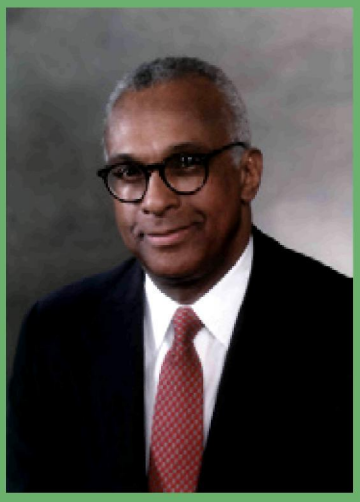
2008–2009 Annual Report President's Cancer Panel

REDUCING ENVIRONMENTAL CANCER RISK

What We Can Do Now

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES National Institutes of Health **National Cancer Institute**



The President's Cancer Panel

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This report is submitted to the President of the United States in fulfillment of the obligations of the President's Cancer Panel to appraise the National Cancer Program as established in accordance with the National Cancer Act of 1971 (P.L. 92-218), the Health Research Extension Act of 1987 (P.L. 99-158), the National Institutes of Health Revitalization Act of 1993 (P.L. 103-43), and Title V, Part A, Public Health Service Act (42 U.S.C. 281 *et seq.*).

April 2010
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What We Can Do Now

Suzanne H. Reuben
for
The President's Cancer Panel

April 2010

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health
National Cancer Institute

The President
The White House
Washington, DC 20500

Dear Mr. President:

Though overall cancer incidence and mortality have continued to decline in recent years, the disease continues to devastate the lives of far too many Americans. In 2009 alone, approximately 1.5 million American men, women, and children were diagnosed with cancer, and 562,000 died from the disease. With the growing body of evidence linking environmental exposures to cancer, the public is becoming increasingly aware of the unacceptable burden of cancer resulting from environmental and occupational exposures that could have been prevented through appropriate national action. The Administration's commitment to the cancer community and recent focus on critically needed reform of the Toxic Substances Control Act is praiseworthy. However, our Nation still has much work ahead to identify the many existing but unrecognized environmental carcinogens and eliminate those that are known from our workplaces, schools, and homes.

To jumpstart this national effort, the President's Cancer Panel (the Panel) dedicated its 2008–2009 activities to examining the impact of environmental factors on cancer risk. The Panel considered industrial, occupational, and agricultural exposures as well as exposures related to medical practice, military activities, modern lifestyles, and natural sources. In addition, key regulatory, political, industrial, and cultural barriers to understanding and reducing environmental and occupational carcinogenic exposures were identified. The attached report presents the Panel's recommendations to mitigate or eliminate these barriers.

The Panel was particularly concerned to find that the true burden of environmentally induced cancer has been grossly underestimated. With nearly 80,000 chemicals on the market in the United States, many of which are used by millions of Americans in their daily lives and are un- or understudied and largely unregulated, exposure to potential environmental carcinogens is widespread. One such ubiquitous chemical, bisphenol A (BPA), is still found in many consumer products and remains unregulated in the United States, despite the growing link between BPA and several diseases, including various cancers.

While BPA has received considerable media coverage, the public remains unaware of many common environmental carcinogens such as naturally occurring radon and manufacturing and combustion by-products such as formaldehyde and benzene. Most also are unaware that children are far more vulnerable to environmental toxins and radiation than adults. Efforts to inform the public of such harmful exposures and how to prevent them must be increased. All levels of government, from federal to local, must work to protect every American from needless disease through rigorous regulation of environmental pollutants.

Environmental exposures that increase the national cancer burden do not represent a new front in the ongoing war on cancer. However, the grievous harm from this group of carcinogens has not been addressed adequately by the National Cancer Program. The American people—even before they are born—are bombarded continually with myriad combinations of these dangerous exposures. The Panel urges you most strongly to use the power of your office to remove the carcinogens and other toxins from our food, water, and air that needlessly increase health care costs, cripple our Nation's productivity, and devastate American lives.

Sincerely,

LaSalle D. Leffall, Jr., M.D., F.A.C.S.
Chair

Margaret L. Kripke, Ph.D.

exposures compared with those using public water supplies. Nitrate levels also can be high in streams and rivers due to runoff of nitrogen fertilizer from agricultural fields. Almost all public water supplies, however, have nitrate levels below the EPA Maximum Contaminant Level (MCL) of 10 mg/L.

