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## **Introduction**

It's every parent's nightmare - a worry that crops up whenever a child looks pale, feels overtired, gets headaches or seems to bruise too easily: Could it be cancer? If it is cancer, what caused it? Was it something in the water? Did it come from the power lines overhead? Was it a genetic mutation that the parent had a hand in creating? The bottom line is: *No one knows what causes most childhood cancer - and no definitive answers are expected in the very near future.*

- Cancer is the second-biggest killer of children in the United States (after accidents) - *and no one knows why.*
- The incidence of childhood cancer in this country is increasing at approximately one percent per year - *and no one knows why.*

Scientists have unlocked the key to how cancer develops, but they still haven't found out why cancer does - or does not - develop in any given child. Is the cause genetics, the

environment - or both? For the most part, no one knows. The answer, when it does come, may be in the form of a “mixed bag.” That's because childhood cancer is not just one disease; the term covers a wide range of unique maladies that may have very different origins and stages of development.

*There are no scientific studies that definitively link environmental hazards to childhood cancer* - with the exception of studies relating prenatal x-ray exposure to leukemia. Yet the public remains concerned about the causes of childhood cancer, and with good reason.

Scientists say there are no working theories to explain the increase of childhood cancer. Some experts surmise that childhood cancer could be part of a mix of maladies that will someday be linked to the “toxic legacy” left behind by the industrial revolution. Environmental hazards have been linked to other childhood disorders, such as asthma, lead poisoning, neurological maladies, and problems with reproductive development - but never directly to childhood cancer.

Where does this scientific uncertainty and public concern leave a journalist, especially when a possible “childhood cancer scare” involves an entire community? It's impossible to prove a negative: We can never know for sure that a certain substance *won't ever* cause cancer. So in a way, everything is suspect. At the same time, there's got to be a way to sort through the hysteria to provide useful information to help your audience understand the issues at hand. That is what this guide is about.

### **Remember the “scares”**

Remember the pre-Thanksgiving “toxic cranberry” panic of 1959? Or the 1969 ban of the artificial sweetener cyclamate? How about the frenzy in 1989 over the use of the growth regulator alar on apples? In each of these cases, the substance in question was ultimately found to be of little or no danger to humans. The press rode the stories to the hilt of panic, yet little was

said when the truth was discovered. Apple growers are still reeling from the furor over alar. (The chemical was used on less than 15% of this country's crop and was voluntarily removed from the market; alar is still being sold internationally.)

It would be easy to be swept away by a story involving childhood cancer. The issues involving the health of children are highly emotional; they deserve and demand our attention. Yet every journalist has to be honest about his or her motives while covering the story. What's more important: informing the public of true risks (and being honest about the parts of the story that are as yet unknown), or riding what may be an irrational scare to higher ratings or profits? The adrenaline “high” that comes from breaking a major story could end up hurting a lot of people - it could also fuel the public mistrust that is growing against mainstream media.

One can be wary in approaching a story without being too cautious in not covering it at all. Journalists have a responsibility not to back off from a story simply because it's complex. Being prudent involves being thorough - willing to spend extra time to make sure you understand the nuances of a story as complex as childhood cancer. Responsible coverage will probably require you to go beyond the principles initially involved in the story to make sure you have all the bases covered.

### **How to use this guide**

The goal of this guide is to provide reporters with a basic “grounding” as you begin to cover stories involving childhood cancer. Here's what you will find in this guide:

- Baseline statistics
- Information about the current state of scientific inquiry
- A rundown of potential environmental hazards

- Information about current initiatives to protect children from environmental harm and to encourage efforts to find the causes of childhood cancer
- A resource section containing contacts, information sources, and suggested readings
- Story ideas
- A glossary of terms

The most valuable part of this guide may be its resource section. This is where you'll find people to talk to, web sites to check out, and suggested reading materials that could further your understanding of childhood cancer. This resource section is designed to help you take the extra steps that will move your story beyond expediency to something you can be personally proud of.

A final word about story sources - it's important that journalists be acutely aware of the biases and agendas that are brought to bear in stories as sensitive as those involving childhood cancer. Professional jealousies abound in the scientific community, interest groups have been known to “stretch” the truth to make a message stronger, industrial spokespeople are under pressure to guard their companies' interests, and parents touched by the horrors of childhood cancer can be understandably strident in their desire to find a culprit for their child's illness.

Childhood cancer is a complex situation and is likely to remain so for the foreseeable future. The journalist's job is not to clean up the mess, but to present it in a way that helps individuals and society to respond to it.

## **Section I: Facts About Childhood Cancer**

**Why cover childhood cancer?**

Cancer is the second-biggest killer of children in the United States, after accidents. More than 8,000 children under the age of fifteen are diagnosed with cancer annually in this country - that's one of every 630 children. In the U.S. the incidence of two types of childhood cancer has risen significantly over the past fifteen years. Acute lymphocytic leukemia (ALL) is up 10%, and brain tumors are up more than 30%. Scientists have no working theories to explain the increase.

The “good news” of childhood cancer lies in the development of effective new treatments and cures for the disease. The five-year survival rate for all childhood cancers now stands at 71%. That's up substantially from the 51% survival rate reported in 1973. Even though treatments are still invasive and wrenching for families, new therapies are being developed that tend to be gentler than in the past.

Compared to cancer rates among adults, childhood cancer is considered to be “rare.” Cancer deaths among children represent less than 1% of all cancer deaths. Statistically, the 8,000 cases of childhood cancer reported each year pale in comparison to numbers associated with adult cancers:

- 160,000 people die from lung cancer each year
- 185,000 cases of breast cancer are reported annually in this country

Yet, children suffering from cancer have more to lose in terms of potential years of life in comparison to adult cancer victims. The median age when adults get cancer is 67; whereas the median age for children is 6.

### **Society's response to childhood cancer**

Childhood cancer “bothers” us as a society more than adult cancer does. Children are not supposed to die. Our collective images of a carefree childhood are upset when we see

youngsters going through the trauma of chemotherapy and bone marrow transplants - something seems terribly wrong and somehow we feel responsible, even if the child is not ours. It's no accident that 20% of the cancer research budget goes toward childhood cancer.

Adding to our discomfort is the fact that the causes of most childhood cancer are unknown. It's fairly well established that many adult cancers result from lifestyle factors that involve *choice*, such as smoking, diet, occupation, and willful exposure to carcinogens. Children are unable to exercise that same degree of choice. For the most part, they live where we tell them to live, eat what we feed them, and inherit a luck-of-the-draw genetic mix from their parents.

We look to our own habits and to our immediate environment for possible answers to the problem of childhood cancer. Is there something we're doing that's responsible for what's happening to our kids? Is there something in the air they're breathing, the food they're eating, the water they're drinking, or the ground they crawl on that could be causing the disease?

### **Just what *is* cancer?**

A fully developed cancer involves many billions of cells. Medical scientists now believe that each case of cancer arises from a single cell that has gone awry, having lost its ability to stop growing and dividing. The creation of a cancerous cell is usually a slow process that occurs over many years, if not decades. The first step in the development of a cancer cell involves an initial change or mutation in the genetic material or DNA of the cell. Many factors can cause this initial mutation. Physical agents, such as radiation and chemical toxins, may be involved. The mutation may appear spontaneously, perhaps because of a genetic predisposition. Some people may be more sensitive than others to carcinogens in the environment. This initial mutation is essential in the formation of cancer, but it is not sufficient to cause the disease.

A series of further mutations make the cell and its descendants increasingly unstable. At some point, the initial mutation activates a type of gene called an oncogene. Activation of the oncogene results in an increased production of factors that cause the cell(s) to grow at a rapid rate. This accelerated growth increases the likelihood of a second mutation which frequently deactivates a tumor suppressor gene, which normally would slow the growth of cancerous cells. The effect of an activated oncogene and a deactivation of a tumor suppressor gene has been likened to that of a car running downhill with no brakes and a brick on top of its accelerator: The cancer cells start growing out of control.

At this point, the cells become highly susceptible to further changes in their genetic material. Chromosomal breaks may occur which render the cell more independent and unable to respond to messages it receives from the cells around it. When a cell becomes totally independent and capable of multiplying chaotically it becomes a true cancer - a malignancy.

A true cancer can develop the ability to metastasize (migrate) from the initial site of the cancer to other areas of the body, where it may cause secondary cancers. Cancers of the intestine often metastasize to the liver. Lung cancer may metastasize to the brain. Metastatic cancer usually responds poorly to treatment.

Molecular biologists have been very successful in recent years in unlocking the processes involved in the development of cancer. Scientific understanding of the evolution of cancer has grown to where it seems possible that one day it will be possible to identify human cancer before it has become malignant. Early identification could lead to treatments that would stop the cancer in its tracks.

### **Principal forms of childhood cancer**

The term “childhood cancer” is a catch-all phrase, designed to cover a myriad of diseases that likely have different origins and development. That's why it's unlikely there will ever be one single cure for all childhood cancers.

That said, there are some significant differences between cancer in children and adults. Adult cancers primarily involve those of the skin, lung, colon, breast, prostate, and pancreas. Childhood cancers are mostly those of the white blood cells, brain, bone, the lymphatic system, and tumors of the muscles, kidneys, and nervous system. Each of these cancers behaves differently, but all are characterized by an uncontrollable growth of abnormal cells.

Children often have a more advanced stage of cancer when they are first diagnosed. Only about 20% of adults with cancer show evidence that the disease has spread to other parts of the body when the disease is first diagnosed, yet 80% of children have cancer that has metastasized by the time of diagnosis.

Leukemias - 39% of childhood cancers: Leukemia is a cancer of the tissues of the body which make the blood cells. When leukemia strikes, the bone marrow makes an abundance of abnormal white cells that do not perform their proper functions. These abnormal cells invade the marrow and crowd out the normal cells, making the child susceptible to infection and bruising.

Significant geographical variations in childhood leukemia rates exist. The highest rates in the world are in Costa Rica; the lowest are in Kuwait. The highest rates in the U.S. are among Hispanic males in southern California, and some of the lowest rates are found among African Americans. According to the National Cancer Institute's Surveillance, Epidemiology, and End Results Program (SEER), the rate for reported cases of acute lymphoblastic leukemia rose from 2.7 per 100,000 children in 1973-1974 to a peak of 3.8 in 1989, followed by a steady decline to 2.9 in 1993-1994.

Brain Tumors - 15% of childhood cancers: Tumors of the brain and spinal cord are the most common types of solid tumors in children. There has been less dramatic progress in treating these tumors than with most other childhood malignancies because they are hard to diagnose and treat. Twenty percent of all primary brain tumors occur in children under age 15, somewhat more often in boys than girls. There is a peak in incidence between the ages of 5 and 10. The SEER program shows the annual incidence rate for reported brain tumors in children up to age 14 rising from 2.4 per 100,000 children in 1973-1974 to 3.3 in 1993-1994.

Lymphomas - 10% of childhood cancers: Lymphoma arises in the lymph system. There are two broad varieties, one called Hodgkin's disease and another called non-Hodgkin's lymphoma. Non-Hodgkin's lymphoma is more common in children than Hodgkin's disease. It can arise in the tonsils, thymus, bone, small intestine, spleen, or in lymph glands anywhere in the body. The disease can progress to the central nervous system and to the bone marrow. Treatments have been developed that can cure many children. Other promising treatments are being developed.

