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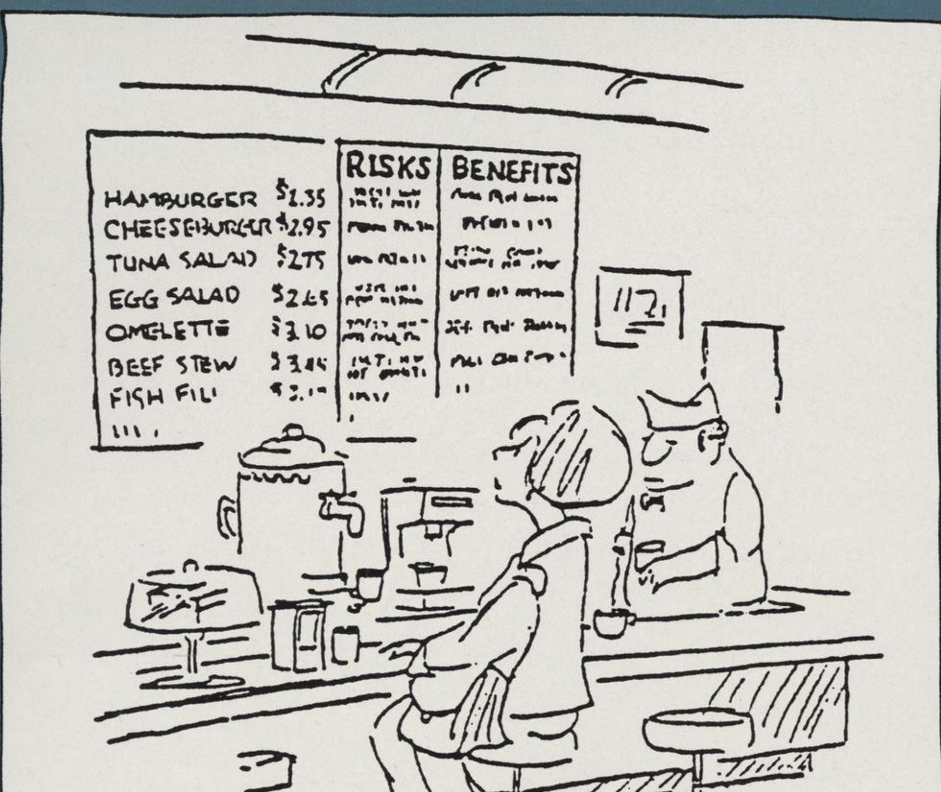
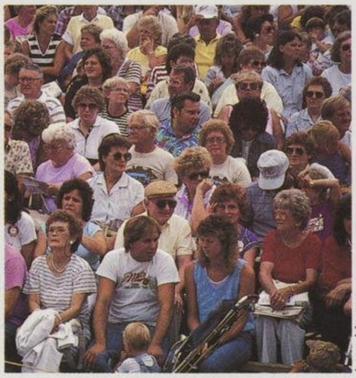
A matter of chance, A matter of choice

Living with environmental risk in Wisconsin



CONTENTS

How do we identify the risks posed by environmental pollutants and how do civic leaders reduce the chance that we might be harmed by those substances? These are the weighty matters a group of environmental researchers from the University of Wisconsin-Madison and managers from the Department of Natural Resources, the Department of Health and Social Services and the Department of Agriculture, Trade and Consumer Protection began to ponder collectively in 1986. The Interagency Risk Steering Committee has since sponsored conferences and other events to highlight progress and analyze setbacks in assessing and managing environmental risk. This publication is part of the continuing effort to share information with the people who make decisions about risks every day — you, your family, your friends and neighbors.



Jean Meyer

The human element

Although the impact of environmental contaminants on species other than *Homo sapiens* is considerable, this supplement will focus exclusively on human risk. Humanity is a critical link in the delicate, intricate chain of life on Earth. Through our own activities, we created the environmental risks we and other living creatures must contend with today. We alone can choose to lessen or eliminate those risks.

If you have any questions about the Interagency Risk Steering Committee, or if you would like to receive notices of our lectures and other events, please write Mr. Marty Kanarek, Director, Center for Human Systems, Institute for Environmental Studies, University of Wisconsin-Madison, 1087 WARF, 610 Walnut St., Madison WI 53705, or call (608) 262-9937.

Sponsors for "A Matter of Chance, A Matter of Choice": The Institute for Environmental Studies, the Robert M. La Follette Institute of Public Affairs, the Center for Natural Resources Policy and the Division of University Outreach at the University of Wisconsin-Madison; the Wisconsin Department of Health and Social Services; and the Wisconsin Department of Natural Resources.

Edited by Maureen Mecozzi

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People think all of life's risks and hazards are out of their hands. In fact, we choose to accept some environmental risks and avoid others.

By chance or by choice?

The way we view environmental risks depends on who we are and where we've been.

Wendy Weisensel

We face a lot of risks in our lives. We drive slick cars at 65 miles an hour (or more), maneuver canoes down treacherous rapids — for fun, no less — eat too much ice cream and not enough broccoli, and get kicked by Holsteins if we're dairy farmers or perhaps by our boss if we work in a different field.

We don't view these familiar activities as particularly risky. The benefits we derive from them (like a salary) make risky business worthwhile.

But our tacit acceptance of risks often disappears if we're exposed to risks we didn't choose. When benzene is found in the well water, or if solvent fumes foul the air we breathe on the job, we get concerned, annoyed, scared or downright mad. That's when the debate about how to protect ourselves from environmental risks begins to heat up.

The intensity of this debate frequently confounds scientists, environmental regulators and health professionals, who respond to queries about risk by citing death statistics that show it's more life-threatening to drive a car on Highway 10 in a snowstorm than to eat a salmon tainted with PCBs from Lake Michigan. Even if the statistics are correct, they're not necessarily comforting. We base our judgment of risk on our own personal blend of facts, experience and common sense, not on mortality tables. The experts may feel our "logic" isn't logical, but it sure makes sense to us.

To find out why environmental risks rank high among society's concerns, we need to take a look back, into the past.

Risk, American style

"There's been a massive change in our country's health agenda since the turn of the century," says William Lowrance, a scientist from Rockefeller University in New York who studies environmental risk. Today, most Americans can expect to live past 70. During the early years of the 20th century, when typhus, cholera, diphtheria and influenza flourished in the absence of basic sanitation practices, the average American's life expectancy was 45. Given our advances in health care, it's understandable that we're concerned about lifetime risks from small quantities of groundwater contaminants and similar environmental hazards.

But we pay a price for living longer, and that cost colors our perceptions of environmental risks. The longer we live, the more we are exposed to pollutants in drinking water, air and food. Health professionals are not certain how many deaths are caused by environmental toxicants, but they do know that some of these toxins can cause cancer, birth defects and other illnesses in humans. This question alone — does a toxicant cause cancer? — is enough to keep interest in environmental issues at an all-time high.

The seed of our current concern about environmental risks was planted in the post-World War II era, when we increased the production and use of industrial chemicals with unknown effects on humans or the ecosystem. And don't forget the popular chemical products most everyone purchased in the 1950s to make

Dean Tvedt

Colorfully packaged and liberally used, DDT compounds were once a staple for agricultural and home "pest" control. Even today, we buy products without understanding the environmental risks of their use.

household chores a breeze: caustic drain cleaners, stain removers and bug sprays.

It wasn't long before we discovered that some of the chemicals we relied upon spread through the environment and crept into the food chain. When we realized we were the last link in that chain, our love affair with chemicals began to crumble. Rachel Carson's indictment of the insecticide DDT in her 1962 book *Silent Spring* was the spark that ignited the environmental movement in the United States.

In the 1970s, we passed strong national laws to clean up the smoke and the smells and the gunk. We thought our job was done — until we realized we'd tackled the obvious criminals, only to leave behind some elusive toxic fugitives. We don't know as much about these substances (often we can't see or smell them) as we do about the more tangible forms of pollution; their stubborn residue dominates and complicates our current national environmental policy. And if that's not enough to worry about, we can extend our concern to the new environmental risks, like pesticides in drinking water, that have been detected with increasingly sophisticated field sampling and laboratory techniques.

The social activism of the 1960s and 1970s left a legacy that is evident today in public debates about environmental problems. We demand to be more involved in decision-making; we challenge the experts. We no longer accept the paternalistic "Father knows best" attitude of government: We still expect government to set policies to protect us from environmental risks, but we want more say in how those policies are made.

The greenhouse effect and the destruction of rain forests adds a global dimension to our environmental concerns. But the stunning knowledge that each day we contribute to our own demise fuels interest in the environmental risks we face and continue to create.

Educated guesses

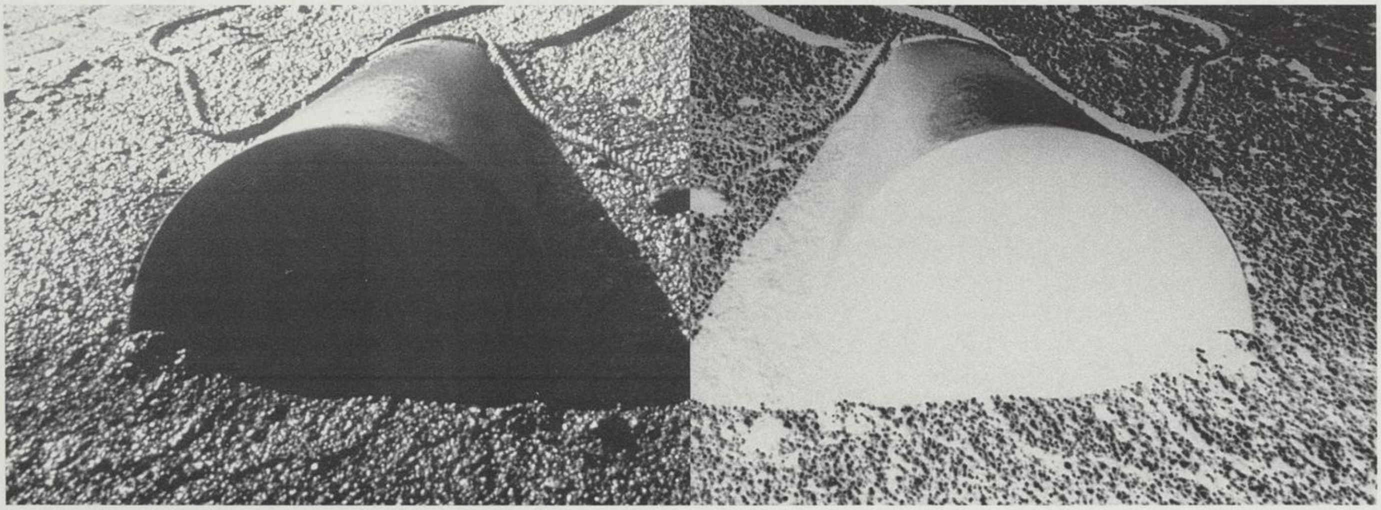
In the absence of facts to measure a risk adequately, the societal judgments we must make to ensure human safety become tougher and more open to disagreement. That's why we need to examine and understand our own perceptions of risk — to be aware of the biases that color the concerns we have about environmental issues.