Ingesting contaminated drinking water is the primary route of human exposure to nitrate from nitrogen fertilizers.[239] Nitrates in drinking water are important because the most likely known mechanism for human cancer related to nitrate is the body's formation of N-nitroso compounds (NOC), which have been shown to cause tumors at multiple organ sites in every animal species tested, including neurological system cancers following transplacental exposure.[240] Nitrite, the reduced form of nitrate, reacts in the acidic stomach to form nitrosating agents that then react with certain compounds from protein or other sources such as medications to form NOCs. NOC formation is inhibited by dietary antioxidants found in vegetables and fruits, which may account in part for the observed protective effect of fruits and vegetables against many cancers.[239]

Agricultural policy in this country has also encouraged the extensive use of fertilizers and that has resulted in the problems that we've seen with contamination of water supplies, which in addition to the concerns about human ingestion of nitrates, has large ecologic effects related to eutrophication [overgrowth of plant life and loss of oxygen in water].

MARY WARD
NATIONAL CANCER INSTITUTE

In humans, nitrosamines and NOCs are suspected brain and CNS carcinogens. In addition, a cohort study of older women in Iowa[241] found that those whose drinking water had higher long-term average nitrate levels had an increased risk of bladder and ovarian cancers. Other studies have had mixed results or shown no association with nitrate intake. Small numbers of epidemiologic studies of any one cancer site have been conducted; such research is needed to identify other potential nitrate-related cancer risks.[239] Limited mechanistic studies suggest that nitrate at levels below the MCL could be carcinogenic.[242] Further research into this question is warranted, particularly because nitrate levels continue to rise in groundwater as use of nitrogen fertilizers increases. With greater production of corn for fuel, nitrate levels in drinking water are likely to continue their upward trend.

Some research indicates that crop rotation and/or the use of cover crops (i.e., grass or legumes planted on a field between production seasons) can reduce or negate the need for nitrogen fertilizers without sacrificing crop yields.[243,244] Legume cover crops can fix (capture) nitrogen, which preserves it for the next growing season and prevents nitrogen in the soil from leaching into groundwater.

CHAPTER 3

Environmental Exposures Related to Modern Lifestyles

Conveniences of modern life—automobile and airplane travel, dry cleaning, potable tap water, electricity, and cellular communications, to name a few—have made daily life easier for virtually all Americans. Many of these conveniences, however, have come at a considerable price to the environment. Some of the environmental effects of modern life are known or suspected of harming human health.

Air Pollution

In June 2009, the Environmental Protection Agency (EPA) released the results of its most recent National-Scale Air Toxics Assessment (NATA), which is conducted every 3 years to estimate concentrations of air pollutants across the country, population exposures, and the potential public health risk due to air toxics inhalation.[80] Using the most current available air emission inventory (2002) and census data, NATA characterized cancer and non-cancer effects from inhaling the 124 air toxics on which chronic exposure health data exist. Of the toxics assessed, 80 are carcinogens.

NATA estimated that the average increased cancer risk in 2002 due to inhalation of outdoor air toxics was 36 per million; that is, an additional 36 people per million (approximately 11,000 Americans based on current population estimates) could be expected to develop cancer as a result of breathing air toxics compared to those not exposed. The estimate assumes that individuals would be exposed at 2002 levels over the course of their lifetime.[251]