Neuroblastoma - 7% of childhood cancers: This is a highly malignant tumor that arises in the adrenal glands of very young children. Neuroblastoma spreads quickly along the sympathetic nerve chain in the chest and abdomen and is often not discovered until the disease is widespread. Early stages are curable by surgery alone. New sophisticated treatments for advanced stages are increasingly effective.

Bone Cancers - 6% of childhood cancers: The bones may be the site to which other cancers spread but some types originate in the skeleton. Osteogenic sarcoma is the most common form of bone cancer. It most frequently occurs around the knee. Wherever it appears, the cancer grows into surrounding muscles and tendons. Ewing's sarcoma is another type of bone cancer, which grows in the bone marrow.

## **Difficulties in studying childhood cancer**

Conducting research on childhood cancer is difficult for three main reasons:

- Childhood cancer is relatively rare.
- The potential risk factors are many and vary.
- Environmental exposures among children are particularly difficult to measure and validate, as is the link between exposure and occurrence of disease.

The research challenge presented by the rarity of childhood cancer has been addressed to a degree by using large, multicenter, cooperative clinical trial groups through the National Cancer Institute. The two largest groups are the Children's Cancer Group (CCG), and the Pediatric Oncology Group (POG).

## **Understanding the studies**

Epidemiology is the medical science that involves the study of the incidence and distribution of diseases in large populations. The different types of studies involved in researching childhood cancer include:

*Descriptive epidemiology:* the study of how a disease occurs in a population, often by examining unusual patterns of disease such as seasonal variations, geographic differences, or gender differences. This type of study can provide hypotheses regarding the underlying cause of a disease.

*Ecologic studies:* an examination of disease incidence based on data that do *not* contain information on which individuals in the data have been exposed to a certain environmental factor, (for example, an examination of the incidence of childhood cancer in counties with and

without chemical dump sites). This approach is limited because it does not include important information: Who was exposed to the toxic element, and what was their level of exposure?

*Cohort studies:* an examination of data in which the exposure status of subjects is known. In this type of study, often two groups of individuals are followed over time - those who have been exposed to an environmental factor, and those who have not - to see whether they develop a disease. Cohort studies can be limited due to difficulties in determining exposure status, and in finding enough cases of a rare disease or outcome. Occupationally-exposed people are often studied in this manner because their exposure level can be determined more easily.

*Case-control studies:* an examination of “cases” who have a disease or health condition contrasted with “controls” who do not have the disease. Usually cases and controls are matched in terms of age, gender and race. Retrospective data are collected on a variety of exposures that may have occurred prior to the onset of the disease. Case-control studies work best for the study of uncommon diseases, including childhood cancer, because they are relatively inexpensive - lengthy follow-up is not needed, and the study allows for the evaluation of many possible causes of a disease. Case-control studies do not work well in the examination of uncommon exposures. This type of study is also limited because controls may not be accurately comparable to cases, and because cases and controls may recall their exposures differently.

*Cluster analysis:* the study of the number of cases which occur:

- (1) between the first and last diagnosis within a certain time period, and
- (2) within a certain geographic area, measured by the distance between the two cases living the farthest apart.

The occurrence of a group of cases of a disease close together in time and place at the time of their diagnosis is called a “cluster.” For understandable reasons, the possibility of a “cluster” of

childhood cancer cases is highly alarming and often gets a lot of attention in the press. It is important to note: *Almost all cluster studies have failed to yield new knowledge about environmental causes of childhood cancer.*

### **The controversy over cluster studies**

Hollywood is in the midst of producing a potential “blockbuster” movie based on a real-life lawsuit involving a suspected childhood cancer cluster in a New England community. A *Civil Action*, due to be released late in 1998, is expected to generate a lot of discussion and debate over the possible causes of childhood cancer. Reporters need to be ready for it.

There is general agreement in the scientific community that studies involving possible childhood cancer clusters are unlikely to lead to any “breakthroughs” in efforts to unlock the causes of childhood clusters. That's because “real” clusters may not even exist.

Dr. Seymour Grufferman, of the University of Pittsburgh School of Medicine, Department of Family Medicine and Clinical Epidemiology, likens cluster analysis to the “Texas Sharpshooter Effect,” whereby in a random distribution of cancer cases in a geographic area, some cases will appear to occur very close together - but only by chance, rather than the result of a particular cause. The “sharpshooter” analogy is based on shooting bullet holes into the side of a barn and then painting targets over the holes so that the holes appear to be at the center of the bull's eye, whereas in fact their location is random, and not the “result” of a target.

Dr. Martyn Smith, Professor of Toxicology at the School of Public Health at the University of California at Berkeley, says studying childhood cancer clusters is “fruitless and a waste of time.” Dr. Phillip Landigran, Chair of the Department of Community Health and Preventive Medicine at the Mt. Sinai Medical Center and author of *Raising Children Toxic Free*, agrees that the studies have been less than illuminating, but says, “It's important to keep looking

at possible cancer clusters; it's an issue of public trust and public health. People are going to be worried, and we need to respect that.”

### **Calls for a nationwide study of childhood cancer**

The establishment of a large nationwide database containing information gathered from each case of childhood cancer may be the key to unlocking the mystery of childhood cancer. Professor Smith says this is the only way scientists will be able to determine the causes of childhood cancer. “Relatively small epidemiological studies won't do it,” he predicts. “We need biologic samples from all cases in order to discover the events that lead to the different forms of childhood cancer.”

Efforts are under way to establish a “North American Childhood Cancer Registry” that would gather data for each case of childhood cancer in a consistent, detailed way. Dr. Robert Amler, Medical Director for the Agency for Toxic Substances and Disease Registry (ATSDR) says forming a registry will be a “daunting” task, both in terms of financing and deciding which specific information should go into it. His agency is scheduling a number of workshops in 1999 to explore the effort. “Having a larger database would put us in the best position to study childhood cancer,” says Amler. “Cluster analysis is not adequate; plotting cases as dots on a map is not the best measure. Families move around; we don't know who's drinking bottled water; we don't know about their lifestyles.”

Scientists credit national cooperative efforts for the great strides made in the treatment of childhood cancer; Dr. Smith says it's logical to assume that the causes of childhood cancer will be determined in the same way. Dr. Landigran says the establishment of a childhood cancer registry could lead to the development of personal environmental risk profiles for childhood cancers, similar to risk profiles now existing for heart disease and diabetes.

## **The challenge to journalists**

It's obvious that childhood cancer is a complex subject - there are disagreements in the scientific community and differing agendas at play in the environmental and political arenas. Add in the emotional effects that come with any story involving children's health and you've got a minefield of issues to walk through before any story makes the air. Your viewers (and your bosses) may want hard and fast answers to questions that are still under investigation. In the short run, you may have to disappoint them - by providing coverage that includes the apparent ambiguities involved in the study of childhood cancer. The reporters job is to help the audience understand the issues, the disagreements and the "loose ends" of the story. There's a compelling mystery unfolding in the study of childhood cancer. That's also part of the story.

## **Section II: What Causes Childhood Cancer: Genetics, the Environment, or Both?**

*No one knows what causes childhood cancer.* Only one environmental risk factor has been scientifically established for childhood cancer - prenatal exposure to x-rays is known to cause leukemia. Only two forms of very rare childhood cancer have been found to stem strictly from hereditary factors - Wilms tumor (a cancer of the kidneys) and retinal blastoma (a cancer of the eyes).

In its struggle to determine the causes of childhood cancer, the scientific community has divided itself into two basic camps: those who look to genetics as the primary cause of the disease, and those who look at environmental factors. The arguments are far from over, although there are some signs that the two camps are starting to consider a third option - the combination of genetics and the environment.

## **The current state of science**

At this point, scientists fundamentally understand how a cancer develops and grows after an initial mutation occurs within a potentially cancerous cell. What they don't understand is what triggers the initial mutation. Finding the answer to this question is the challenge faced in laboratories today.

Cancer is a *genetic* disease, meaning it starts with an initial mutation within the *genes* of a individual cell. One can inherit genes that increase the likelihood of developing a particular form of cancer (for example, breast or colon cancer). In these cases cancer is the primary feature of the inherited syndrome. One can also inherit genes that influence *how* the body reacts to certain events within its cells. In these cases cancer is considered a secondary effect of the inherited genes.

The situation gets more complicated. There is a popular misconception that all genetic diseases are by nature inherited diseases. This is not always the case. In many instances the initial mutation within a cell is caused by an *acquired* genetic alteration, not an inherited one. Many acquired genetic alterations in adult cancers have been linked to environmental agents, such as ultraviolet radiation, cigarette smoke, and industrial toxins. The interplay between inherited genetic tendencies (both primary and secondary) and acquired genetic alterations appears to have a lot to do with who does or does not develop cancer.

Every person has genes called “tumor suppressors” that inhibit uncontrolled growth in cells. Scientists believe that those of us who have inherited “good” tumor suppressor genes can hold in check cell mutations that might otherwise result in cancer. “Good” tumor suppressor genes can override inherited tendencies to develop a specific form of cancer, which explains why some people who inherit genes for a particular type of cancer (for example, breast cancer) never develop it. “Good” tumor suppressor genes can also override mutations caused by

environmental agents. Concurrently, those who inherit “weak” tumor suppressor genes would be more likely to develop cancer, whether it's from inherited or acquired genetic mutations.

Genes are inexhaustible workers. In addition to regulating cellular growth and development and DNA replication and repair, genes also determine how cells metabolize substances introduced into the body from the environment. According to Dr. Brad Pollack, lead epidemiologist for the Pediatric Oncology Group at the University of Florida, there are a number of studies under way looking at a class of enzymes that detoxify substances within the body. They're called “housekeeping” enzymes, and they are associated with inheritable genes. One current supposition is that people who have inherited genes for “good housekeeping” enzymes are less likely to develop environmentally-caused cancer because their bodies are able to metabolize the toxins before any harm is done. Concurrently, those who have “bad housekeeping” enzymes would be more susceptible to developing cancer as a secondary effect of their inherited makeup.

“Most people in the field don't think it's environmental,” says Pollack, speaking of the possible cause of childhood cancer. “Most people think the role of genetic predisposition will be the key factor in childhood cancer.”

Dr. Kevin Shannon, Department of Pediatrics, University of California, San Francisco agrees. “I believe that we have only seen the tip of the iceberg with respect to the influence of genetic predisposition on the development of childhood cancer.” Dr. Shannon believes inherited tendencies for inactive tumor suppressor genes will account for most inherited cancer predispositions that will be discovered in the future. “Interactions between different genes and environmental factors will likely be important in determining which patients with inherited

genetic susceptibilities will actually develop cancer, along with what type of cancer they develop, and their age when the disease develops.”

Taking a slightly different tack, Leslie Robison, Ph.D., the principal investigator of the Childhood Cancer Group, thinks the interaction of genetics and environmental factors will be the key element in unlocking the causes of childhood cancer. “If that's the case, we may never be able to identify the cause of childhood cancer,” says Robinson. “We may be forced to come to that conclusion that's it's not a disease like lung cancer, which is so directly linked to smoking. There could be an infinite number of events, both genetic and environmental, which play a factor in the disease.”

### **Children's vulnerability to environmental hazards**

It makes no sense to ignore potential environmental hazards to children, even though no direct links have been made between environmental toxins and childhood cancer. If one needs a strong reason to take sensible precautions, it is only necessary to look to studies that have definitively linked environmental toxins to childhood diseases of lead poisoning and asthma, and to current studies that suggest environmental toxins may play a part in childhood neurological disorders and in problems with reproductive development.