Peter M. Sandman, director of the environmental communication research program at Rutgers University in New Jersey, has studied people's perceptions of risk (see sidebar). Try applying his concepts to a typical environmental risk many Wisconsinites face: eating sport fish contaminated with PCBs or mercury.

When Wisconsin started to issue advisories about the hazards of eating contaminated fish in 1978, skeptical anglers boasted: "I've been eating fish from this lake all my life and I never once got sick from 'em." Using Sandman's descriptive terms, it's apparent that catching and eating fish was something these anglers did frequently (familiar) for fun; they chose to do it (voluntary, self-controlled); and they believed PCBs and mercury wouldn't make them sick (not fatal).

Pregnant women were also a primary audience for the fish consumption advisories because human fetuses are extremely sensitive to PCBs and mercury. Many women who were interviewed said they did not fish (unfamiliar) but ate sport fish caught by others. They were not responsible for contaminating the fish (unfair, uncontrollable). The health risks to the fetuses were hard to identify (undetectable) and uncertain (dread).

Each group's perception of the risk helped form public policy on the environmental issue of contaminated fish. Wisconsin's health and environmental professionals decided — with public support — to offer stricter warnings about eating fish to pregnant women. Health and environmental officials now advise citizens twice a year which sizes and species of sport fish contain contaminants, the amount of contaminants in the fish, where the fish are located, and what individuals can do to minimize their risk (eat leaner fish with lower levels of contaminants, don't eat sport fish, etc.) The information is based on an extensive fish sampling program to monitor contaminant levels.



Environmental Protection Agency

More drastic measures could have been taken, of course — if people wanted it that way. Officials in New York closed a sport fishery because of contamination problems, but the outcry from angry sport anglers forced the state to allow fishing again.

Wisconsin's fish advisory hasn't stopped the debate about the risks of eating contaminated sport fish, only changed it. Today, some people are concerned that the federal food safety standards on which we base the fish advisory are inadequate to protect human health. That sentiment could change how we choose to protect ourselves from tainted fish in the future. But, as Peter Sandman says, "How people perceive risk determines how they respond to it — and this in turn sets public policy."

Nothing in life is risk-free. But we can examine our perceptions of the environmental risks we face and make decisions on how we choose to live with them.

No one can blame us, then, for deciding to eat the double-dip rocky road cone instead of the steamed broccoli. These days, we never know what's in the broccoli. And after all, it's our choice.

Wendy Weisensel leads the environmental information unit in DNR's Bureau of Information and Education. John Cain, soil specialist in DNR's Office of Technical Services, provided additional research for this article.

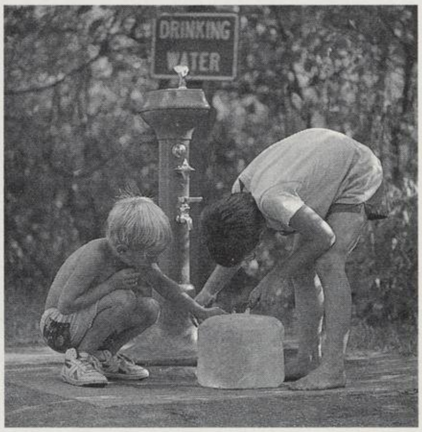
Reacting to risk

Peter Sandman and other environmental communications researchers have examined how people react to environmental risks. By reviewing news coverage, interviewing people facing risks, assessing government communications and delving into human psychology, the researchers developed a list of factors people consider in forming opinions about risks they face. When gauging how people are likely to react, risks that can be described using terms in the left column are less upsetting and less scary than risks labeled with the terms in the right column.

LESS RISKY	MORE RISKY
Voluntary	Involuntary
Familiar	Unfamiliar
Controllable	Uncontrollable
Fair	Unfair
Not memorable	Memorable
Not dread	Dread
Chronic	Acute
Diffuse in time & space	Focused in time & space
Not fatal	Fatal
Immediate	Delayed
Natural	Artificial
Individual mitigation possible	Individual mitigation impossible
Detectable	Undetectable

Environmental health risks in Wisconsin

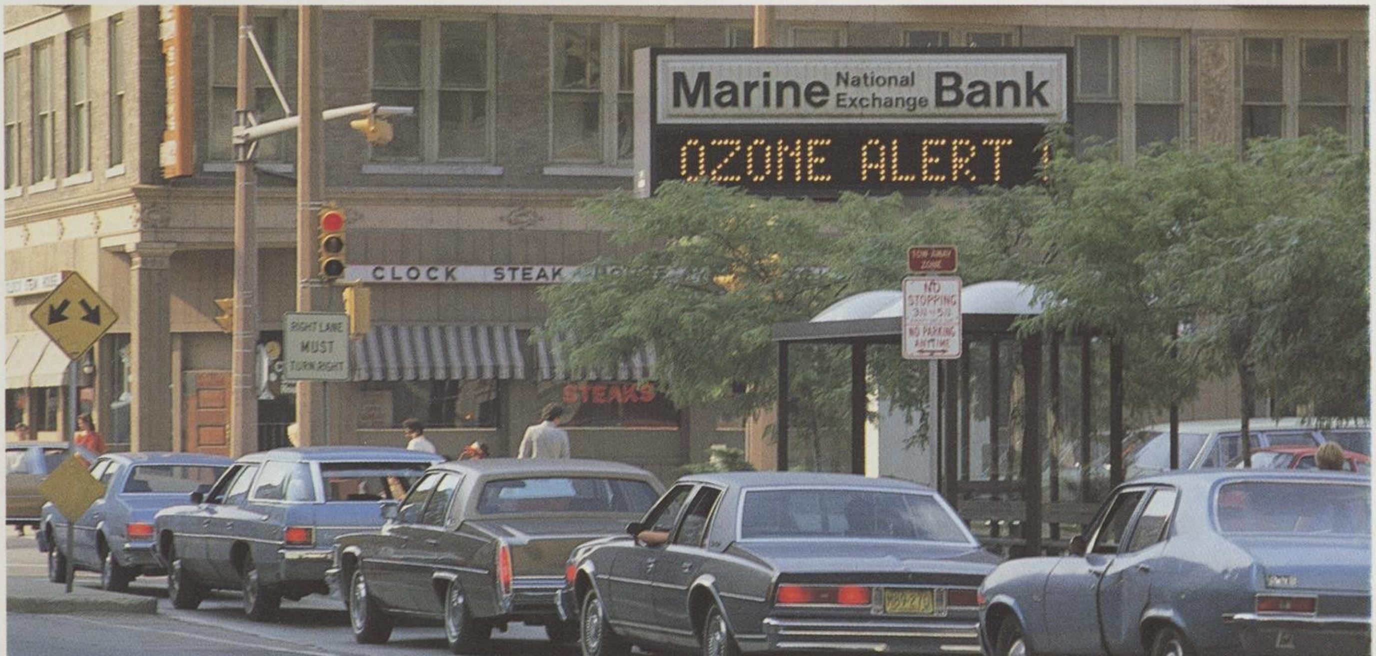
The substances listed below are among those most often cited as potential environmental health risks in Wisconsin. For emergency information about these substances, contact local poison control centers or a local hospital. If you are concerned about your exposure to these substances, the best person to assess your health risk is your physician or health clinic. City and county health officials will also know who has local expertise to address your health concerns.



Robert Queen

NAME	SOURCE OF EXPOSURE	HEALTH RISK	CORRECTIVE ACTION
air toxicants	Inhaled at home, at work and from factories.	wide-ranging, from respiratory irritations to cancer	New laws limit emissions of more than 400 suspected air toxicants.
airborne particles	Inhaling soot and fine ashes from incomplete combustion.	eye and throat irritation, lung damage, respiratory cancer in occupational exposures	Regulated and monitored nationwide.
algal toxins	Direct contact in lakes where toxic algae are present or by drinking water from these lakes.	skin irritations, flu-like symptoms, gastrointestinal upset	Don't swim in lakes with large algal accumulations; prevent excess nutrient loadings by controlling water pollutants.
arsenic	Found in air, food and water. Metal smelting, pesticide manufacture and use, treated lumber, glass, paints, dyes, and the leather-tanning process are common sources.	vomiting, nerve damage, liver and kidney damage among metal and pesticide workers, lymph system and skin cancers	Restricted in drinking water, regulated as a hazardous waste and less frequently used as a pesticide.
asbestos	Asbestos exposure occurs when people inhale the fibers in the air of schools, hospitals, commercial buildings and homes where the mineral was used for insulation, roofing, wallboard and fireproofing.	lung irritation, asbestosis, bronchitis, cancer	Seal exposed asbestos or have it professionally removed.
bacterial contamination	Improper well construction, location or maintenance; failing septic systems; and poorly managed animal wastes contaminate drinking water. Also, people may have direct contact at swimming beaches and pools.	Stomach upset, cramping, mild fevers and diarrhea. Water-borne bacterial diseases can also cause more severe illnesses.	Check that your well meets health codes, maintain septic systems, manage animal wastes and test wells at least once a year for signs of contaminants.
carbon monoxide	A by-product of the incomplete combustion of many fuels. Accumulates in closed spaces.	When inhaled, it replaces oxygen in the blood, causing asphyxiation.	Proper ventilation of homes and garages; have gas furnaces checked annually. Never run a motor vehicle or portable fuel heater in a closed space.
dioxin	Inhaled and ingested from air, water and soil. Dioxin is a by-product of pesticide manufacture, burning of chlorinated wastes and pulp and paper manufacture.	Wide range of responses from skin rashes to birth defects to fatal poisoning.	Nationwide testing program for dioxin in pesticide manufacture, formulation and use.
formaldehyde	Found in air and water. Used in plastics and building materials like wall paneling and insulation. Also used as a chemical preservative, in textiles and in fungicides.	eye, nose, throat, lung, and skin irritant	Formaldehyde is less frequently used as a biological preservative and its uses in building materials and insulation have been restricted.