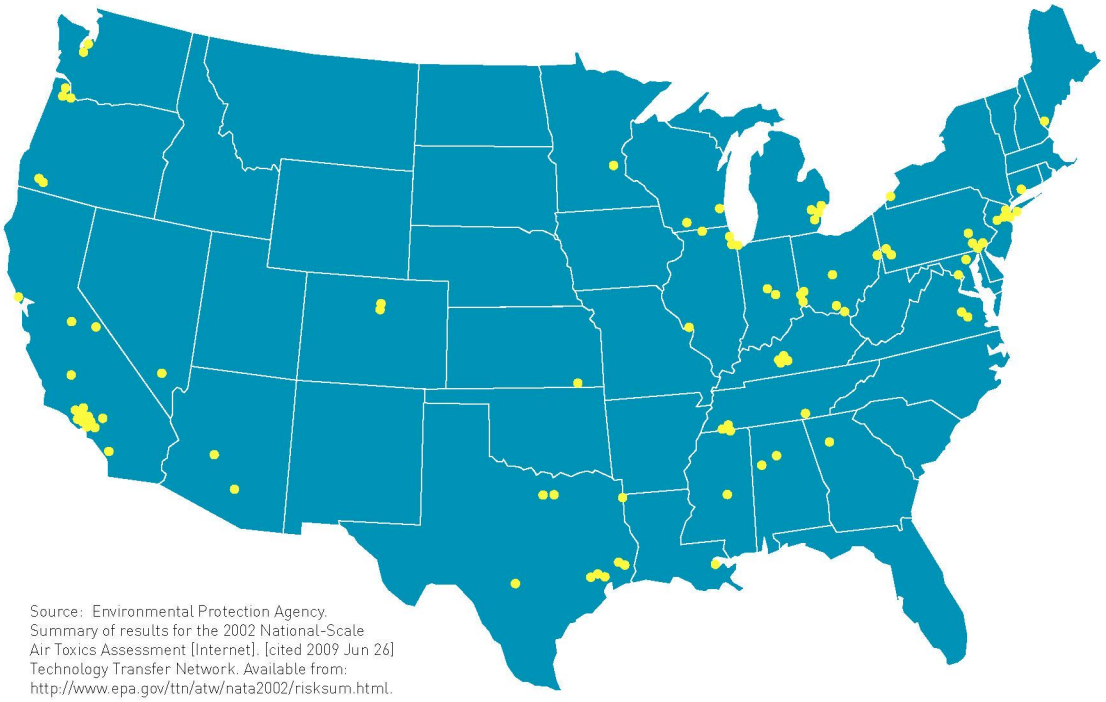
Figure 5 shows the distribution of the estimated 2 million Americans (<1 percent of the total U.S. population) with a cancer risk greater than 100 per million. Some of the areas shown are "hotspots" created by local industrial emissions. Examples of these emissions include tetrachloroethylene from dry cleaning operations and methylene chloride, a commonly used industrial solvent. NATA results indicate that local industry emissions account for about 25 percent of the average overall cancer risk due to air toxics.[251] EPA is preparing a NATA update using 2005 data that is expected to be released in late 2009 or early 2010.

Mobile Sources of Air Pollution

According to the 2002 NATA results, emissions from personal cars, power boats, off-road vehicles, and other on-road vehicles, excluding particulate matter from diesel exhaust, account for about 30 percent of the overall cancer risk from air pollutants. The majority of this risk is from benzene,

Figure 5

Census Tracts with 2002 NATA Estimated Cancer Risk Greater Than 100 Per Million



Source: Environmental Protection Agency. Summary of results for the 2002 National-Scale Air Toxics Assessment [Internet]. [cited 2009 Jun 26] Technology Transfer Network. Available from: http://www.epa.gov/ttn/atw/nata2002/risksum.html.

a known carcinogen. Smog, so common in many large urban areas, is composed of varied and changing mixtures of toxic gases (e.g., formaldehyde, benzene, sulfuric acid) and suspended particulates. Incomplete petroleum product combustion produces the particles most commonly found in smog.

U.S. regulation of air pollution is exceptionally fragmented and probably exceptionally costly for what it actually accomplishes.

WINIFRED HAMILTON
BAYLOR COLLEGE OF MEDICINE

Environmental Tobacco Smoke (ETS)

Tobacco smoke contains approximately 4,000 chemicals, including 69 known carcinogens.[252,253] Tobacco use (including the use of smokeless tobacco) is the number one cause of preventable death in the United States.[254] It is responsible for an estimated 87 percent of U.S. lung cancer deaths.[255] ETS, also referred to as secondhand smoke, passive smoking, and involuntary smoking, causes an estimated 3,400 annual lung cancer deaths among non-smokers in the U.S.[256] and evidence indicates that ETS exposure increases breast cancer risk.[257–259] In 2006, the U.S. Surgeon General stated that there is no safe level of exposure to environmental tobacco smoke.[260]

In 2006–2007, the President's Cancer Panel held hearings on tobacco use and cancer. The Panel's findings, conclusions, and related recommendations are contained in its August 2007 report.[261] Among other recommendations, the Panel strongly urged that the Food and Drug Administration (FDA) be empowered to regulate the contents, marketing, and sales of tobacco products. In June 2009, the Family Smoking Prevention and Tobacco Control Act[262] was signed into law.

Much progress has been made over the past decade in protecting workers from occupational exposure to tobacco smoke.