Children are highly vulnerable to environmental toxins. A detailed analysis by the National Research Council based this finding on the following factors:

1. Children have greater exposures to environmental toxins than adults. Pound for pound of body weight, children drink more water, eat more food, and breathe more air than adults. For example, in the first six months of life a child consumes seven times as much water per pound as does the average American adult. In addition, children have unique food preferences. For example, the average one-year-old drinks 21 times more apple juice and 11

times more grape juice and eats two to seven times more grapes, bananas, pears, carrots and broccoli than the average adult. Two behavioral characteristics of children further magnify their exposures to toxins in the environment: their hand-to-mouth activity, which increases their exposure to toxins in dust or soil; and their play close to the ground.

2. Children's metabolic pathways, especially in the first months after birth, are immature compared with those of adults. A child's ability to metabolize, detoxify, and excrete many toxins is different from that of an adult. In some instances, children are actually better able than adults to deal with environmental hazards. More commonly, however, they are less able to deal with toxic chemicals and thus are more vulnerable to them.
3. Children grow and develop very rapidly; their delicate developmental processes are easily disrupted. Many organ systems in young children, especially the nervous system, the lungs, the immune system and the reproductive organs, undergo extensive growth and development throughout pregnancy and in the first months and years of life. These systems are not well adapted to repair any damage that may be caused by environmental toxins.
4. Because children have more future years of life than most adults, they have more time to develop chronic diseases that may be triggered by early exposures. Many diseases that are triggered by toxins in the environment take decades to develop. Examples include pleural mesothelioma (cancer of the lining of the lung) caused by exposure to asbestos, leukemia caused by benzene, and breast cancer that may be caused by intrauterine exposure to the pesticide DDT. Toxic exposures sustained early in life appear more likely to lead to disease than similar exposures encountered later.

**When does childhood cancer begin?**

If cancer formation is a multi-step process, when does a child's cancer begin? Prior to conception in the sex cells of the parents? During gestation? In the early days of infancy? This is a question that makes the study of childhood cancer even more complex, as scientists are forced to unravel the minute details of human development in light of the effects of genetic mutations and possible environmental hazards. It's a daunting task that has revealed few answers.

According to Dr. Robison, there's a group of researchers in England studying blood samples obtained from infant heel sticks. Dr. Robison says these researchers are discovering that the mutation present in childhood leukemia was also present in the affected children at birth. In this one case, he says it's obvious that the so-called "damage" occurred in the uterus. But no one knows why the initial mutation occurred, and it's clear that not everyone with a similar mutation would get leukemia. Researchers have begun to follow the thread back even earlier, and are beginning to question possible connections between genetic damage prior to conception and childhood cancer. At present, the question is very much an open one, and Dr. Robison says data in this area are very weak. Genetic damage to the sex cells of parents has been shown in some animal studies, but has not been concretely observed in studies involving humans.

### **Section III: What We Don't Know May Be Harming Our Kids**

#### **The difficulties in pinning down environmental risk factors**

*With the exception of prenatal exposure to x-rays, no environmental factors have been scientifically proven to cause childhood cancer.* It may be years before the scientific community is fully able to unravel the mystery of why cancer develops in children. In the meantime, society

is faced with the possibility that toxins present in the air we breathe, the food we eat, the water we drink, and the ground we walk on play a role in the development of childhood malignancies.

Stories involving potential dangers to the health of children are highly emotional. No one is “against” protecting the welfare of kids. Yet there are enormous arguments in the scientific, political, and regulatory communities about what may or may not pose a threat to the health of our children. There are disagreements about what should be done and who should take responsibility for the problems. Journalists need to be aware that an examination of the potential risk factors for childhood cancer involves taking a walk through a minefield of conflicting scientific studies, political agendas, and regulatory nightmares.

Here are some of the factors that complicate this examination:

- Compared with other diseases, childhood cancer is relatively rare. Epidemiologists don't have many cases to “work backwards” from to determine what might have caused the malignancy. It's also difficult to determine children's level of exposure to environmental toxins.

- Potential environmental hazards have to be measured in terms of risks vs. benefits.

Pesticides may be a contributing factor to childhood cancer, yet the use of pesticides ensures a plentiful and inexpensive availability of fresh fruits and vegetables. Fresh fruits and vegetables are known to provide powerful protection against cancer. Where does the potential risk outweigh the obvious benefit?

- Advancements in analytical science are making the concept of “pure” practically untenable. Chemicals (both natural and synthetic) are in everything we eat, drink and breathe. Scientists are now able to detect minute particles of chemical substances in our food, water and air - for example, a teaspoon of salt in a million gallons of water. Almost everything contains

something that could pose a risk to children's health. Efforts to determine and control actual risk factors are expected to involve scientific and regulatory slugs for some time to come.

- Most of the studies that examine potential carcinogens involve rodent studies, which are highly controversial in the scientific community and may be particularly inappropriate for studies of childhood cancer. Dr. Bruce Ames, Professor of Biochemistry and Molecular Biology at the University of California in Berkeley, explains that in standard cancer tests, rodents are given chronic, near-toxic doses of selected chemicals. He says rodent cancers may develop because of the sheer volume of the introduced chemicals (as opposed to the chemical itself). Massive doses of chemicals may overwhelm the animal's ability to repair damage done to its cells, and spur the onset of cancer. Dr. Martyn Smith, Professor of Toxicology at the School of Public Health at the University of California in Berkeley, says there are no good animal models for the study of childhood cancer. Dr. Smith says six-week-old rodents are the equivalent of a 15-year-old human; the development of rodent offspring is very different from that of humans.

### **The risk assessment process**

The Environmental Protection Agency (EPA) estimates the severity of environmental risks that could influence human populations. Risk assessments are important because they provide a systematic, consistent way of estimating risk. Risk assessment is a complex, analytical process involving expertise in various disciplines, such as chemistry, biology, ecology, statistics, and medicine. Typically, a human-health risk assessment entails a four-stage process:

1. Hazard Identification: Determines whether exposure to a substance can cause cancer, birth defects, or other adverse health effects.

2. Dose-Response Assessment: Determines the possible severity of adverse health effects at different levels of exposure.
3. Exposure Assessment: Estimates the amount of contact individuals within a population (including potentially sensitive groups, such as children) could have with the substance.
4. Risk Characterization: Combines the information in the first three steps to determine the level of potential risks to humans and the environment.

### **Potential risk factors**

Here are overviews of some of the potential environmental risk factors currently under examination as possible causes of childhood cancer.

#### Pesticides

The term “pesticides” encompasses a wide range of chemicals that are used to control insects, unwanted plants, fungi, rodents, and other pests. By controlling agricultural pests, pesticides have contributed greatly to our country's abundant supply of fruits and vegetables. They are used in other countries to control the spread of insect-bearing diseases (for example, malaria). Pesticides are used in our homes to control termites, cockroaches, ants, mites and rodents. Pesticides are used to control the growth of unwanted plants, both in gardens and lawns and along our highways and under power line right-of-ways. Although many pesticides are synthesized from petroleum, some are derived from natural origins. More than 1,500 different pesticides are currently used in the United States. They are sold as sprays, powders, crystals, balls and foggers.

Pesticides are probably one of the most regulated chemical products used in the United States. There are currently more than 14 separate regulations governing the use of these

chemicals. Several major organizations, including the EPA, the Food & Drug Administration (FDA), and the Department of Agriculture, are involved in monitoring the use of pesticides.

Dr. Sheila Zahm of the National Cancer Institute says that ample evidence exists to indicate that some pesticides are carcinogenic, based on data from the National Toxicology Program and the International Agency for Research on Cancer (IARC). The EPA's pesticide program and other national and international bodies have classified approximately 165 pesticidal chemicals as known, probable, or possible human carcinogens.

According to statistics in the EPA's *Children's Environmental Health Yearbook*, children develop leukemia three to nine times more often when pesticides are used around their homes. The EPA estimates that as much as 75% of household pesticide use is inside the home and 22% is in yards and gardens. Children come in contact with pesticides through:

- **Dietary exposure:** Infants and children may be exposed to trace amounts of pesticides in food and in breast milk. The EPA regulates trace amounts of pesticides, termed “residues,” in food through a system of standards called “food tolerances”. A tolerance is a legal limit on the amount of pesticide in a particular food. In the past, the amount of pesticide predicted to be consumed was based on the behavior and diet of an average adult American - the diets, behaviors, and susceptibility of young children were not taken into account. Also in the past, the EPA considered the effects of each pesticide in isolation rather than recognizing that people (especially children) are often exposed to many pesticide residues at the same time. These practices have changed in light of the requirements of the 1996 Food Quality Protection Act (see Section 4).
- **Skin contact and airborne exposure:** Indoors, children are exposed to pesticides from flea bombs, insecticide sprays, and foggers. Lawn-care pesticides are also a major source of

childhood exposure - children come in contact with these pesticides when they play outside; they also track the chemicals into the house. Children living on or near farms may be exposed to pesticides in the air; they may also be exposed via the shoes and clothing of their parents. Children may also come into contact with pesticide residues at schools. Because of health concerns and costs, schools are trying to reduce pesticide use through integrated pest management strategies (see Section 5).

It is difficult to measure children's exposure to pesticides, making it also difficult to determine how much risk pesticides represent for childhood cancer. An article entitled "Pesticides and Childhood Cancer" in the October 1997 issue of *Environmental Health Perspectives*, reviewed 31 epidemiological studies of the relationship between pesticides and childhood cancer. The authors found the general reported risk in the studies to be "modest." Risk appeared to be stronger when pesticide exposure could be measured in more detail.

Reports about the potential danger of pesticides get a lot of media attention. It is important that journalist go beyond press releases to get a broad understanding of the most recent scientific studies; seek out people who have differing views on the matter. "With pesticides it's never just one number," says Penelope Fenner-Crisp, special assistant to the EPA assistant administrator for Prevention, Pesticides and Toxic Substances. Fenner-Crisp advises reporters to go to more than one place for information on a particular pesticide or chemical, and adds, "However objective scientists think they might be, they are human. Everyone brings a measure of judgement or point of view to their work. This can happen personally, it can also happen organizationally."

Industrial Chemicals

According to Lynn Goldman, M.D., assistant administrator of the EPA's Office of Prevention, Pesticides and Toxic Substances, exposure to industrial chemicals represents a potentially larger link to childhood cancer than pesticide exposure does. That's because we know so little about the 70,000 industrial chemicals that are on the market in this country. According to the EPA, only 29% of the industrial chemicals on the market have enough information available for a minimum health screening. Little or no risk screening data are available for a majority of approximately 3,000 high volume industrial chemicals produced in the United States.

“There is a vast amount of ignorance about registered chemicals,” says Dr. Ellen Silbergeld, Professor of Epidemiology at the University of Maryland School of Medicine, and one of the authors of *Toxic Ignorance*, published by the Environmental Defense Fund. “We've done a totally inadequate job of making sure these chemicals are adequately checked. By law, industrial chemicals must be registered for use in this country - 2,000 to 3,000 new chemicals are registered each year. But registration does not require full testing for toxicity.”