Dean Tvedt



Dean Tvedt

(*top*) Sampling furnace ashes and flue gases to estimate potential air pollution.
(*bottom*) Ozone warnings cause some people to change summer plans in parts of southeastern Wisconsin.

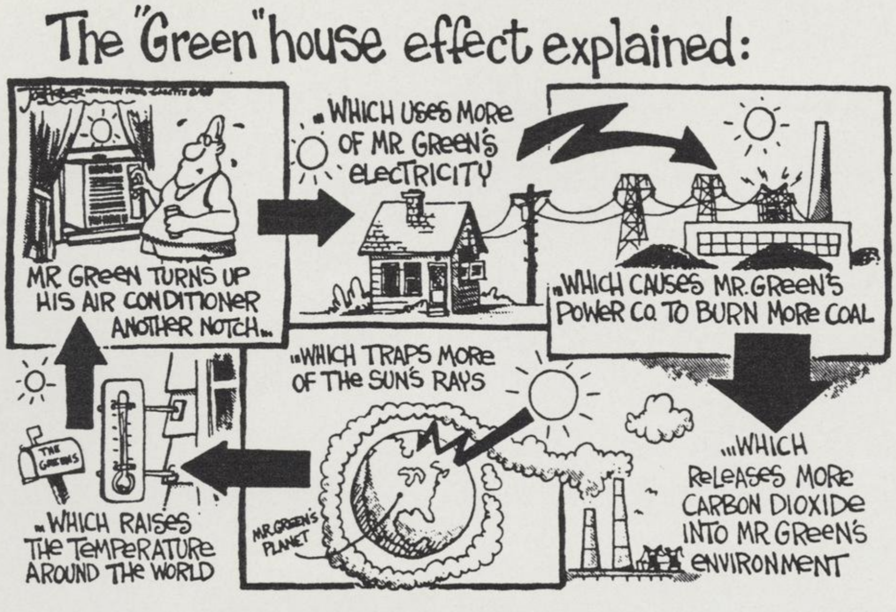
Dean Tvedt

Dean Tvedt

(*top*) Careful application of pesticides (including wearing protective gear) minimizes risks to growers and consumers.
(*bottom*) Barrels dumped in sandy soil on a Mississippi River island are sampled for signs of PCBs.

NAME	SOURCE OF EXPOSURE	HEALTH RISK	CORRECTIVE ACTION
indoor air pollution	Most commonly caused by smoking or using paints, finishes and household chemicals that evaporate in poorly ventilated rooms. Poor air circulation can be a real concern in energy-efficient homes and buildings.	eye and respiratory distress	Inspect houses and ensure sufficient exchanges of fresh air. Also check that appliances and furnace are properly vented. Use chemicals in well-ventilated areas.
lead	Found in air, water and food. Car exhaust, lead paints, lead solders on water pipes, in enamel glazes, residues in soil and food are common sources.	anemia, kidney damage, nervous system damage	Minimize exposure by: removing lead paints around the home; running tap water in the morning for a few minutes before using; testing pottery glazes for lead; and ensuring that children do not play near main thoroughfares where car exhausts settle on playgrounds.
mercury	In air, water and food. Used in chlorine production, scientific and industrial instruments, pesticides, batteries and contraceptive creams. Eating contaminated fish is a source of exposure.	irritability, nervousness, depression, kidney damage, liver damage, nervous system damage, fetal abnormalities	Industrial controls over mercury wastes; testing fish for signs of contamination.
nitrates	Contaminated drinking water if liquid runoff, fertilizers, wastewater, refuse or decaying plants carry nitrates into well water.	Primarily a health concern for bottle-fed infants less than six months old. Nitrates can form nitrites, which interfere with normal hemoglobin/oxygen transfer creating the so-called "blue baby" syndrome. Cause stomach and bowel upset in adults.	Water can be readily and inexpensively tested for signs of nitrates. Testing kits are available from private testing labs and the State Lab of Hygiene. Proper zoning and construction minimize nitrate contamination by separating wells from potential sources of contaminants.
nitrogen oxides	Most common contact is from inhaling engine exhaust and emissions from unvented gas stoves.	respiratory illness and lung disease	Regulated and monitored nationwide; proper ventilation of kitchen exhaust fans.
noise	Industrial noises made by engines, manufacturing equipment, construction equipment; community noises from traffic, emergency sirens, lawn mowers, farm machinery; occupational noises from manufacturing and office equipment; home noises from telephones, televisions and radios and stereos, and home appliances.	hearing loss, feeling of isolation, stress, fatigue, vertigo and loss of balance, irritability	Use protective ear muffs and plugs.
odors	Natural odors from decomposition, organic wastes, human wastes; industrial odors from petroleum manufacturing, chemical manufacture, pulp and paper mills, coke ovens, coal burning, steel industry, food processing, meat and fish processing, tanneries, and other industries.	Highly variable with each individual. Responses can include loss of appetite, nausea, vomiting, insomnia, stress, aggravation, respiratory distress or triggering of allergic responses.	Some odors can be lessened by complete burning, absorption, masking, counteracting, dilution, eliminating the odor source and chemical or biological treatments.
ozone and smog	Caused by hydrocarbons mixing with sunlight on warm days.	respiratory distress— breathing difficulty, asthma, eye irritation, nasal congestion	Regulated and monitored nationwide.

NAME	SOURCE OF EXPOSURE	HEALTH RISK	CORRECTIVE ACTION
pesticides	In air, water and food. Pesticides not absorbed by plants, soil or soil bacteria can be blown away by wind or seep into groundwater and drinking water supplies. People who formulate, store, transport and commercially apply pesticides have greater exposure to these compounds. Aside from home use of pesticide products, the general public is primarily exposed to pesticides when private wells are located near agricultural fields where pesticides are applied or near businesses where pesticides are commercially mixed and stored.	In general, no adverse health effects are expected from consuming water containing smaller amounts of pesticide than those listed in state health standards. Symptoms of pesticide exposure can range from headaches, dizziness, stomach and intestinal upset to spasms, convulsions or heart attacks. Note: No such symptoms have been recorded in Wisconsin. Also, some pesticides are suspected carcinogens.	Health advisory levels and groundwater standards have been set for many pesticides used in Wisconsin. State standards regulate how pesticides are commercially stored, used and handled. Many pesticides have been banned due to their toxicity.
polychlorinated biphenyls	Contaminated fish, other food and water. Originate from spills, industrial fluids, coolants, electrical transformers, capacitors, lubricants, coatings, sealants, fluorescent lighting, some well pumps. Residual burning and spills release PCBs into the environment.	fatigue, vomiting, skin irritations, still births	Banned in pesticides since 1970; wastewater discharge standards set in 1977; banned in manufactured goods since 1979. Residues are monitored in fish and wildlife species near industrial areas. Standards for PCBs in surface waters were set in 1989.
radium	Drinking water drawn from groundwater aquifers containing natural radium.	potential for cancer from a lifetime of exposure	Water softeners remove radium. Public water supplies are blended to reduce radium levels.
radon	Inhaled when this natural radioactive gas seeps from soils or water into basement and foundation cracks.	potential for lung cancer	Inexpensive monitors can check radon exposure in your house. Corrective actions include increasing ventilation and air circulation where radon levels are high.
sulfur dioxide	Airborne. Contamination occurs largely from burning coal and oil fuels. A primary component of acid rain.	respiratory damage, eye irritation, aggravation of other lung conditions	Monitored and regulated nationwide.
volatile organic chemicals (VOCs)	Direct contact with chemicals or with contaminated air, water or land. These commonly-used chemicals rapidly evaporate when exposed to air. VOCs are components of cleaning compounds and liquefying agents used in fuels, grease removers, solvents, polishes, cosmetics, drugs, spot removers and dry cleaning solutions. VOCs are often used at airports, engine repair shops, service stations, paint shops, electronics firms, machine and print shops and in household products. When VOCs are dumped or spilled, they can percolate into groundwater.	Many VOCs are suspected to cause cancer, liver and nerve damage.	Test wells for signs of VOCs if you suspect contamination.
water-borne toxicants	Surface water, possibly in drinking water drawn from surface water, possibly from eating fish and game living in waters receiving toxic discharges.	No health problems from human exposure to surface water toxicants have been documented in Wisconsin. Water-borne toxicants are present in minute amounts. Some of these compounds cause cancer.	DNR has developed standards for measuring water-borne toxicants.



Joe Heller, Green Bay Press-Gazette.

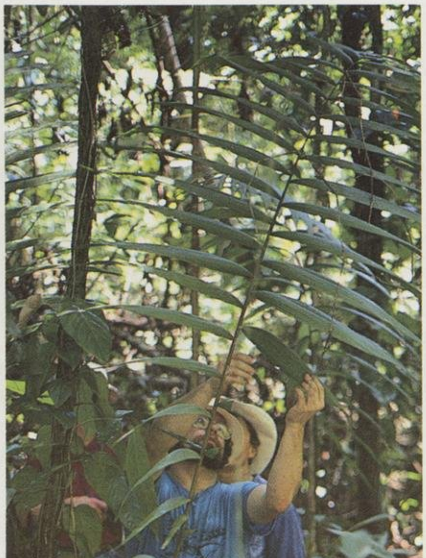
Making the connection

Ecologist Barry Commoner used three expressions in the late 1960s and early 1970s to capsulize how human activities on land, air and water invariably link together to change natural conditions: "Everything is connected to everything else," "There is no free lunch," and "The whole is greater than the sum of its parts."