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

this decade. According to the Cellular Telecommunications and Internet Association, Americans spent a total of 2.2 trillion minutes on their mobile phones in 2008, up 100 billion minutes from the previous year.[274] Usage is expected to continue to rise, along with the use of other wireless devices and networks, as these become affordable for greater proportions of the population and more people give up their landlines in favor of wireless phones. Cell phone use also is becoming increasingly common among children, for many of whom electronic communications (e.g., text messaging, social networking, access to games and music) are considered a crucial link to friends and their overall social milieu. Similarly, many parents now provide cell phones to their children to help coordinate and facilitate family activities, and as a means of communication in the event of an emergency.

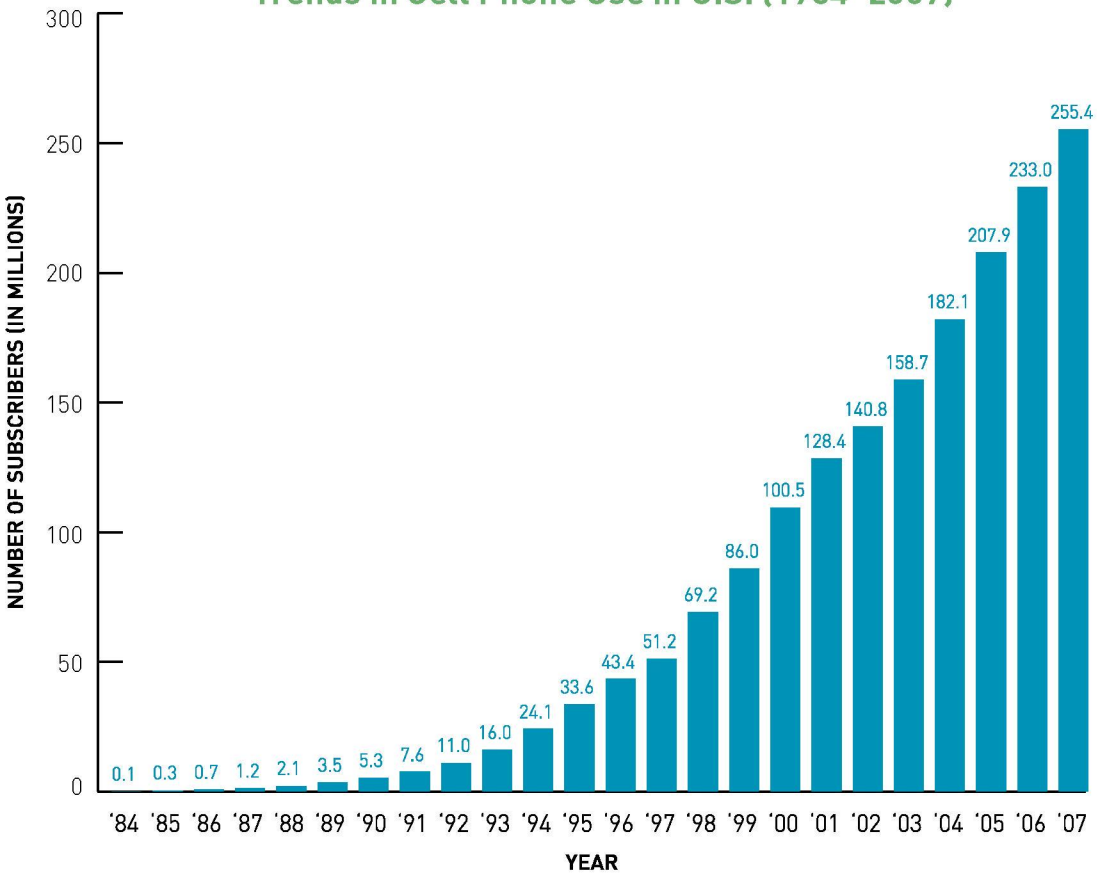
As the use of cell phones has increased, so has concern about their potential harmful health effects, particularly whether cell phone users are at greater risk for brain cancer. Cell phones and related devices become more sophisticated each year, and they are producing energy at increasingly higher radiofrequencies necessary for their expanded functions. The number of cell phone towers also is growing as cellular service providers strive to provide customers a maximally robust network. At the same time, patterns of cell phone use appear to be

...with over a million people using cell phones, even if the risk is of an increase in brain tumors that's relatively small, say 5 or 10 percent. Five or 10 percent of a million people is going to be a very, very large number.

MICHAEL LERNER
COMMONWEAL

Trends in Cell Phone Use in U.S. (1984–2007)

Figure 6



Source: Cellular Telecommunications and Internet Association [Internet]. [cited 2009 Jan 9] Available from: http://www.ctia.org.