Dr. Silbergeld calls the U.S. system of new chemical registration “bizarre,” and suggests that the process does not allow sufficient time to establish risk. “Basically, all a manufacturer has to do is tell the EPA or FDA that they intend to make a new chemical,” she says, summarizing the process. “The manufacturer submits the basic structure of the chemical, which could change, and tells the government what it's going to be used for. The government gets just 60 days to establish a risk. How do they do that with such a lack of information?”

The EPA's Toxics Release Inventory (TRI) reports that during 1994, 22,744 facilities in the United States released 2.26 billion pounds of toxic substances into the environment - 69% into the air; 13% on land; 14% underground by injection and 3% onto surface waters. Approximately one-third of the hazardous toxins are known to cause cancer in rodents. Efforts

are under way by both government and industrial organizations (see Section 5) to test industrial chemicals and make public information regarding their potential dangers.

### Hazardous Wastes

The EPA's Superfund project currently lists approximately 1,400 hazardous waste sites on its National Priority List. Children may be at risk from hazardous wastes that have been released at these and other locations. Hazardous wastes include substances that are possible carcinogens, in addition to corrosive materials or chemicals that may present a danger due to fire or explosion. Children may be exposed to such wastes when they play or live near uncontrolled hazardous waste sites or spills. The EPA estimates that four million children live within one mile of a hazardous waste site.

### Household exposure to toxic chemicals

There is growing evidence that the greatest risk of exposure (to both children and adults) to toxic chemicals comes not from industrial sources, or hazardous waste sites, but from within our own homes. That's because toxins "collect" inside our homes, instead of being dispersed as they are in out-of-door environments.

An article in the February 1998 edition of *Scientific American*, "Everyday Exposure to Toxic Pollutants" (available online at <http://www.sciam.com>) describes studies that assessed everyday exposure to toxic substances. According to the article's authors, Wayne Ott and John Roberts, "It is difficult to know whether the contacts most people have with these substances pose an especially large health risk, because the capacity for low levels of each compound to cause sickness is exceedingly hard to estimate. Still, these studies produced results that were disturbing: Most citizens were very likely to have the greatest contact with potentially toxic pollutants not outside but inside the places they usually consider to be essentially unpolluted,

such as homes, offices, and automobiles. The exposure arising from sources normally targeted by environmental laws - Superfund sites, factories, local industry - was negligible in comparison.”

The chief sources of toxic exposure appear to be ordinary consumer products, such as air fresheners, solvents, moth repellents, cleansers, drycleaned clothes, gasoline, particle board, dusty carpets, adhesives, and fumes from cooking and heating, to name a few. Tobacco smoke is also included in the list.

*Benzene* is a chemical known to cause leukemia in adults and is present in gasoline and in many household products. It is also one of about 4,000 chemicals found in tobacco smoke. Scientists have calculated that some 45% of the total exposure of the U.S. population to benzene comes from smoking (or breathing smoke exhaled by others), 36% from inhaling gasoline fumes or from using various common products (such as glues) and 16% from other home sources (such as paints and solvents stored in basements or attached garages).

*Toxic house dust* is thought to be a particular menace to small children who play on floors, crawl on carpets, and regularly put their hands in their mouths. In the *Scientific American* article, Ott and Roberts estimated that each day the average urban infant ingests 110 nanograms of bezo(a)pyrene, the most toxic polycyclic aromatic hydrocarbon. (Polycyclic aromatic hydrocarbons are produced by incomplete combustion - from smoking, cooking, burning candles, or firewood - they are known to cause cancer in animals and are thought to induce cancer in humans.) The authors say, “Although it is hard to say definitively how much this intake might raise a child's chance of acquiring cancer at some point, the amount is sobering: It is equivalent to what the child would get from smoking three cigarettes.”

Household dust also contains polychlorinated biphenyls (PCBs) - a known carcinogen. PCBs belong to a family of synthetic chemical compounds that contain atoms of the element chlorine. PCBs were widely used as a liquid insulator from the 1930s to the mid-1970s when they were banned in this country. PCBs do not break down. Because they resist the microbes that naturally destroy most chemical compounds, PCBs last for decades. Millions of tons of PCBs are still prevalent in our environment.

### Electromagnetic Fields

The debate over whether the energy emitted from power lines and electrical appliances cause childhood cancer has been the focus of much scientific research for the past 19 years. The real estate value of homes built near power stations and power lines began dropping in 1979 when some studies suggested that children living close to high concentrations of certain types of electrical wires were 1.5 times more likely to develop acute lymphoblastic leukemia (ALL).

In a report released in the May 1998 issue of *Epidemiology*, several investigators from the National Cancer Institute (NCI) and the Children's Cancer Group (CCG) concluded that it is unlikely that magnetic fields from household electrical appliances increase a child's chance of developing leukemia. Researchers published an earlier report in July 1997 that showed little evidence that the electromagnetic radiation from high current power lines was associated with an increased risk of the disease. The 1997 study involved 636 children with acute lymphoblastic leukemia (ALL), the most common childhood cancer, and 620 healthy children who were matched to the cancer patients by race, age and residential neighborhoods.

*New England Journal of Medicine (NEJM)* deputy editor, Edward Campion, M.D., hailed the findings as finally putting to rest the debate on electromagnetic fields (EMFs). "The 18 years of research (on power lines and cancer) have produced considerable paranoia, but little insight

and no prevention,” Campion wrote in a July 3, 1997 editorial. “It is time to stop wasting our research resources.”

But not everyone agrees with the NCI/CCG studies. An international panel of experts convened by the National Institute of Environmental Health Sciences said in June 1998 that an electric and magnetic field like the one surrounding electric power lines should be regarded as a “possible human carcinogen.” In a reply to the *NEJM* editorial Daniel Wartenberg, Ph.D., of the Environmental and Occupational Health Sciences Institute, Piscataway, N.J., wrote, “Abandoning research on exposure to magnetic fields is premature. Given that ALL is the most common childhood cancer and that we have little insight into its causes, it is imperative from a public health standpoint that we aggressively seek explanations.”

Scientists say the weak link that has been shown between the proximity to power lines and childhood leukemia may be the result of factors other than magnetic fields that are common to houses with the types of external wiring identified with the disease. These possible factors include a home's proximity to high traffic density, local air quality and construction features of older homes located near power lines.

### Radon

NCI researchers are investigating indoor residential radon radiation as a possible risk factor for childhood leukemia. Radon, a known human carcinogen, is a naturally occurring, radioactive gas that is colorless, odorless, and tasteless. It comes from the natural decay of uranium, a radioactive metal found in soil and rock in the earth's crust all over the United States. Radon travels through soil and enters the indoor environments of buildings through cracks and other openings in the foundation. Eventually radon decays into radioactive particles that can be

inhaled and trapped in the lungs. As these particles decay, they release small bursts of radiation that can damage lung tissue and lead to lung cancer later in life.

### X-rays

Excessive prenatal exposure to x-rays has been definitely linked to childhood leukemia - to date, this is the only known cause of childhood cancer. The harmful effects of repeated exposure to x-rays have been known for years. Detailed information regarding the relationship between cancer and radiation came from studies of children and adults who survived the atomic bombings in Hiroshima and Nagasaki. Japanese survivors of the bombing had a twenty-fold increased risk of developing leukemia, usually within six to eight years after exposure.

Significant radiation exposure to the fetus within the first months of development may cause up to a five-fold increased risk of developing leukemia for the child. For that reason, pregnant women are advised to minimize exposure to x-rays. Fortunately, abdominal examinations of pregnant women can now be done with sonograms, which create diagnostic images through the use of radio waves and carry no risk to unborn children.

## **Section IV: Federal Responses**

### **How it began**

A 1993 report by the National Research Council, *Pesticides in the Diets of Infants and Children* heralded a dramatic shift in the recognition of children's environmental health issues in Congress and federal agencies. That report recommended these changes in scientific and regulatory procedures to afford infants and children greater protection from possible adverse health effects of pesticides:

- Develop new test procedures for evaluating pesticide toxicity to children.

- Collect more detailed data on the kinds and amounts of foods children eat.
- Improve measurements of “residues” - the amounts of pesticides present in foods.
- Consider all sources of exposure - dietary and non-dietary - when assessing risk factors.
- Expand the use of an “uncertainty factor” that provides an added margin of safety in regulating pesticides that could be harmful to children.

In response to this report, Environmental Protection Agency (EPA) Administrator Carol Browner directed her staff to consider environmental health risks of infants and children in all risk assessments, risk characterizations, and public health standards set for this country. In the fall of 1996, Browner announced a seven-step “National Agenda to Protect Children's Health from Environmental Threats” that would:

1. Ensure that all standards set by EPA are protective of the potentially heightened risks faced by children, and the most significant current standards be reevaluated as more is learned.
2. Identify and expand scientific research opportunities on child-specific susceptibility and exposure to environmental pollutants so that the best information can be employed in developing protective standards for children.
3. Develop new comprehensive policies to address cumulative and simultaneous exposures faced by children, moving beyond the chemical-by-chemical approach of the past.
4. Expand community right-to-know, by expanding the available tools through a Family Right-to-Know initiative, to allow families to make informed choices concerning environmental exposures to their children.
5. Provide parents with basic information so they can take individual responsibility for protecting their children from environmental health threats in their homes, schools, and communities.

6. Expand educational efforts with health and environmental professionals to identify, prevent, and reduce environmental health threats to children.
7. Commit to provide the necessary funding to address children's environmental health issues as a top priority among relative health risks.

### **The Food Quality Protection Act of 1996 (FQPA)**

Congress unanimously passed landmark food safety legislation in the summer of 1996. This brought to an end a 20-year effort to update and resolve inconsistencies in the two major pesticide statutes, the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and the Federal Food, Drug and Cosmetic Act (FFDCA). The new law amended both laws to establish a more consistent, protective regulatory scheme, grounded in sound science. The FQPA mandates:

- A single health-based standard for all pesticides in all foods.
- Special protections for infants and children.
- Procedures expediting approval of safer pesticides.
- Creation of incentives for the development and maintenance of effective crop protection tools for American farmers.
- Periodic reevaluation of pesticide registrations and tolerances to ensure that scientific data remains up-to-date in the future.

As it relates specifically to children and infants the FQPA:

- Requires the EPA to strengthen health-based standards to limit risks of pesticide exposure to children.
- Provides an additional safety factor to ensure that tolerances are safe for infants and children.
- Requires consideration of all sources of pesticide exposure, such as diet and drinking water, and the cumulative effect of pesticide residues when determining health risks to children.

- Expands consumers' right-to-know about pesticide risks to children.

Under the auspices of the FQPA, about 10,000 existing tolerances for pesticide residues are supposed to be reviewed by the year 2006. The EPA has begun the process by analyzing 3,300 tolerances that pose the worst risks to children. EPA officials say that over time, the carcinogenic pesticides that pose the greatest risk to children will be replaced by safer alternatives.

### **The Safe Drinking Water Act Amendments (SDWA) of 1996**

The SDWA includes measures to protect the public from harmful contaminants in water. By 1999, the EPA will require each of the nation's 56,000 water districts to alert their customers to the presence of pesticides, solvents, metals, microorganisms, and other regulated substances that are routinely found in drinking water.

The information will resemble the nutrition labels attached to most food products and will be sent to customers at least once a year.

### **April 1997: President Clinton signs “Executive Order to Protect Children from Environmental Health and Safety Risks”**

This order made children's health a priority across all levels of government by requiring that each federal agency ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental or safety risks. The order established the Task Force on Environmental Health Risks and Safety Risks to Children, and asked it to recommend:

- General policy related to children's health.
- A coordinated research agenda for the Federal Government.
- Appropriate partnerships among federal, state, local, and tribal governments and the private, academic, and nonprofit sectors.