Recent global research shows some environmental risks we face in Wisconsin indeed follow these maxims despite the fact that our own actions rarely seem to have global consequences.

Think about the risks involved in cutting down one tree to clear space for a garden. One must safely use a chain saw, axe or saw; avoid felling the tree on people or houses; carefully split, stack and transport the logs or chip up the branches for mulch.

The same action on a larger scale presents larger risks. Last year, fast-food hamburger chains in the United States used 300 million pounds of beef imported from Central America. Grazing land in Central and South America is created mainly by slashing and burning the native rain forest. In fact, ecologists have calculated that



Nathan Kraucunas, Milwaukee Public Museum

Researchers studying the tropical rain forest know our actions at home have worldwide consequences.

55 square feet of rain forest are cleared to produce the beef needed for each quarter-pound burger. Clearing and burning each 55 square-foot swath of forest releases 500 pounds of carbon dioxide into the atmosphere.

Tropical deforestation worldwide continues at a dizzying pace, no longer giving us the luxury of measuring environmental risks one tree or even one tract at a time. Each year, nearly 20 million acres of tropical forest are logged or cleared for farms and pasture. Millions of trees that used to absorb carbon dioxide and release oxygen are now being cut down and burned, releasing a billion tons of carbon into the air each year — one sixth of all the carbon dioxide produced by human activities.

How serious is the environmental risk? We're not certain . . . yet. We know that atmospheric carbon dioxide acts as the Earth's thermostat, keeping our temperatures in a relatively narrow range and ensuring steady water recycling from plants to groundwater and surface water to evaporation to precipitation. Atmospheric carbon dioxide acts like a huge greenhouse, passing energy in the form of light from the sun to Earth

Dry-cleaning fluids and spot removers contain volatile organic compounds (VOCs), some of which are suspected carcinogens. For many, rubbing out the social embarrassment caused by a mustard stain on the collar is worth the risk of using VOCs.

but trapping radiated heat. As carbon dioxide concentrations increase in the upper atmosphere, the "window panes" around the Earth's "greenhouse" thicken. This could slowly warm the planet.

Global risk researchers are warning us that long-lasting consequences, which start from seemingly subtle actions like raising the normal temperature a few degrees, are not well understood.

University of Wisconsin-Madison meteorologist Francis Bretherton told a national newsmagazine recently that our simulations of this greenhouse effect are still too crude.

"We haven't determined all the important factors and we haven't accounted for how and when these factors will interact," Bretherton noted. "We have a general idea of what will happen, but we don't know the details. Unfortunately a lot of the things that are important to humans, such as rainfall patterns, sea levels and hurricanes are locked in those details."

Other activities pose equally frightening risks. Consider chloroflurocarbons (CFCs), used for many years in automobile and building air conditioners, spray cans and in the manufacture of foam packaging. As these lighter-than-air gases filter up five to seven miles into the stratosphere, they react with a protective shield of ozone gas. Each molecule of a CFC can destroy thousands of ozone molecules that filter harmful ultraviolet radiation from sunlight.

Similarly, environmental risks from continental indiscretions like acid rain, erosion, and oceanic dumping of sludges and infectious wastes eventually drift back to land in search of a solution.

What sorts of actions can we take in the Midwest to reduce these global risks?

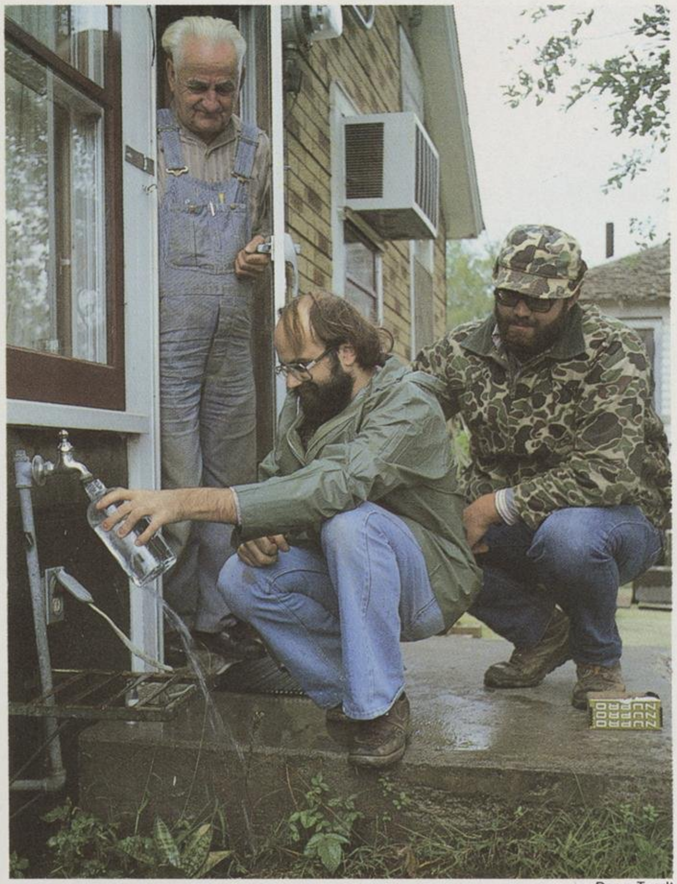
• Recognize that we can't keep mortgaging the future by ignoring current environmental problems.

• Read more about regional and global environmental issues that most interest you. Many organizations produce literature and newsletters that explain these issues and track worldwide progress in resolving them. For names and addresses of organizations, consult a good reference like the *Conservation Directory* published annually by the National Wildlife Federation.

• Let your legislators know that global issues like tropical deforestation, waste recycling, ocean preservation and soil conservation are important to you.

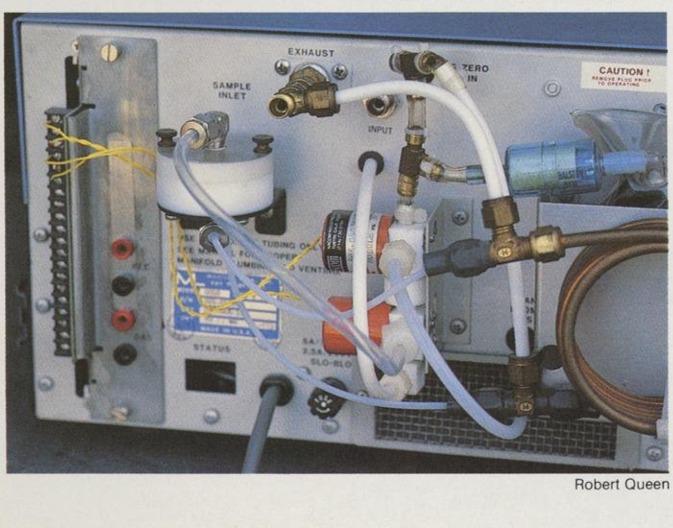
• Work at becoming a discriminating consumer — examine your own lifestyle, recycle wastes, evaluate which environmental risks you are willing to accept, and teach yourself and your family to read labels carefully. Purchase long-lasting products made with simpler ingredients.

(***top***) Testing drinking water for toxicants on St. Feriole Island in the Mississippi River.
(***middle***) Be careful. Unvented kerosene and propane heaters produce carbon monoxide, a deadly gas, which can build up in closed spaces.
(***bottom***) Monitoring the quantity of sulfur dioxide in the air. SO_2 irritates the lungs and is one of the primary components of acid rain.



Dean Tvedt

Jay Salvo. UW Photographic Media Center



Robert Queen

The following agency contacts are familiar with statewide programs and laws for the environmental health concerns listed below.

DATCP	—	Department of Agriculture, Trade and Consumer Protection
DHSS	—	Department of Health and Social Services
DILHR	—	Department of Industry, Labor and Human Relations
DNR	—	Department of Natural Resources
DOA	—	Department of Administration
EPA	—	Environmental Protection Agency (federal)

Agent Orange	Henry Anderson, MD, DHSS (608) 266-1253
Air monitoring	Julian Chazin, DNR (608) 266-1902 Tom Anderson, DHSS (608) 266-7089
Air pollution	DNR Bureau of Air Management, (608) 266-7718 *health effects of air pollutants,* Bill Otto, DHSS (608) 266-9337
Air toxicants	DNR Bureau of Air Management, (608) 266-7718 Bill Otto, DHSS (608) 266-9337
Algal toxins	DNR Bureau of Water Resources Management, (608) 267-7610 local health departments
Arsenic	*in drinking water,* DNR Bureau of Water Supply, (608) 266-0821 David Belluck, DHSS, (608) 266-7480
Asbestos	*removal in commercial, industrial and institutional buildings,* Joe Brehm, DNR, (608) 267-7541 *inspecting small businesses and certifying asbestos abatement services,* Terry Moen, DHSS, (608) 266-8579 *monitoring asbestos in public buildings,* DILHR Safety and Buildings Division, (608) 266-3151 *asbestos health information and removing asbestos in schools,* Bill Otto, DHSS, (608) 266-9337
Bacterial contamination	DNR Bureau of Water Supply, Private Water Supply Section, (608) 266-0821 DNR district water resources staff; county sanitarians
Cancer clusters	Beth Fiore, DHSS, (608) 266-6914

David L. Sperling

A clean sweep of attics, basements and garages shows we all use lots of products containing hazardous solvents.