What Individuals Can Do: Recommendations

Much remains to be learned about the effects of environmental exposures on cancer risk. Based on what is known, however, there is much that government and industry can do now to address environmental cancer risk. The Panel's recommendations in this regard are detailed above. At the same time, individuals can take important steps in their own lives to reduce their exposure to environmental elements that increase risk for cancer and other diseases. And collectively, individual small actions can drastically reduce the number and levels of environmental contaminants.

CHILDREN
1. It is vitally important to recognize that children are far more susceptible to damage from environmental carcinogens and endocrine-disrupting compounds than adults. To the extent possible, parents and child care providers should choose foods, house and garden products, play spaces, toys, medicines, and medical tests that will minimize children's exposure to toxics. Ideally, both mothers and fathers should avoid exposure to endocrine-disrupting chemicals and known or suspected carcinogens prior to a child's conception and throughout pregnancy and early life, when risk of damage is greatest.
CHEMICAL EXPOSURES
2. Individuals and families have many opportunities to reduce or eliminate chemical exposures. For example: • Family exposure to numerous occupational chemicals can be reduced by removing shoes before entering the home and washing work clothes separately from the other family laundry. • Filtering home tap or well water can decrease exposure to numerous known or suspected carcinogens and endocrine-disrupting chemicals. Unless the home water source is known to be contaminated, it is preferable to use filtered tap water instead of commercially bottled water. • Storing and carrying water in stainless steel, glass, or BPA- and phthalate-free containers will reduce exposure to endocrine-disrupting and other chemicals that may leach into water from plastics. This action also will decrease the need for plastic bottles, the manufacture of which produces toxic by-products, and reduce the need to dispose of and recycle plastic bottles. Similarly, microwaving food and beverages in ceramic or glass instead of plastic containers will reduce exposure to endocrine-disrupting chemicals that may leach into food when containers are heated.

- Exposure to pesticides can be decreased by choosing, to the extent possible, food grown without pesticides or chemical fertilizers and washing conventionally grown produce to remove residues. Similarly, exposure to antibiotics, growth hormones, and toxic run-off from livestock feed lots can be minimized by eating free-range meat raised without these medications if it is available. Avoiding or minimizing consumption of processed, charred, and well-done meats will reduce exposure to carcinogenic heterocyclic amines and polyaromatic hydrocarbons.
- Individuals can consult information sources such as the Household Products Database to help them make informed decisions about the products they buy and use.
- Properly disposing of pharmaceuticals, household chemicals, paints, and other materials will minimize drinking water and soil contamination. Individuals also can choose products made with non-toxic substances or environmentally safe chemicals. Similarly, reducing or ceasing landscaping pesticide and fertilizer use will help keep these chemicals from contaminating drinking water supplies.
- Turning off lights and electrical devices when not in use reduces exposure to petroleum combustion by-products because doing so reduces the need for electricity, much of which is generated using fossil fuels. Driving a fuel-efficient car, biking or walking when possible, or using public transportation also cuts the amount of toxic auto exhaust in the air.
- Individuals can reduce or eliminate exposure to secondhand tobacco smoke in the home, auto, and public places. Most counseling and medications to help smokers quit are covered by health insurance or available at little or no cost.

RADIATION

3. Adults and children can reduce their exposure to electromagnetic energy by wearing a headset when using a cell phone, texting instead of calling, and keeping calls brief.

4. It is advisable to periodically check home radon levels. Home buyers should conduct a radon test in any home they are considering purchasing.

5. To reduce exposure to radiation from medical sources, patients should discuss with their health care providers the need for medical tests or procedures that involve radiation exposure. Key considerations include personal history of radiation exposure, the expected benefit of the test, and alternative ways of obtaining the same information. In addition, to help limit cumulative medical radiation exposure, individuals can create a record of all imaging or nuclear medicine tests received and, if known, the estimated radiation dose for each test.

6. Adults and children can avoid overexposure to ultraviolet light by wearing protective clothing and sunscreens when outdoors and avoiding exposure when the sunlight is most intense.

SELF-ADVOCACY

7. Each person can become an active voice in his or her community. To a greater extent than many realize, individuals have the power to affect public policy by letting policymakers know that they strongly support environmental cancer research and measures that will reduce or remove from the environment toxics that are known or suspected carcinogens or endocrine-disrupting chemicals. Individuals also can influence industry by selecting non-toxic products and, where these do not exist, communicating with manufacturers and trade organizations about their desire for safer products.