- Proposals to enhance public outreach and communication to assist families in making informed consumer choices related to children's health.
- High-priority initiatives that the federal government has, or will undertake to advance protection of children's environmental health and safety.
- Any new legislation needed to address the protection of children's health.

### **EPA Office of Children's Health Protection (OCHP)**

In May of 1997 EPA Administrator Browner established the OCHP to ensure the implementation of the President's Executive Order as well as the EPA's National Agenda to Protect Children's Health from Environmental Threats. As one of its first official actions, the OCHP sponsored a conference on "Preventable Causes of Cancer in Children." Notes from the conference, which took place in September 1997, can be accessed from the OCHP home page.

### **Proposed: Children's Environmental Protection Act**

This legislation, introduced in Congress in 1997, is designed to protect children in their homes, schools, and all other areas accessible to them. If passed, it would go beyond the FQPA, which only focuses on pesticides and food.

The Children's Environmental Protection Act would:

- Require the EPA, the Department of Agriculture, and the Department of Health and Human Services to collect toxicity data so scientists can begin to understand the long-term effects of environmental pollutants on children, the cumulative effect of toxins in children's bodies, and the synergistic effect of one toxin interacting with another.
- Require the EPA to set standards for all environmental pollutants at levels that protect children and publish a list of products that are "Safe for Children."

- Create a family “Right-to-Know” kit, which would enable families to educate themselves about potential threats of environmental pollutants.

U.S. Rep. James Moran (Democrat-VA), a co-sponsor of the bill, says the new law would assist communities in determining the environmental dangers to which they are exposed. For example, Moran says communities could learn about pesticide applications before spraying occurs.

## **Section V: Current Initiatives in the Fight Against Childhood Cancer**

### **Where should research go?**

There is no general agreement within the scientific community regarding the direction research should take in efforts to discover the causes of childhood cancer. The debate stems from the basic argument over genetics and the environment: Which one should be the lead factor in research efforts to unlock the key to the development of childhood cancer?

Dr. Seymour Grufferman, Department of Family Medicine and Clinical Epidemiology at the University of Pittsburgh School of Medicine, has been researching possible environmental causes of childhood cancer for 15 years. “So far we've come up with nothing”, he says. “It's taking us back to genetics, that's what's likely to be productive.”

Exposure to suspected toxins for most people is lower than the amounts known to cause cancer, Grufferman writes in a commentary in the September 1998 issue of the *Journal of Epidemiology and Biostatistics*. Even in areas reporting elevated exposures to carcinogens, extensive studies show no confirmed links between the toxins and occurrences of disease. At the end of the article, Grufferman states, “The ultimate conclusion is that we do not know if environmental pollution plays any role in the causation of cancer in children. Calls to clean-up our environment, while perhaps being of general societal merit, cannot be justified on the grounds of helping to prevent cancer in children.”

Dr. Philip Landigran, Chair of the Department of Community Health and Preventive Medicine at the Mt. Sinai Medical Center in New York, praises Grufferman's work and admits to the “honest disagreement” that exists in the research community over childhood cancer. Landigran believes environmental factors, especially prenatal exposures to toxic substances, will ultimately be shown to be a major factor in the development of childhood cancer. “When children get cancer before the age of three it's almost certain it stems from something in the womb. We need to be looking at parental exposures and parental lifestyles.” Agreeing that the studies of childhood cancer clusters have been mostly inconclusive, Landigran says, “It's important to keep looking at possible clusters. It's an issue of public trust; people are going to be worried, we need to respect that.”

### **Calls for the development of a North American Registry for Childhood Cancer**

Even though science has made great strides in the detection and treatment of childhood cancer, efforts to understand the causes of the various forms of the disease are still in their infancy. Because the lack of available, consistently gathered data is a major roadblock to scientific study, researchers are calling for the development of a North American Registry for Childhood Cancer.

Dr. Leslie Robison, of the University of Minnesota, and lead epidemiologist for the Childhood Cancer Group, says the National Cancer Institute's Surveillance, Epidemiology, and End Results Program (SEER) registry only includes 14% of youngsters with cancer. Data collected by the two major childhood cancer clinical trial groups are not formally gathered or shared in a manner that makes the information easy to use.

Dr. Robison says a registry would provide clear and precise data. “Every child with cancer would be identified and included in the registry. It would be a major asset in our work;

we'd have information on where they lived and how old they were. It would allow cases to be tracked and followed up.” Dr. Robert Amler, Medical Director for the Agency for Toxic Substances and Disease Registry (ASTDR), says efforts to establish a registry are “evolving,” his agency will hold a series of workshops in 1999 to discuss the financial costs and possible scientific perimeters of establishing a registry.

### **Current studies - nationally and internationally**

A major study on childhood cancer is under way in the United Kingdom; preliminary results are expected by the end of 1998. Investigators in the U.K. have collected information on all children diagnosed with cancer in England and Wales since 1992. Blood samples have been taken from the children and their families to determine genetic and immunologic characteristics of disease. Researchers are testing theories that focus on these possible causes of childhood cancer:

- Radiation exposures in utero or after birth.
- In utero or postnatal chemical exposures.
- Occupational chemical or radiation exposure to fathers' sperm.
- Postnatal EMF exposures.
- A rare abnormal response to infection.

A similar study is being conducted in California. Researchers at the School of Public Health, University of California at Berkeley, are collecting information and biologic samples on all cases of childhood leukemia diagnosed in Northern and Central California. The study's primary aim is to assess exposures of the child and the parents to pesticides and other chemicals, in concert with dietary habits and genetic makeup. Like their counterparts in the U.K., the

Berkeley researchers are interested in identifying subtypes of leukemia that may help explain causes of the disease.

The Berkeley study is being funded by the federal Superfund program, although the study does not focus on Superfund sites. Project director Dr. Martyn Smith, Professor of Toxicology at the School of Public Health, says studies focusing on suspected cancer clusters near such sites have not been productive. Dr. Smith says useful answers are more likely to emerge from large and broad-based studies such as the one currently under way.

## **U.S. Initiatives**

### Centers of Excellence in Children's Environmental Health Research

In August 1998, Vice President Gore announced the establishment of the first federal research centers dedicated solely to studying children's environmental health hazards. The eight centers will address two important areas of children's environmental health - the causes of asthma and the effects of pesticide exposure. Funded by the EPA and the Department of Health and Human Services, these research institutions will translate their scientific findings into intervention and prevention strategies by working directly with communities and community groups. Dr. Landigran says the establishment of these centers will create a "structure and platform" essential to the study of children's environmental health.

The School of Public Health at the University of California in Berkeley will study the impact of pesticide exposure on children living in the agricultural community of Salinas, California. The Department of Environmental Health Sciences at the University of Washington in Seattle will conduct research and begin intervention projects among children of farm workers in the Yakima Valley. In addition, researchers at the Mount Sinai School of Medicine in New

York City will undertake studies and develop methods for reducing household exposures to pollutants among children living in East Harlem.

#### Child Health Champion - Campaign Pilot Program

This program, sponsored by the EPA's Office of Childhood Health Protection, involves 11 communities that are participating in a pilot program designed to empower local citizens to take voluntary steps toward protecting children from environmental health threats. Each Champion Community Team includes participants from health care, education, government, citizens groups, business/agricultural groups, and contractors/building managers.

The teams will:

- Identify local children's environmental health issues, such as a high incidence of hospital admissions or school absences.
- Set community-specific goals to protect children.
- Develop action plans to achieve those goals.

The pilot projects are being carried out in the following communities: the Cherokee Nation, Talequah, Oklahoma; the Chippewa Cree Tribe, Rocky Boy Reservation, Montana; East Los Angeles, California; Manchester, New Hampshire; the north and near south sections of Milwaukee, Wisconsin; the Ironbound section of Newark, New Jersey; three communities in New Madrid County, Missouri; Nogales, Arizona; Prichard, Alabama; Toppenish Washington; and Ward 8, Washington, D.C.

#### Improving indoor air quality (IAQ) in the schools

The EPA is working with the American Association of School Administrators, the National Education Association and the National Parent Teachers Association to develop indoor air quality programs that offer workshops, distribute educational materials, and conduct media

campaigns, home audits, and school inspections. Extensive efforts are under way in each of the EPA's 10 regional offices to distribute *IAQ Tools for Schools* materials and assist schools in implementing an IAQ program.

#### Studying PAHs Exposures in children from low-income families

Polycyclic aromatic hydrocarbons (PAHs) are a bi-product of incomplete combustion (from fireplaces, cooking, automobile exhaust and smoke stacks), they are fairly pervasive in the environment and are known to cause cancer in adults. The EPA is undertaking research to understand the extent to which children from low-income families are exposed to PAHs in daycare centers. This expands current studies of both rural and inner-city homes, which examine the exposures of children to PAHs in air, water, food, house dust and soil.

#### Support for Integrated Pest Management (IPM)

The overall goals of IPM are to minimize pesticide use, choose those pesticides that are least toxic to people and increase the use of non-chemical approaches, such as good housekeeping and preventative maintenance. The EPA is working with several organizations around the country (including the National Foundation for Integrated Pest Management) to develop and maintain IPM programs in schools and inner-city dwellings.

#### Superfund and children's health

Superfund is the program that funds EPA's efforts to identify, manage, remove and clean up major hazardous waste disposal sites in this country. There are approximately 1,400 sites currently on the National Priorities List for EPA attention. Potential cancer risks and other hazards to children from exposure to chemicals in the air, water and soil at major sites are analyzed as a routine part of the Superfund program. These evaluations include assessing risks to children aged six months to six years who may ingest soil, evaluating the risk to all children

through inhalation of fumes, and evaluating potential risks to children and teenagers trespassing on abandoned hazardous waste sites.

#### Toxic Release Inventory (TRI) - Community Right-to-Know

The TRI is a national database that provides the public with annual release information on over 600 toxic chemicals commonly used by U.S. industry. This inventory requires that each of the 31,000 industrial facilities across the nation provide EPA with chemical-specific reports specifying the amount of chemicals that they release to the air, land, and water. The reports are made available to the public in a variety of means, including online services, public libraries, and by request from EPA. The EPA is developing TRI chemical fact sheets for parents and an indexing project that will provide environmental performance profiles for five major industries.

#### Agricultural Health Study

This study of 90,000 commercial pesticide applicators, farmers, and farmers' spouses is being conducted in Iowa and North Carolina. It is a collaborative project involving the National Cancer Institute, the EPA, and the National Institute of Environmental Health Sciences. The Agricultural Health Study includes interviews to obtain information on agricultural practices, lifestyle factors, diseases and medications, monitoring of pesticide exposures, and collection of biologic tissues from participants.

#### **Industry/Governmental Programs**

##### National Pesticide Residue Database

The National Food Processors Association and other private sector groups are working with the EPA, the Food and Drug Administration and the Department of Agriculture to develop a National Pesticide Residue Database. This database will enable the EPA to develop more accurate estimates of pesticide residues in food. EPA is developing methods for estimating

pesticide exposures and risks from multiple sources, such as food, drinking water, and household pesticides.