Cancer prevention	Pat Remington, MD, DHSS, (608) 267-3835 Cancer Information Center, 1-800-4-CANCER
Chronic disease clusters	Beth Fiore, DHSS, (608) 266-6914
Coal	Shelley Moore, DOA, (608) 266-7375
Dioxin	*testing*, EPA Chicago office, (312) 886-1491 *handling dioxin-contaminated wastes*, DNR, (608)266-5741 *dioxin in surface water*, DNR Bureau of Water Resources Management, (608) 267-7610 *contaminated property*, John Olson, DHSS, (608) 266-0923
Drinking water	DNR Bureau of Water Supply, (608) 266-0821 David Belluck, DHSS, (608) 266-7480
Emergency response	Tom Anderson, DHSS, (608) 266-7089
Fish toxicants	*fish sampling and consumption advisories*, Lee Liebenstein, DNR, (608) 266-0164 *health considerations*, John Olson, DHSS, (608) 266-0923
Food toxicants	Steve Steinhoff, DATCP, (608) 266-7260
Formaldehyde	*workplace and mobile home testing as well as health information*, Bill Otto, DHSS, (608) 266-9337
Groundwater Standards Program	DNR Bureau of Water Resources Management, (608) 267-7610 David Belluck, DHSS, (608) 266-7480
Hazardous waste sites	DNR Environmental Response and Repair Section, Mark Giesfeldt, (608) 267-7562 Meg Ziarnik, DHSS, (608) 266-8154
Herbicides (see Pesticides)	
Incinerators	Don Wichert, DOA, 266-7312
Indoor air pollution	Julian Chazin, DNR, (608) 266-1902 Tom Anderson, DHSS, (608) 266-7089
Insecticides (see Pesticides)	

Industrial hygiene	Joe Schirmer, DHSS, (608) 266-5885 Terry Moen, DHSS, (608) 266-8579
Insulation	Bill Otto, DHSS, (608) 266-9337
Lead	*in drinking water,* DNR Bureau of Water Supply, (608) 266-0821 Joe Schirmer, DHSS, (608) 266-5885
Mercury	*health questions about mercury poisoning,* John Olson, DHSS, (608) 266-0923 *mercury contaminant testing in fish,* Lee Liebenstein, (608) 266-0164
Molds	Tom Anderson, DHSS, (608) 266-7089
Nitrates	*in drinking water,* DNR Bureau of Water Supply, (608) 266-0821 David Belluck, DHSS, (608) 266-7480
Nitrogen oxides	DNR Bureau of Air Management, (608) 266-7718
Noise	primarily handled by local community action and ordinance. Federal laws are administered by the Environmental Protection Agency.
Occupational health consultation	Terry Moen, DHSS, (608) 266-8579 DILHR Safety and Buildings Division, (608) 266-3151
Occupational reproductive risk	Laurie Lifson, DHSS, (608) 266-2074
Odors	primarily handled by local ordinance and action. DNR can conduct odor survey to document community concerns about odors. Most odor complaints are resolved through negotiation with the odor source.
Ozone and smog	DNR Bureau of Air Management, (608) 266-7718 or call your local health department.
PBBs (polybrominated biphenyls)	Henry Anderson, MD, DHSS, (608) 266-1253
PCBs (polychlorinated biphenyls)	*health effects,* John Olson, DHSS, (608) 266-0923 *contaminant monitoring in fish,* Lee Liebenstein, DNR, (608) 266-0164 *contaminant monitoring in wildlife,* Sarah Hurley, DNR, (608) 267-7472 *private water supplies,* Bill Furbish, DNR, (608) 266-9264
PCP (pentachlorophenol)	Henry Anderson, MD, DHSS, (608) 266-1253
Pesticides	*groundwater standards,* DNR, (608) 267-9350 *tank standards,* DILHR, (608) 266-8981 *agricultural uses,* Nick Neher, DATCP, (608) 266-7130 *health standards,* David Belluck, DHSS, (608) 266-7480
Radioactive waste	Jim Mapp, DOA, (608) 266-8020
Radiological consultation	Larry McDonnell, DHSS, (608) 273-5181 Teri Vierima, DHSS, (608) 273-6437
Radium	DNR Bureau of Water Supply, Public Water Supply Section, (608) 266-0821 DHSS Radiation Protection Section, (608) 273-5180
Radon	Larry McDonnell, DHSS, (608) 273-5181 DHSS Radiation Protection Section, (608) 273-5180 DNR Bureau of Water Supply, (608) 266-0821 *policy information on the Radiation Protection Council,* Teri Vierima, DHSS, (608) 273-6437
Spills	Ted Amman, DNR, (608) 266-2857 Meg Ziarnik, DHSS, (608) 266-8154
Sulfur dioxide	DNR Bureau of Air Management, (608) 266-7718
VOCs (volatile organic compounds)	DNR Bureau of Water Supply, (608) 266-0821 Tom Anderson, DHSS, (608) 266-7089
Water-borne toxicants	DNR Bureau of Water Resources Management, (608) 267-7610 David Belluck, DHSS, (608) 266-7480
Water pollution	DNR Bureau of Water Resources Management, (608) 267-7610
Well contamination	DNR Bureau of Water Supply, (608) 266-0821
Wood use	Dan Moran, DOA, (608) 266-1067
X-ray exposure	Henry Anderson, MD, DHSS, (608) 266-1253

"...THE D.N.R. FEEDS ME P.C.B... THE F.D.A. FEEDS ME E.D.B... THE E.P.A. FEEDS ME D.D.T. AND NOW IRRADIATED FRUIT!! WHAT EVER HAPPENED TO THE GOOD OLD DAYS OF SACCHARIN AND CIGARETTES?"

You can learn a lot from a rat

. . . but not everything. Environmental health researchers use a variety of methods to determine "how much is too much."

Marty Kanarek

"All things are poisons, for there is nothing without poisonous qualities. It is only the dose which makes a thing a poison."
—Paracelsus, 1493-1541.

Meet Sodium Sal and his pal, No-salt Walt. Sal loved salt, but Walt couldn't stand it. Finally, at the end of a long ocean voyage, the two elderly sailors made a deal: Sal told Walt he would refrain from eating or drinking anything containing salt or sodium for a month if Walt would eat a pound of salt in an hour. They shook on it. Three hours later Walt was dead; 30 days passed, and Sal was buried beside him.

Sodium is an essential element for human life; too much or too little can be fatal. The key to The Mystery of the Two Old Salts is the quantity, or dose, of the salt the sailors ingested. Toxicologists — scientists who study the harmful actions of substances on biological tissue — search for similar keys. The question they seek to answer is: How much is too much?

Environmental health research is used to estimate the degree of harm people will face if exposed to a particular level or quantity of a substance. This is called *risk assessment*. Scientists and governmental agency employees use risk assessment to determine the hazards that might result from human activities — for example, the risks to human health and the environment from the production and use of industrial chemicals. *Risk management* is the process of deciding what to do after a risk has been identified and includes balancing the economic, social and political costs of reducing a particular risk. People from all walks of life can and should be a part of the risk management process.

Making contact

How do risk assessors find out how much is too much? They begin by *defining the conditions of exposure*, or determining how people come in contact with a toxic substance and how much of it they are exposed to.

People can be exposed to toxic substances in all kinds of ways. Lead is a good example: Auto exhaust, old paint, certain pottery glazes, discarded batteries and various industrial processes all contain lead, which can turn up in the air, water, soil and plants. Humans can ingest lead by breathing, eating, or drinking; young children are often exposed to lead by chewing on toys painted with lead-based paint or eating old paint peeled off a wall.

Once in the body, a toxic substance can be absorbed by tissues or organs; excreted by exhaling, sweating, urinating or defecating; detoxified by the liver; or perhaps transformed into a more toxic substance. Each tissue or organ is sensitive to certain substances. Researchers take samples of hair, urine, blood, mother's milk or tissue to measure the amount of the toxic substance the body has absorbed and find out which organs are affected the most.

Today, scientists can measure minute concentrations of a substance in human or animal tissue, fluids, plants, air, water or soil. The concentration is expressed in parts per million (ppm), billion (ppb), trillion (ppt) or smaller. A part per trillion, for instance, is about equal to one grain of salt dissolved in an Olympic-sized swimming pool of water.

The ability to detect tiny quantities of contaminants presents unique problems to science and society. We can now measure concentrations of chemicals with qualities we are unsure about; merely detecting a contaminant does not provide the information we need to decide if the substance could be harmful to people. And although we strive to eliminate all contaminants from the environment, many contaminants occur naturally. The important goal is to determine what levels of specific contaminants pose an unacceptable risk to human health and to find ways to decrease those levels.

Where does it hurt?

After risk assessors find out how people have been exposed to a substance and how much of it they've been exposed to, they're ready to *identify the adverse effects* of the substance.

Human reactions to toxic substances range from irritating to life-threatening ailments. Some reactions are acute; they show up immediately after exposure, like a skin rash caused by touching a paint stripper. Remove the substance and the acute reaction is lessened or may stop altogether.

Chronic effects from exposure to toxic substances persist long after the initial contact. Some chronic diseases appear only after a lengthy incubation period of several years or more. Cancer, birth defects and infertility are examples of chronic conditions that may be caused by exposure to environmental contaminants.

Environmental health scientists conduct experiments to compile evidence on the potentially harmful effects of a substance. Human volunteers may be used in some experiments: Grain silo workers volunteered for an experiment conducted by the University of Wisconsin-Madison Department of Preventive Medicine in which they were exposed to different components of grain dust. The experiment helped determine the causes of allergies and other conditions that habitually plague grain workers. For ethical reasons, humans are never used to test carcinogens or any other substances that researchers believe might result in serious or irreversible effects.

Animals — mice, rats, hamsters, rabbits, guinea pigs, dogs and monkeys — are the subjects of numerous toxicology tests. The animals are exposed to controlled amounts of a substance in their feed and water or through the air they breathe in experiments that last for a few weeks or as long as two years. During this time, the animals are monitored for changes in weight or behavior; blood and urine samples are examined as well. Finally, the animals are humanely put to death and dissected to see if they have developed cancer or other chronic effects. This information is compared to that collected from a "control group" of animals not exposed to the substance. Animal tests are expensive and at times controversial, but they are often the only tool researchers have to gather accurate data without using human subjects.

Unfortunately, people may inadvertently become guinea pigs. Environmental health hazards frequently come to light when workers in a particular occupation suffer from similar symptoms or diseases after they've been exposed to the same substances on the job. Cancers and other diseases associated with asbestos, coal, arsenic, nickel and vinyl chloride first appeared in workers exposed to high levels of the substances; those problems may also affect people in the community who are exposed to much lower doses of the contaminants. By reviewing exposure records and examining the results of industrial or other accidents involving a substance, occupational physicians can add an important piece to the risk assessment puzzle.

Epidemiological studies — investigations of the distribution and causes of illness and disease in human populations — are valuable sources of information for risk assessment. However, investigating the effects of smaller doses of environmental substances on a wide segment of the population is difficult, expensive and time-consuming. Large groups of people — sometimes a million — must be examined to gather accurate data. Because a long time elapses between exposure to a substance and the effects of some cancers and diseases, the study must continue over many years. Some chronic illnesses, such as cancer and heart disease, may be caused by a combination of other factors besides the environmental substance in question. For instance, in a lung cancer epidemiology study, researchers need to know if a subject smokes cigarettes; is exposed to "second-hand" smoke; is exposed to asbestos, arsenic, nickel, hydrocarbons or radioactivity on the job; lives in an area with severe air pollution; is under a great deal of stress . . . and

Jim McEvoy

that's just the beginning. For any one cancer, 20 or more factors must be studied in addition to the suspected contaminant.

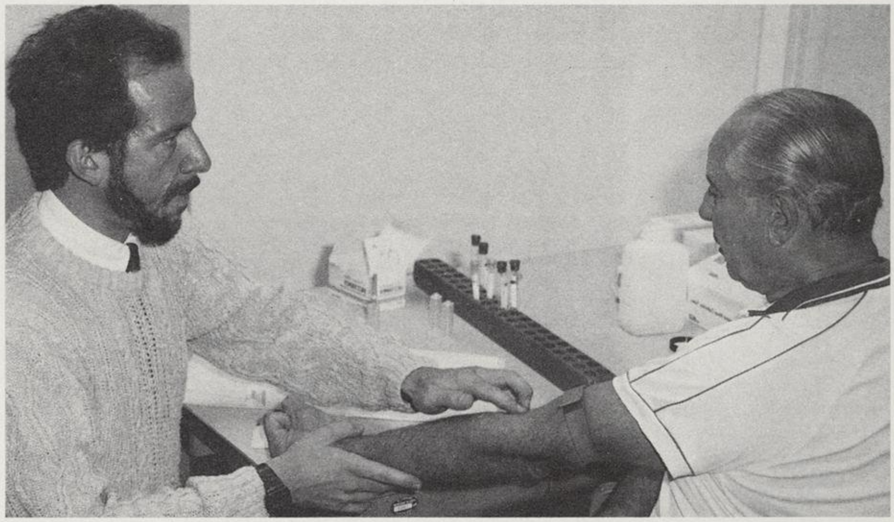
Cause and effect

All substances have the potential to become toxic; it's only a matter of the dose, as our salty sailors illustrated so well at the beginning of this article. Scientists aim to determine the smallest dose of a substance that will result in an adverse effect on human health in order to *relate exposure with effect.*

Among 100 genetically-bred white rats fed the same quantity of a virulent strain of bacteria, a few will resist infection, some will be highly susceptible to disease, and a majority may experience milder symptoms that would be considered an average response. Risk assessors know that each member of any population of living things reacts differently to the same dose of a substance, so it's important to determine the dose that will be the least harmful to the greatest number of people.

Investigators must take care when applying information from animal studies to people. Animal studies are conducted in carefully controlled settings to keep other environmental substances from interfering with the one being tested. But people are exposed to food additives, prescription drugs, cigarette smoke, air pollution and a whole host of other substances that can mask or magnify the effect of the contaminant in question. Consequently, assumptions based on data collected in the animal study may be inaccurate when applied to humans.

To make better use of the time and funds required for an animal study, toxicologists test very high doses of a substance on a small group of animals, then use the results to make predictions on how the substance will affect millions of people who are exposed to very low doses during a lifetime. Scientists continue to search for a way to make this theoretical, mathematical extrapolation more accurate.


Robert Queen

Blood samples drawn from a volunteer will help Division of Health epidemiologists determine the possible range of human reactions to environmental toxicants.

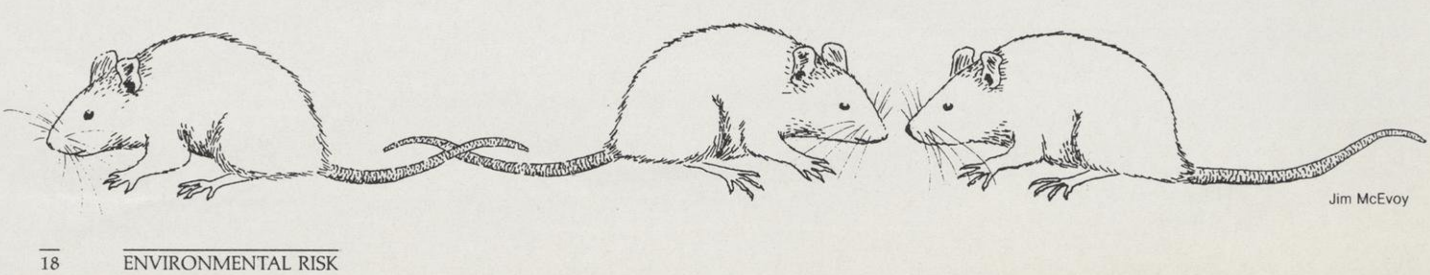
Assessing the risk

When the test results are in and all the studies have been studied, the risk assessors *estimate the overall risk* people face when exposed to a substance. To do this, the risk assessors use the collected data to estimate the expected health effects and project how often those symptoms or illnesses might occur. Pinpointing the concentration of a substance in air, food or water at which health risks first develop is an important part of risk assessment.

An overall risk assessment is only one of the elements managers at regulatory agencies consider when called upon to make decisions about an environmental risk situation. Managers reviewing a permit request for an incinerator, for example, will want to know if air emissions from the smokestack could endanger the health of people who live nearby, but they'll also be thinking about the cost of the incinerator, other options for disposal, if people far away from the site will be affected, if the incinerator will help or harm the local economy, and so on. They arrive at one common denominator of risk by making conservative assumptions on how these variables affect people's chances of exposure to a substance.

An overall risk assessment is often rife with uncertainty. There may be different interpretations of the data by scientists; extrapolating results from animal tests to people may present a skewed picture of the hazard a substance poses to humans; risk assessors may overestimate the degree of risk. Although the information may not be conclusive, it can assist people as they make decisions about occupations, diet, habits and the kind of world they want to live in.

Marty Kanarek is an epidemiologist in the Department of Preventive Medicine and the Institute for Environmental Studies at the University of Wisconsin-Madison.

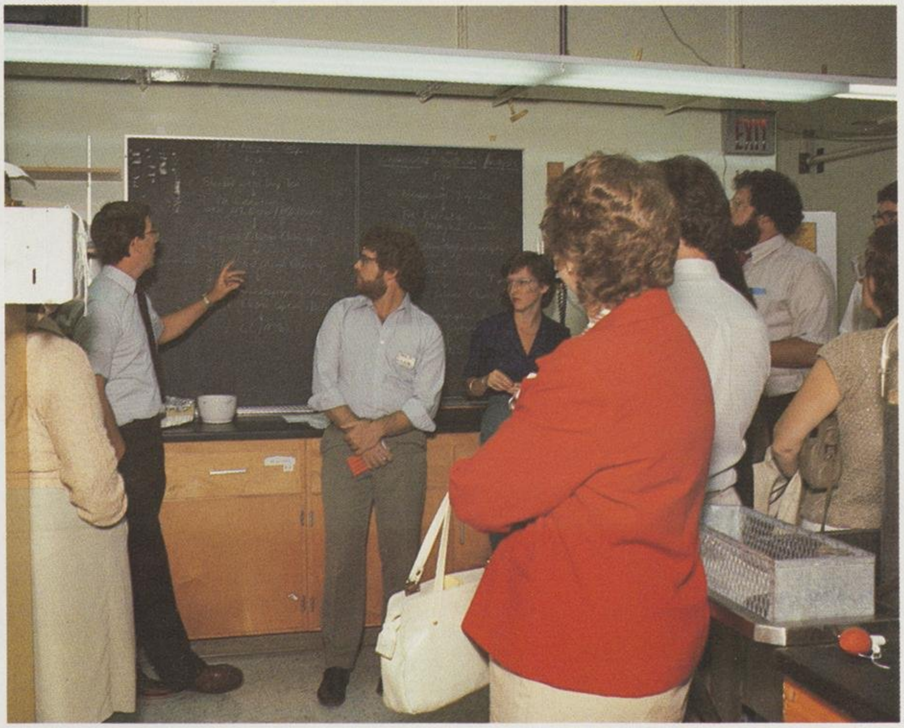

Jim McEvoy

In theory and in practice

In the lab and out in the field, researchers are helping you decide what's healthy and what's not.

John Cain, Maureen McCurdy, Tom Sinclair and Meg Ziarnik

Trust your instincts . . . sometimes. They'll tell you when to beat feet from a fire and steer clear of an auto pile-up, but they won't help you judge many environmental risks that slip past your eyes, ears, nose and throat undetected. How are researchers and scientists using risk assessment and management techniques to make sense of environmental contaminants that could literally knock you senseless? Here's a rundown of some current investigations in Wisconsin.



DNR photo

Chemists at the State Laboratory of Hygiene on the UW-Madison campus explain techniques for analyzing the PCB content of fish.

Health studies

Environmental health programs aim to reduce human exposure to natural and manmade contaminants. State and local health departments are studying which contaminants Wisconsinites are exposed to and which substances we need to protect ourselves from.

Since 1985, the Division of Health's Environmental and Chronic Disease Epidemiology Section (ECDE) has been studying women whose drinking water comes from wells contaminated with the pesticide aldicarb. Preliminary study results show that aldicarb exposure causes subtle chemical changes in the immune system. Further study is needed to confirm the initial results and clarify if the chemical changes are reversible.

Pesticides that inadvertently seep into groundwater can change or decompose as they pass through soil and soil microbes. Little is known about the health effects of exposure to these pesticide breakdown products. Furthermore, lab methods to detect and analyze these compounds have not been developed. The State Lab of Hygiene is studying the breakdown products of atrazine and alachlor, two known animal carcinogens.

Advice to anglers about choosing which fish to keep for dinner is compiled twice a year in fish consumption health advisories. It's a true cooperative project — DNR fisheries managers collect fish and prepare them for lab tests, the State Lab of Hygiene analyzes fish samples for a host of contaminants and the Division of Health works with the Department of Natural Resources to interpret test results.