#### Consumer Labeling Initiative

A new Consumer Labeling Initiative will expand the amount of hazard and health information on pesticide labels, similar to nutrition labels now available for foods. The Consumer Product Safety Commission and the EPA are working with key industry groups, parents, and health professionals to implement this program.

#### Industrial Chemical Initiative

The EPA, the Chemical Manufacturers Association, and the Environmental Defense Fund are expected to announce a new program in late 1998 which would involve a voluntary effort to generate and make public screening data for 3,000 high production chemicals in this country. Industry officials estimate the program will involve \$500- 700,000,000 in test costs over the next five to seven years. The petroleum and food additive industries are expected to be involved in the effort.

### **Section VI: Protecting Children: What to Do in the Meantime**

The incidence of childhood cancer is increasing by approximately one percent each year in this country, and no one knows why. Even though no environmental hazards have been established as a cause for childhood cancer, the worry remains that substances in the air our children breathe, the food they eat, the water they drink, and the ground they play on are somehow responsible for the increase in the disease.

What's a prudent parent (or other involved person) to do to protect children from environmental hazards? Relative to childhood cancer, there's a wide range of recommendations

from both the scientific and environmental fields. Opinions vary from “I wouldn't do anything different” to “take every precaution you can.” The only thing everyone agrees on is the basic advice to pregnant women: Don't smoke, drink alcohol, take illicit drugs, or expose yourself to excessive x-rays. Until science comes up with some definitive answers on the causes of childhood cancer, the decision about what's prudent will have to be dealt with on an individual basis.

Here are some of the issues under consideration:

### **Parental exposure**

More than 40 studies have researched the relationship between childhood cancer and parental occupations. According to Aaron Blair, Ph.D., of the National Cancer Institute, many of the studies show no link between a parent's job and the disease. However some research suggests a higher risk of leukemia and lymphoma exists among children of parents who are regularly exposed to paints and pigments, vehicle exhausts, textiles, and solvents. Dr. Blair says additional research found higher risk of childhood brain cancer among children of parents exposed to paints, hydrocarbons, and metals.

Research into the possible link between parental occupations and childhood cancer is based on three assumptions:

- That damage may occur within the sex cells of the parent (prior to conception).
- There may be risks from in utero exposure when the mother is in the workplace.
- Both father and mother may transport chemicals home from the workplace.

It's essential that parents be aware of potential environmental hazards in their workplace. If they exist, women should ask to be reassigned to less hazardous work areas during pregnancy. If hazardous environmental conditions exist for any parent or caretaker of children at the

workplace, that person should change clothes and shower before leaving work, and transport exposed garments only in car trunks, not on car seats where toxic residues could pose a threat to children.

### **Prenatal vitamins**

Mothers who take vitamins during their pregnancy may give their offspring protection against childhood cancer. The International Agency for Research of Cancer (IARC) compared 1,056 children from six countries diagnosed with brain cancer between 1980 and 1994, with 1,925 children who did not have the disease. Susan Preston-Martin, Ph.D., of the University of Southern California, says data showed that mothers who used vitamins during all three trimesters of pregnancy had a 40% reduction in the risk of having a child with a brain tumor. Dr. Preston-Martin said it was not possible to evaluate the possible separate effects of the four micronutrients studied - vitamins A, C, E, and folate - all of them appeared to reduce risk with increasing dosage.

No one knows for sure how vitamins protect an unborn child, but researchers are looking at these possibilities:

- Antioxidants (vitamins C and E) may prevent damage to DNA by scavenging free radicals.
- Vitamins A and D may regulate cell differentiation and growth.
- Vitamins may prevent other deficiencies (for example, folic acid) that can alter gene expression.
- Vitamins may interact with other compounds to alter the metabolism of carcinogens within the fetus.

### **Exposure to tobacco smoke**

A study by Dr. Bruce Ames, Professor of Biochemistry and Molecular Biology at the University of California, provides prospective fathers-to-be with another reason to stop smoking. In an article in the spring 1997 issue of *National Institute for Environmental Health Sciences Newsletter*, Dr. Ames says that men who smoke cigarettes damage the DNA of their sperm. His study showed that smoking reduced levels of Vitamin C both in blood plasma and seminal fluid. Dr. Ames says insufficient Vitamin C levels in seminal fluid increase lesions in sperm DNA by 250%. A study in the 1997 *Journal of the National Cancer Institute* (89:238-244) suggests that numbers of cases of all types of childhood cancer are increased in offspring of male smokers.

Cigarette smoke also poses a danger to children who have left the womb - youngsters exposed to secondhand smoke have a greater tendency to suffer from respiratory problems. It appears that these children may also be at increased risk for cancer. Benzene, one of about 4,000 chemicals found in tobacco smoke, is known to cause leukemia and lymphoma in adults. In an article in the February 1998 edition of *Scientific American*, Lance Wallace of the EPA states that 45% of the total exposure of the U.S. population to benzene comes either from smoking or inhaling secondhand smoke.

### **Household toxins**

The *Scientific American* article, "Everyday Exposure to Toxic Pollutants" (February 1998) maintains that children are much more at risk from environmental hazards in their homes and schools than they are outdoors. That's because homes become a "collecting site" for pollutants that would normally be dispersed outdoors.

Undertaking an environmental assessment of one's home can be a daunting task. Keeping a home as toxic-free as possible can be even more of a challenge - many modern-day products

(air fresheners, cleaning supplies, pet shampoos, art supplies) contain chemicals that could pose a danger to children.

Amy Duggan, of Seattle's "Master Home Environmentalist Program," recommends these beginning steps for maintaining a toxic-free home:

- Vacuum and clean regularly - carpets and furniture can be repositories for toxic dust.
- Wipe feet on doormats, better yet - take off shoes before entering the home. Shoes can carry in pesticides and other toxins that do not decompose in an indoor environment.
- Avoid smoke from wood stoves, fireplaces, and cigarettes.
- Use less toxic products for managing pests in the home and garden.
- Use fans or open windows to reduce moisture in bathrooms and kitchens and to reduce the buildup of indoor pollutants.

## **Pesticides**

Integrated Pest Management Programs (IPMs) focus on alternatives to pesticide use in the home and garden. The Washington Toxics Coalition has several articles available online that offer alternative advice on controlling household pests (fleas, ants, roaches), along with suggestions for lawn and garden care. "Master Gardener" programs are becoming more available around the country. Offered through local water districts, community colleges, or gardening supply stores, these programs teach homeowners how to eliminate or reduce the use of toxic chemicals in lawns and gardens.

Organic produce is becoming more available at grocery and health food stores around the country. While the term "organic" does not necessarily mean that foods will be pesticide-free, it usually means that the least toxic methods of fertilization and pest control have been used in crop

cultivation. Unfortunately, organic produce is often more expensive than conventionally grown crops, and costs can be prohibitive for many households.

### **Diet and nutrition**

Researchers attending the EPA's 1997 "Conference on Preventable Causes of Cancer in Children" called for research on the role of nutrition in the development of childhood cancer. Is increasing obesity among children leading to increased storage of carcinogens in fatty tissues? Is the lack of micronutrients in children's diets leading to an increased susceptibility to cancer?

It's indisputable that eating fruits and vegetables provides protection against cancer in adults. (Statistics show that the quarter of the population with the lowest dietary intake of fruits and vegetables has roughly twice the rate for most types of cancer.) While the amount of cancer-protection afforded children is unknown at this time, it would make sense to encourage good eating habits in youngsters. Even if the good habits don't pay off in childhood, they most certainly will later in life.

Eighty percent of American children and 68% of adults do not eat the five daily servings of fruits and vegetables recommended by the National Cancer Institute and the National Research Council (1995 *American Journal of Public Health*, 85, 1623-1629). Some scientists say efforts to improve the intake of vitamins and minerals and to encourage a balanced diet among the poor should be a high priority for public policy.

### **Story Ideas**

1. The Environmental Protection Agency (EPA) is actively pursuing projects related to children's health in each of its ten national regions. Obtain a copy of the *EPA Children's Environmental Health Yearbook*. Determine what's happening in your locale, interview the researchers, community leaders and citizens involved in the efforts.

2. Cockroaches are a big deal in children's health. Recent studies lay some of the blame for the increase of childhood asthma on the inhalation of dried roach excrement. Yet many regulatory agencies are considering additional controls on the pesticides used to control roaches based on concerns about childhood cancer. What's the cockroach situation in your community? Are there any integrated pest management programs in place to control the roaches? What do regional EPA officials have to say about the situation?
3. Are pesticides regularly used on school yards or public parks in your community? Are they known to be harmful to children? Is there any acceptance of integrated pest management programs by local school or recreational officials?
4. How healthy are your local schools? The New York Healthy Schools Network has a questionnaire available online to help parents and community leaders take a beginning look at the state of the school environments. Are your local PTA's involved in any of the national efforts to improve air quality in the schools?
5. Is winter coming? Do a story on the dangers of inhaling fumes from wood stoves and fireplaces. Are there any ventilation schemes that make the practices safer?
6. Is it mosquito season in your community? Has there been an outbreak of flea infestations or head lice problems in the schools? Is the gardening season getting under way? Talk to an integrated pest management expert. Are there safer alternatives available for pest control? What would it take to make them effective?
7. Is there a home environmental program in your area? If there is, ask an expert to tour a home with you. What are some of the measures that could be taken to protect children and adults from toxic substances that collect in the home? If there is no home environmental program

available in your locale do a story from that angle. What are the potential dangers that lurk in our homes? Where could people go for help?

8. Along those same lines, do a story about dust. Call your regional EPA office for help in locating an expert. What's usually in household dust? What toxic substances do we need to be aware of? What's the latest scoop on vacuums and other cleaning paraphernalia?
9. What's the availability of "organic" produce in your local market? How does your state define "organic"? Is it more expensive? Are people buying more of it? Are there experts in your area who can discuss the pros and cons of buying fruits and vegetables that have been minimally (if at all) treated with chemicals?
10. Check the National Cancer Institute's listing of Designated Cancer Centers (see web resources). Call the one nearest to you; what are researchers exploring there that relates to childhood cancer? What's their take on the debate between environmental and genetic factors as the most probable causes of cancer? Do they see a need for the establishment of a National Childhood Cancer Registry?
11. Talk to a local pediatric oncologist. Do parents of his/her patients focus on what may have caused their child's illness? Does the doctor have any opinion on the direction research should take?
12. A movie version of the book *A Civil Action* is due to be released late in 1998. The story focuses on a real-life lawsuit based on reported childhood cancer clusters in a New England town. Do a story on the scientific controversies surrounding so-called cancer clusters. How has your community reacted to the movie? Are there any cancer researchers in your locale who can comment on the movie and the state of current research?

13. What's the status of right-to-know initiatives in your community? The Safe Drinking Water Act and the 1996 Food Quality Protection Act require community notification of possible environmental risks. Information on toxic emissions from industrial facilities is also available for public review. Call your regional EPA office; let your viewers in on what information is available. Help them understand the figures. Interview experts on how to respond to possible problems.