Groundwater cleanliness standards for 50 compounds, including pesticides, volatile organic chemicals, metals and organic contaminants have been set by the Department of Health and Social Services and the Department of Natural Resources with advice from environmental groups, industrial trade associations and communities. Potential groundwater contaminants are continually tested and will be added each year.

Health risks from leaking toxicants at Superfund sites are assessed by a team of state health professionals and a federal agency — the Agency for Toxic Substances and Disease Registry. The team estimates current exposure to chemicals at these sites, projects potential future exposures and, since some health effects take decades to develop, conducts long-term health studies of people previously exposed to chemicals.

One study is examining whether an important recycling method poses health risks. Dried sludges — by-products of the paper-making process — are mixed into soil to improve soil tilth and fertility while using a product otherwise wasted. The joint study by paper companies, health and environmental officials is examining if dioxin contaminants in sludges are passed on to plants, animals and people living in areas treated with sludges.

Contrary to popular opinion, the air we breathe inside our homes may be harboring more environmental contaminants than the air outdoors. The risks of exposure to contaminated drinking water, radon, carbon monoxide, formaldehyde, sooty particles, molds, fungi, bacteria and excessive humidity are under study by the Division of Health's Bureau of Environmental Health and the Bureau of Community Health and Prevention.

When communities believe a neighborhood experiences more than the normal number of cancer cases, the Division of Health's Environmental and Chronic Disease Epidemiology Section investigates to see if a true cancer cluster exists. Allaying fears and discussing perceptions about cancer risk is part of a healing process that is an emotional as well as a medical issue.

How do we determine long-term patterns of what makes people sick and die? Epidemiologists evaluate hospital records and death certificates to look for patterns among diseases, geographic locations, occupations and human activities. Since people are exposed to a multitude of hazardous substances every day throughout a lifetime, these health associations can suggest preventive measures to reduce the risks of illness.

Environmental studies

Environmental risk methods are used in setting most of the purity guidelines for drinking water, stream and river water, groundwater and clean air. DNR field investigators use these same guidelines to determine what we consider "clean" and "contaminated." An extensive network of people and machines keeps tabs on environmental quality by regularly sampling air and water. It's an important factor we build into social decisions, like planning the economic and environmental recovery of Green Bay.

Dean Tvedt

Since bottom-feeding fish, like carp, absorb large quantities of toxicants from food and sediment, they are often used as early indicators of environmental problems.

One risk assessment technique is helping environmental managers determine when liquid wastes may be toxic. Water fleas and day-old minnows that need clean water to live are exposed to liquid wastes typically discharged by sewage treatment plants, industries and businesses. Even if scientists can't separate all the components in the waste, they can determine if the mixture may be toxic by watching how the young bugs and fish react. The technique, called bioassay, is a practical means of measuring when the wastes from industrial societies can harm aquatic organisms.

How do environmental managers determine when a pollution problem is solved? It's rarely easy. For instance, when cleaning up groundwater after a gasoline spill, the cleanup squad might recover 99 percent of the gasoline in a few days but would have to spend another year trying to collect the last bit of gas adhering to soil and rocks. With some contaminants, water that is 99 percent clean is perfectly usable. Risk management techniques help determine when cleanup work should end because the costs of additional cleanup outweigh the benefits of complete recovery.

Samples of fish and wildlife flesh are analyzed to answer three environmental risk questions: Are environmental contaminants spreading throughout the ecosystem? Can animal and plant monitoring help us pinpoint hot spots of contamination? Which of the quarry taken by anglers and hunters are least fit for eating?

Studies to determine how close people should live to sources of air pollution all rely on risk management techniques. Setting limits on smokestack emissions, minimum distances between homes and factories, even the risks of exposure to landfill gases can be estimated.

University research

Risk issues and research span a wide variety of disciplines at the University of Wisconsin-Madison, from science and engineering to social studies and agriculture.

A nuclear engineer seeks to reduce the risks in nuclear power plant operation. By analyzing power plant systems and simulating how plant operators react during accidents, he develops training programs to teach operators how to reduce risks.

A journalism professor ponders how people use information they get from newspapers, radio and television to make decisions about environmental risks. She is examining which information channels people prefer and select when judging risks.

Do uncertainties about risks make people perceive risks differently? An environmental sciences professor and a graduate student are studying people's attitudes about chemical contaminants in the Great Lakes. The researchers are interviewing citizens, scientists, environmental activists and industrialists in Great Lakes border communities to determine if people perceive greater risks from exposure to unfamiliar chemicals than from chemicals they know more about. The professor also studies which varieties of PCBs pose the most significant health risks.

Epidemiologists in preventive medicine and environmental studies are tracking the development of 1,200 babies born to mothers who ate PCB-laden fish during their pregnancies. They hope to determine whether the mothers' diets influenced the health of the children in the early years of their lives.

A rural sociologist is concerned that people no longer believe the scientific experts who warn them about environmental risks. He is examining how and why scientists' views differ from those widely held by the general public.

Two visiting professors in public policy invited national experts to UW-Madison to discuss risk decision-making with managers from public agencies. The group considered the economic, political and social issues that are inextricably tied to decisions on health, safety and environmental risks.

Other university studies are examining the risks from global warming and the greenhouse effect, genetic changes caused by low-level exposure to environmental contaminants, how substances in the environment change cancer rates and even how environmental risks change business decisions. A risk management and insurance program in the School of Business's Department of Actuarial Science, for instance, seeks new ways to reduce business liabilities for managing wastes containing asbestos and hazardous materials.

We are on the frontiers of understanding the risks environmental contaminants pose and more carefully weighing those risks against other activities we more readily accept. Slowly, studies like those discussed above are helping redefine "safe" and "risky" options we all choose. ■

John Cain is a DNR soils specialist, Maureen McCurdy is a graduate student in environmental studies at the University of Wisconsin-Madison, Tom Sinclair manages the public information and outreach office of the UW-Madison Institute for Environmental Studies, and Meg Ziarnik coordinates environmental health programs for the Division of Health's Environmental and Chronic Disease Epidemiology Section.

Sophisticated techniques for distilling chemical solutions help extract information about environmental contaminants.

State Lab of Hygiene

Trouble in the neighborhood?

Environmental causes are prime suspects when cancer strikes a community, but conjecture must bow to the facts before the real culprit can emerge.

Beth Jones Fiore

"I hear Mr. Wilson has brain cancer. And you know, the man down the street in the yellow house just passed away and I heard he had lung cancer—"

"That's odd. His wife had cancer too; breast cancer I believe. I'm just positive that landfill on the north end of town is the cause!"

Cancer is one of the most feared diseases we face. Over the years, cancer will strike three out of four families, or about one of every four people. It's the second leading cause of death in America, surpassed only by heart disease. Given these statistics, it's not surprising to know more than one person in a neighborhood with cancer.

Some well-known causes of cancer have already been identified: We know smoking causes lung cancer; overexposure to ultraviolet rays from sunlight may result in skin cancer; radioactive materials trigger leukemia, a cancer that disrupts the body's normal balance of white and red blood cells. Conjecture abounds, however, when a number of cancer cases occur in a particular area. Because we come in contact with many substances for which the cancer-inducing risks are unknown, it's not unusual for people to suspect an environmental cause — air pollution or an old landfill — as the source of the disease.

The Wisconsin Division of Health's Section of Environmental and Chronic Disease Epidemiology (ECDE) is the agency that investigates cancer clusters. A "cancer cluster" occurs when a larger than expected number of people are diagnosed with cancer in a specific geographical area during a limited time period. Since 1985, ECDE has received over 70 requests for investigation of potential cancer clusters.

Division of Health investigators follow a six-step approach to determine if an environmental cause is at the root of a cancer cluster. A recent study of a suspected cluster in Franklin, Wis. illustrates a typical investigation.

The problem

Investigators begin a study by *defining the problem using observations made by people in the area.* A Franklin resident claiming that many different types of cancer had occurred among men and women of all ages in the city from about 1960 to 1985 contacted the local health depart-

When several neighbors are stricken with cancer, people often suspect some contaminant near home caused the disease. Division of Health specialists investigate these cases, but signs of a true cancer "cluster" have rarely occurred in Wisconsin.

Robert Queen

ment, which in turn contacted the Division of Health to register a complaint. The suspicion was that naturally occurring radium and other contaminants in the community's drinking water were causing the cancers. Two nearby landfills were believed to be the source of the contaminants.

The probability

After defining the problem, the investigators reviewed scientific literature to *examine the probability* that radium and the other contaminants in the drinking water caused the cancers. Their research revealed that bone cancer has been associated with radium, but only at very high levels of exposure. Therefore, there was a very small probability that a bone cancer cluster due to radium exposure might exist in Franklin.

The citizen's concern, however, was for several types of cancer. A cluster caused by a carcinogen (a cancer-causing substance) in the air or water usually results in a higher risk for only one or two different types of cancer. If a suspected cluster includes many different types of cancer, it's almost certainly not a true cluster and cannot be attributed to one toxic substance present in the environment. It seemed a true cancer cluster was unlikely in Franklin; nonetheless, the investigators decided to gather more information before drawing any conclusions.

The evidence

Just because Franklin had landfills didn't mean those landfills were contaminating the drinking water. And just because radium occurred naturally in the city's drinking water supply didn't mean it was causing cancer. The investigators needed objective *evidence on exposure*, not hearsay or suspicion, to help confirm or disprove the allegations.

Department of Natural Resources water supply specialists consulted recent test records to see if carcinogenic substances were present in Franklin's water. They discovered that the municipal well and one private well contained radium, but at a level only slightly above the drinking water standard. In addition, tests of landfill monitoring wells and private wells showed no toxic substances from the nearby landfills had entered the groundwater.

The evidence, part II

Next, investigators sought objective *evidence on the actual number and type of cancer cases* occurring among Franklin residents. Had they relied solely on reports from area citizens, the investigators might have inaccurately counted or classified the cases. A brain cancer case being talked about in a neighborhood, for instance, could have begun as a lung cancer that metastasized, or spread, to the brain.

To determine if a cluster exists, it's crucial to know the types of cancer and the number of cases in the area. To calculate mortality rates, the investigators counted and classified Franklin's cancer deaths and used state records to provide information for the years 1960 to 1985. The age of the Franklin population was also considered, since cancer is more prevalent in older people.