### **Sources: People/Places to Call**

#### **Environmental Protection Agency**

##### ***Office of Children's Health Protection***

401 M Street, SW, Mail Code 1102

Washington, DC 20460

202-260-7778

Liz Blackburn, Coordinator, Community Affairs and Outreach

Dr. Steven Galson, Scientific Director

Margaret Kelly, Regulatory Affairs Coordinator

##### ***Office of Prevention, Pesticides and Toxic Substances***

401 M Street, SW

Washington, DC 20460

202-260-0947

Penelope Fenner-Crisp

Special Assistant to Assistant Administrator

#### **National Cancer Institute**

Office of Cancer Communications

Building 31, Room 10A24

Bethesda, MD 20892

301-496-6641

#### **Questions regarding the epidemiology of childhood cancer**

Leslie Robison, MD

Professor of Pediatrics

University of Minnesota

Box 422, UMHC

Minneapolis, MN 55455

612-626-2902

Brad Pollack, Ph.D.  
Associate Professor of Health Policy and Epidemiology  
University of Florida  
Pediatric Oncology Group  
104 N. Main Street  
Suite 600  
Gainesville, FL 32601  
352-392-5198

Seymour Grufferman, M.D., PhD.  
Department of Family Medicine and Clinical Epidemiology  
University of Pittsburgh School of Medicine  
152 Lothrop Hall  
Pittsburgh, PA 15261  
412-383-8831

Martyn Smith, Ph.D.  
Professor of Toxicology  
School of Public Health  
140 Earl Warren Hall  
University of California  
Berkeley, CA 94720  
510-642-8770

**Questions involving the National Childhood Cancer Registry**

Dr. Robert Amler  
Agency for Toxic Substances and Disease Registry  
1600 Clifton Rd. NE  
Mail Stop E-28  
Atlanta, GA 30333  
404-639-0700

**Questions regarding genetic predispositions and childhood cancer**

Dr. Kevin Shannon  
Department of Pediatrics,  
Room HSE 302  
Box 0519  
University of California  
513 Parnassus Avenue  
San Francisco, CA 94143  
415-502-5127

### **Questions involving environmental factors and childhood cancer**

Dr. Philip Landigran  
Chair, Department of Community Health and  
Preventive Medicine  
Mt. Sinai Medical Center  
1 Gustave L. Levy Place  
Box 1057  
New York, NY 10029  
212-241-6173

### **Questions regarding household exposures to environmental toxins**

Amy Duggan  
Master Home Environmentalist Program  
2625 Third Avenue  
Seattle, WA 98121-1200  
206-441-5100

John Roberts  
c/o American Lung Association of Washington  
2525 Third Avenue  
Seattle, WA 98121-1200  
425-868-9439

### **Questions regarding integrated pest management:**

National Coalition Against the Misuse of Pesticides  
Jay Feldman  
701 E Street, SE  
Suite 200  
Washington, DC 20003  
202-543-5450

New York Coalition for Alternatives to Pesticides  
James Moore  
353 Hamilton Street  
Albany, NY 12210  
518-426-8246

### **Industry Spokespeople**

American Crop Protection Association  
Chris Klose  
1156 Fifteenth Street, NW  
Suite 400

Washington, DC 20005-1704  
202-872-3869

Chemical Manufacturers Association  
Sandra Tirey  
Public Health Team  
1300 Wilson Blvd.  
Arlington, VA 22209  
703-741-5000

### **Questions regarding scientific reviews**

American Council on Science and Health  
Jeff Steir, Esq.  
1995 Broadway  
Second Floor  
New York, NY 10023-5860  
212-362-7044

Citizens for the Integrity of Science  
Steve Milloy, MHS, JD, LLM  
1155 Connecticut Avenue, NW, Suite 300  
Washington, DC 20036  
202-467-8586

### **Hotlines**

Electric and Magnetic Field (EMF) InfoLine  
1-800-EMF-2383  
US Environmental Protection Agency and the EMF Research and Information Dissemination Program.  
The EMF InfoLine was established to help the public by providing accurate, current and balanced information in response to questions on electric and magnetic fields.

Indoor Air Quality Information Clearinghouse (IAQ Info)  
US Environmental Protection Agency  
1-800-438-4318  
An easily accessible, central source of information on indoor air quality. The IAQ Info Clearinghouse can provide information regarding indoor air pollutants, health effects of indoor air pollutants and testing and measuring indoor air pollutants

National Pesticide Telecommunications Network (NPTN)  
US Environmental Protection Agency and Oregon State University  
1-800-858-7378

The NPTN is a resource to provide the public with easy access to accurate and unbiased pesticide information. NPTN provides chemical, health and environmental information on the 600+ active ingredients incorporated into over 50,000 different pesticide products.

## **Sources: Internet Sites**

### **Government or Government-Related**

#### **Agency for Toxic Substances and Disease Registry (ATSDR)**

ATSDR's mission is to prevent exposure and adverse human health effects and diminished quality of life associated with exposure to hazardous substances from waste sites, unplanned releases, and other sources of pollution in the environment. This site also includes a database of hazardous substance releases and health effects on human populations.

<http://atsdr1.atsdr.cdc.gov>

#### **The Carcinogenic Potency Project**

Supported by the National Institute of Environmental Health Science through the NIEHS Center, University of California, Berkeley and by the Department of Energy and Lawrence Berkeley National Laboratory. Source for the HERP Index, a study of risks of human exposure to carcinogens in relation to rodent studies.

<http://potency.berkeley.edu/cpdb.html>

#### **Centers for Disease Control and Prevention**

##### **National Center for Environmental Health**

The mission of the National Center for Environmental Health, Centers for Disease Control and Prevention (CDC), is to provide national leadership, through science and service to promote health and quality of life by preventing and controlling disease, birth defects, disability, and death resulting from interactions between people and their environment.

<http://www.cdc.gov/nceh/oncehhom.html>

#### **Environmental Protection Agency**

##### **Office of Children's Protection**

The mission of the Office of Children's Health Protection is to make the protection of children's health a fundamental goal of public health and environmental protection in the United States. They are involved in research, public policy, regulatory and educational efforts to protect the health of children.

<http://www.epa.gov/children>

#### **Environmental Protection Agency**

##### **Chemical Fact Sheets and Summaries**

This is a good starting place for background information on a selected number of chemicals. The Fact Sheets include information on usage, common routes of exposure and environmental and human health effects. The Chemical Summaries provide more technical information, including a description of physical and chemical properties, as well as studies on human health effects.

<http://www.epa.gov/docs/chemfact/>

**Environmental Protection Agency  
Office of Prevention, Pesticides and Toxic Substances**

The office is charged with protecting the public health and environment from potential risks from pesticides and toxic chemicals. This office is involved in pollution prevention and the public's right to know.

<http://www.epa.gov/internet/oppts/>

**Environmental Protection Agency  
Toxic Chemical Release Inventory (TRI)**

This database is an annual compilation of information on estimated releases into the environment of over 300 toxic chemicals. By law, industrial facilities must file reports on their handling of these chemicals, including environmental release, waste treatment and off-site waste transfer.

[http://www.epa.gov/enviro/html/tris/tris\\_overview.html](http://www.epa.gov/enviro/html/tris/tris_overview.html)

**National Cancer Institute**

This is the gateway for government-related information on cancer. This site has information regarding research, legislation and information for health professionals. It also has sizable media resources.

<http://www.nci.nih.gov>

SEER - The Surveillance, Epidemiology and End Results Program: For the latest cancer statistics available from the NCI epidemiological and statistical data base:

<http://www-seer.ims.nic.nih.gov/Publications/CSR7394/index.html>

The NCI-designated Cancer Centers Public Affairs Network. To find clinicians and other cancer specialists across the nation through these public affairs offices:

<http://rex.nci.nih.gov/massmedia/pressreleases/cancercenters.html>

**National Institute of Environmental Health Science (NIEHS)**

As part of the National Institutes of Health, NIEHS's mission is to reduce the burden of environmentally associated diseases and dysfunctions. NIEHS achieves its mission through multidisciplinary biomedical research programs, prevention and intervention efforts and public communication strategies. NIEHS publishes *Environmental Health Perspectives* which is available through this site..

<http://www.niehs.nih.gov>

**National Institute for Occupational Safety and Health (NIOSH)**

NIOSH was created to conduct research and training and make recommendations for the prevention of work-related illnesses and injuries. NIOSH concern about child health stems from parental workplace exposures which adversely affect fetuses in utero, and childhood exposures to workplace toxins which parents inadvertently carry into the home environment.

<http://www.cdc.gov/niosh/homepage.html>

**National Library of Medicine**

This international database represents citations from more than 3,700 journals in the biomedical and health care fields, dating back to 1966. Literature on environmental health topics is well represented here.

<http://www.nlm.nih.gov/databases/freemedl.html>

### **National Toxicology Program (NTP)**

Headquartered at the National Institute of Environmental Health Science, NTP released *The Eighth Report on Carcinogens* in May 1998. Fourteen substances were added to the 184 substances already included in the federal government's official list of known or "anticipated" human carcinogens.

<http://ehis.nih.gov/roc/>

## **Cancer-Related Sites**

### **American Cancer Society**

The American Cancer Society is the nationwide, community-based voluntary health organization dedicated to eliminating cancer as a major health problem. ACS work focuses on children's issues when matters involving childhood cancer care or risk factors are involved.

<http://www.cancer.org>

### **National Childhood Cancer Foundation (NCCF)**

The NCCF is a non-profit organization which supports pediatric treatment and research programs at over 115 of the most prestigious pediatric medical institutes in the U.S., Canada and Australia. NCCF also sponsors the network of 2,800 pediatric cancer specialists called the Childhood Cancer Group.

<http://www.ncff.org>

### **Pediatric Oncology Group (POG)**

One of two cooperative clinical research groups focused on childhood cancer. POG is funded by the National Cancer Institute.

<http://pog.ufl.edu>

## **Environmental Organizations**

### **Children's Environmental Health Network**

The Children's Environmental Health Network is a national multidisciplinary project whose mission is to promote a healthy environment and to protect the fetus and the child from environmental hazards. The Network is composed of experts in the fields of medicine, nursing, research and policy.

<http://cehn.org>

### **Children's Health Environmental Coalition**

The mission of the Children's Health Environmental Coalition is to protect children's right to good health through a safe and clean environment. CHEC is a national, bipartisan grassroots coalition focused on increasing environmental health protections for children.

<http://www.checnet.org>

### **Environmental Defense Fund**

The mission of the Environmental Defense Fund is to prevent environmentally induced harm to human populations. Publishers of the report *Toxic Ignorance*.

<http://www.edf.org>

### **The Healthy House Institute**

The Healthy House Institute is an independent resource center offering information, books and videos for designers, architects, contractors and homeowners interested in making houses healthy places in which to live.

<http://www.hhinst.com>

### **National Coalition Against the Misuse of Pesticides (NCAMP)**

NCAMP is a broad coalition of health, environmental, labor, farm, consumer and church groups and individuals who share common concerns about the potential hazards associated with pesticides. The Coalition focuses public attention on health problems related to pesticide use and promotes reduced pesticide exposure through alternative pest management strategies.

<http://www.ncamp.org>

### **Natural Resources Defense Council (NRDC)**

#### **Children's Environmental Health Initiative**

NRDC's Children's Environmental Health Initiative was launched in 1989 following the release of *Intolerable Risks: Pesticides in Our Children's Food*. A later publication, *Handle with Care: Children and Environmental Carcinogens* documented children's exposure to a host of carcinogens and the failure of government standards to adequately protect children. The NRDC has 350,000 members nationwide.

<http://www.nrdc.org>

### **Northwest Coalition for Alternatives to Pesticides (NCAP)**

NCAP has been involved in efforts to develop and oversee integrated pest management programs in schools in Eugene, Oregon. NCAP currently runs a School Pesticide Use Reduction Program, focused on schools in the Northwest. The organization has published several guides related to pesticide use in schools.

<http://www.efn.org/~ncap>

### **Pesticide Action Network North America (PANNA)**

PANNA advocates the adoption of ecologically sound practices in place of pesticide use, stressing the reduction of pesticide use in the context of children's health. Their website features a weekly pesticide update and a children's page.

<http://www.panna.org/panna/>

### **Washington Toxics Coalition**

The Washington Toxics Coalition is a non-profit, member-based organization dedicated to protecting public health and the environment by identifying and promoting alternatives to toxic chemicals. The organization has several articles available on-line related to integrated pest management and the reduction of household toxins.

<http://www.accessone.com/~watoxics>

## **Integrated Pest Management**

**University of California Integrated Pest Management Program**

<http://axp.ipm.ucdavis.edu/>

**Integrated Pest Management Information Services**

<http://www.efn.org/~ipmpa/>

## **Children's Health & Well Being**

**American Academy of Pediatrics (AAP)**

The AAP's Committee on Environmental Health establishes policy statements on issues related to childhood cancer and other environmental concerns involving children. AAP is in the process of writing a professional handbook on environmental health for pediatricians; they also publish brochures for parents.

<http://ambpeds.org>

**National Parent Teachers Association (PTA)**

The National PTA has adopted a number of position statements and resolutions on environmental issues such as pesticide use in schools and daycare centers, hazardous waste management and indoor air quality. The National PTA and the Environmental Protection Agency have collaborated on a number of publications targeted to parents to help them understand environmental hazards in schools including *Radon Community Action Kits* and the *Indoor Air Quality Tools for Schools Action Kit*.

<http://www.pta.org>

**New York Healthy Schools Network**

This is a state-wide coalition of parent, environmental, health and education organizations working to ensure every child and school employee an environmentally healthy school which is clean and in good repair, through shared advocacy and information and referral. Instrumental in the state adoption of a model "bill of environmental rights" for school building occupants.

<http://www.hsnet.org>

## **Industry-related Sites**

**American Crop Protection Association**

The American Crop Protection Association represents the companies that produce, sell and distribute virtually all of the active compounds used in crop protection chemicals for use in the United States.

<http://www.acpa.org>

**Chemical Manufacturer's Association**

The Chemical Manufacturers Association serves as a focal point for the chemical industry's collective action on legislation, regulatory and legal matters. The 200 industry members and partners of CMA have a productive capacity of 90% of U.S. basic industrial chemicals.

<http://cmahq.com>

## **Scientific Reviews**

### **American Council on Science and Health**

The American Council on Science and Health, Inc. (ACSH) is a consumer education consortium concerned with issues related to food, nutrition, chemicals, pharmaceuticals, lifestyle, the environment and health. ACSH is an independent, nonprofit, tax-exempt organization. ACSH was founded in 1978 by a group of scientists who had become concerned that many important public policies related to health and the environment did not have a sound scientific basis. These scientists created the organization to add reason and balance to debates about public health issues and bring common sense views to the public.

<http://acsh.org>

## **Recommended Reading**

National Institute of Environmental Health Sciences. "Children's Environmental Health, Cancer in Children." *Environmental Health Perspective Supplements* 106, no. 3 (June 1998).

(<http://www.niehs.nih.gov>)

United States Environmental Protection Agency (US EPA). *Environmental Health Threats to Children*. Washington, D.C: US EPA Office of the Administrator, 1996

The United States Environmental Protection Agency (US EPA). *The EPA Children's Environmental Health Yearbook*. Washington, D.C.: US EPA Office of the Administrator, 1998.

Mott, L; V. Kun; W. Gordon; and K. Lavelle. *Handle With Care: Children and Environmental Carcinogen*. New York: Natural Resources Defense Council, 1994.

Bower, J. *The Healthy House Book: Answers to the 133 Most Commonly Asked Questions*. Bloomington, Indiana: Healthy House Institute, 1998.

United States Environmental Protection Agency (US EPA). *Indoor Air Pollution: An Introduction for Health Professionals*. Washington, DC: US EPA Office of Air and Radiation, 1994.

Rapp, D. *Is This Your Child's World? How You Can Fix the Schools and Homes That Are Making Your Children Sick*. New York:, Bantam Books, 1996.

Wargo, J. *Our Children's Toxic Legacy: How Science and Law Fail to Protect Us from Pesticides*. New Haven, Connecticut: Yale University Press, 1998.

National Research Council. *Pesticides in the Diets of Infants and Children*. Washington, DC: National Academy Press, 1993.

Robinson J; W.S. Pease; D.S. Albright; and R.A. Morello-Frosch. *Pesticides in the Home and Community: Health Risks and Policy Alternatives*. Berkeley, Calif.: California Policy Seminar, 1994.

Needleman, H.L.; and P.J. Landrigan. *Raising Children Toxic Free*. New York: Farrar, Straus and Giroux, 1994.

West, B.; and Sandman, P. *The Reporters Environmental Handbook*. Piscataway, New Jersey: Rutgers University Press, 1995.

*Resource Guide on Children's Environmental Health*. Emeryville, Calif.: Children's Environmental Health Network, 1997.

Graham, J. *Risk Versus Risk: Tradeoffs in Protecting Health and the Environment*. Cambridge, Mass.: Harvard University Press, 1997.

Roe, D.; W. Pease; K. Florini; and Silbergeld, E. *Toxic Ignorance*. New York: The Environmental Defense Fund, 1997. (<http://www.edf.org>)

### **Sources: Video Footage**

The Environmental Protection Agency (EPA)

Bryan Taylor

202-260-2044

The EPA has file footage of Superfund sites, pesticide spraying, radon testing and smokestack emissions. Available on betacam, there may be transfer charges.

The Center for Disease Control

Gail Hayes

404-639-3286

The CDC has footage of lab activity (computer based) related to environmental testing. Available on betacam, free of charge

The Northwest Coalition for Alternatives to Pesticides

This organization has footage from a documentary "Pesticide Use and Our Right to Know"

541-344-5044

The Pesticide Action Network

Ellen Hickey

415-541-9253

A source for footage of pesticide spraying of strawberry fields and home fumigation.

The Pesticide Education Center  
Call for footage from “Harvest of Sorrow”  
Marion Moses  
415-391-8511

#### WGBH-TV

This public television station has a searchable archive of file footage; environmental footage comes from programs such as *Race to Save the Planet* and *Save the Earth, Feed the Planet*. Video/animation about genetics is available from *Secrets of Life*. Local television stations are charged \$20/sec with a :30 minimum, plus transfer charges.

James Auclair  
617-492-3079

<http://www.wgbh.org/footage>

## Glossary of Terms

**Adverse health effect:** Any change resulting in anatomical, functional, or psychological impairment that may affect the performance of the whole organism.

**Benzene:** A chemical known to cause leukemia in adults, found in paints, solvents, gasoline fumes, and cigarette smoke.

**Carcinogen:** Any substance that can cause or promote cancer.

**Cluster analysis:** An epidemiologic study in which incidences of disease are studied between the time the first and last cases are diagnosed, and within the geographic area that covers the distance between the two cases living farthest apart. The occurrence of a group of cases of a disease close together in time and place at the time of their diagnosis is called a “cluster.”

**Cumulative exposures:** Multiple exposures to a substance (or group of substances) from multiple pathways; for example, pesticides exposure via food, water, and air.

**Cumulative risk assessment:** A process that involves the consideration of the combined health risk to an organism caused by the accumulation of risk from multiple stressors and multiple pathways of exposure.

**Dose:** Administered dose is the mass of a substance given to an organism and in contact with an exchange boundary (e.g., skin or gastrointestinal tract) per unit body weight, per unit of time (e.g., mg/kg-day).

**DNA:** (Deoxyribonucleic acid) The carrier of genetic information in cells.

**EMFs:** Electromagnetic fields; energy emitted from power lines and electrical appliances.

**Epidemiology:** The medical science involving the study of the incidence and distribution of diseases in large populations.

**Exposure:** Contact of an organism with a chemical or physical agent. Exposure is quantified as the amount of the agent available at the exchange boundaries of the organism (e.g., skin, lungs, stomach) and available for absorption.

**Hazardous waste:** Waste defined by the Resource Conservation and Recovery Act (RCRA) as those that may cause, or significantly contribute to illness or death, or that may substantially threaten human health or the environment when not properly controlled.

**Integrated Pest Management (IPM):** A mixture of chemical and other non-pesticide methods to control pests.

**Leukemia:** Cancer of the tissues of the body which make the blood cells. Acute lymphoblastic leukemia (ALL) is the most common type of cancer in children.

**Lymphomas:** A form of cancer arising in the lymph system. There are two broad varieties of lymphoma, one called Hodgkin's disease and another called non-Hodgkin's lymphoma. Non-Hodgkin's lymphoma is more common in children than Hodgkin's disease.

**Malignancy:** A fully developed cancer.

**Metastatic cancer:** Cancer that has developed the ability to migrate from the original site of the cancer to other areas of the body.

**Neuroblastoma:** A highly malignant tumor that arises in the adrenal glands of very young children.

**Oncogene:** A gene that gets triggered during the evolutionary process of cellular cancer development. The oncogene is responsible for rapid growth and reproduction of abnormal cells which could develop into true cancer.

**Osteogenic sarcoma:** The most common form of bone cancer. It most frequently occurs around the knee and can spread to surrounding muscle and tissue.

**Parental exposure:** Contact by a parent with a toxic agent that carries potential harm to a fetus or young child.

**PCBs:** A synthetic chemical compound, polychlorinated biphenyls were widely used as a liquid insulator before being banned in the mid-1970's in this country. PCBs, a known carcinogen, do not break down and are still ubiquitous in our environment.

**Pesticide:** Any chemical substance used to kill pests - insects, rodents, molds, termites, spiders, worms and unwanted vegetation.

**Polycyclic Aromatic Hydrocarbons (PAHs):** A chemical compound produced by incomplete combustion. Known to cause cancer in animals, believed to cause cancer in humans.

**Radon:** Radon is a naturally occurring, colorless, odorless, tasteless, radioactive gas produced by the breakdown of uranium in rocks and soils.

**Residues:** Trace amounts of pesticides found in food products.

**Risk:** The probability of injury, disease or death under specific circumstances. In quantitative terms, risk is expressed in values ranging from zero (representing the certainty that harm will not occur) to one (representing the certainty that harm will occur).

**Risk assessment:** The determination of the kind and degree of hazard posed by an agent, the extent to which a particular group of people has been or may be exposed to the agent, and the present or potential health risk that exists due to the agent.

**Risk factor:** A characteristic (e.g., race, sex, age, obesity) or variable (e.g., smoking, occupational exposure) which might increase a person's chance of getting cancer. Risk factors are either lifestyle-related, environmental or genetic (inherited).

**Solvent:** A liquid capable of dissolving a material and holding it in solution. For example, paint remover is a solvent.

**Superfund:** The program administered by the Environmental Protection Agency involving solid waste emergency and long-term removal activities for hazardous waste sites in this country.

**Tolerance:** The legal limit on the amount of pesticide found in a particular food.

**Toxic:** Poisonous.

**Toxicology:** The study of the adverse effects of chemicals in living organisms.

**Tumor suppressor gene:** A gene which suppresses the development of cancer cells. This gene often becomes deactivated during the evolutionary process of cancer development.