The comparison

After compiling Franklin's cancer mortality rates from 1960 to 1985, the investigators *compared the rate of cancer in the community with rates in the county, state and nation.* Rate comparisons were made for over 25 different types of cancer. The Franklin rates, for both women and men, were not significantly higher than the other rates. More importantly, the Franklin rates for bone and liver cancer and for leukemia (the cancers associated with the ingestion of radium or toxic substances), were not significantly higher than the comparison rates.

The decision

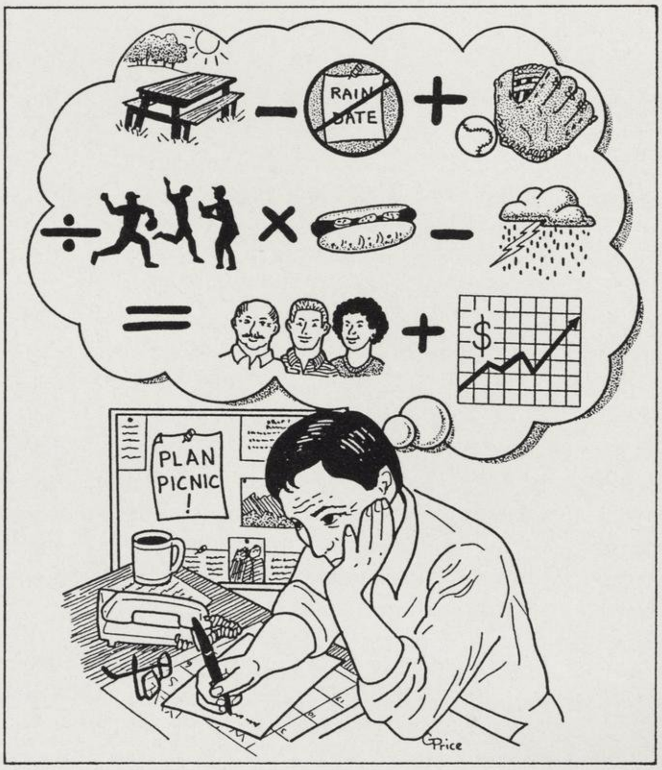
Finally, the investigators were ready to make a *decision on the case based on the assembled facts.* They concluded that the objective evidence did not support the claim that radium and other toxic substances in Franklin's drinking water were causing cancer. There was no evidence of significant exposure to radium or other toxic substances from the drinking water and no evidence of higher-than-expected cancer rates.

Given these findings, the Division of Health investigators felt no further sleuthing was necessary. They recommended that the local health department monitor the number of deaths from cancers known to be associated with the ingestion of toxic substances. A public meeting was held to explain the study results and answer citizen questions.

Though cancer clusters and their causes concern both citizens and scientists, the fact is that many suspected clusters turn out not to be true clusters. Others are proven to be true clusters, but the causes remain unknown, are attributed to personal lifestyle habits, or are chalked up to chance.

It's difficult to prove a cause-effect relationship between cancer and exposure to a toxic substance present in the environment. To do this, investigators must examine a large number of cancer cases — more than are usually found in one community — and show that people who developed cancer were exposed to a toxic substance at greater levels than those who did not. Cancer is a tough disease to track because it doesn't develop immediately when exposure to a toxic substance occurs: Five to 30 years may pass between the time of exposure and the onset of cancer. Nevertheless, cluster investigations, even with these inherent difficulties, can still help us learn more about cancer and its causes. ■

Beth Jones Fiore is a public health educator in the Environmental and Chronic Disease Epidemiology Section in the Division of Health, Department of Health and Social Services.



Georgine Price

Managing risks is no picnic

If only it were as simple as ordering enough buns for the hot dogs . . .

Lyman F. Wible

You're the lucky winner . . . again! The company has chosen you to arrange the big spring picnic! There's a lot of planning to be done — and as you begin to work out the details of this important event, the kinds of questions you ask will be similar to those managers at state agencies ponder when making decisions about risk.

Risk assessments are helpful, just as weather forecasters are helpful when they tell you there's a 60 percent chance of rain on Saturday. But will that knowledge cause you to cancel the big spring picnic? No. You'll take many other factors into account besides the weather when you plan the picnic. Let's look at a few of them.

Assigned duties

This is your job! The president of the company personally asked you to handle picnic planning.

Similarly, the Department of Natural Resources and other agencies are charged by state and national law to preserve and protect the environment, health and safety of the public. An alert public, the Legislature, the federal government, businesses and policy boards are watching to see that agencies follow through on their assigned tasks.

Practical concerns

You need to examine alternatives. Can you hold a successful picnic if it rains? Are there any rain shelters at the park? There are social concerns, too. The boss is rumored to color his hair: Do you want to see red streaks down his neck and dye dripping onto the canvas of third base during a soggy softball game?

When regulating toxics, agencies examine alternatives as well. Do we have the technical equipment and know-how to control toxic flow and sample emissions in air or water? Public attitudes are considered as well. Is there a grassroots concern over a pollutant or an industry? Will a particular decision tend to stimulate or hinder innovation in the industry?

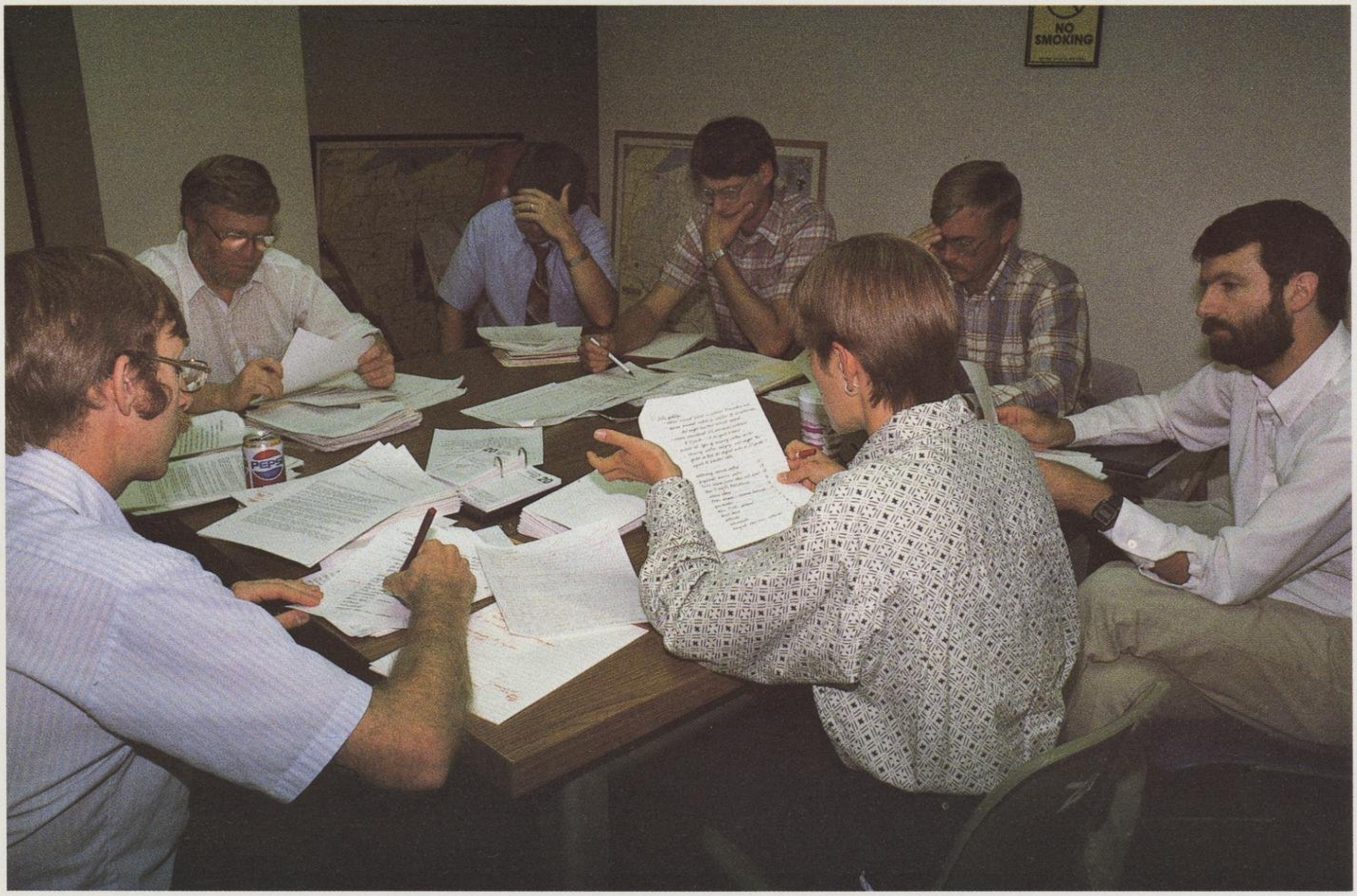
Social impact

The picnic is a tradition, a benchmark of the year; it builds company spirit and encourages teamwork. Special awards are announced and bonus checks are distributed after the softball game. It will be a bleak year if the picnic doesn't come off with a bang!

Regulatory agencies also consider how their decisions disrupt personal lifestyles and community life or affect the physical environment.

Economic effects

The park shelter has been reserved and paid for. But the park is already booked for your rain date, so you'll host the picnic in your own backyard if necessary.



Jean Meyer

A group review of proposed restrictions on water toxicants. Reaching a consensus on risk issues requires long hours of negotiation with health officials, university researchers, private industry and the public.

Cancelling the picnic isn't an attractive option: the informal discussions with management, and chitchat between the sales and production people over hot dogs and beer raises company spirit and encourages a team approach to solving problems. The good feeling employees get from the picnic helps to boost productivity — and profits. Plus, over $1,000 was raised for a local charity at last year's picnic (the CEO sat in a dunk tank, employees paid a dollar for three tries); the charity won't survive without another big donation this year.

Money won't dictate the outcome, but the economic costs to industry, taxpayers, and consumers are considered by agencies when regulatory decisions are made.

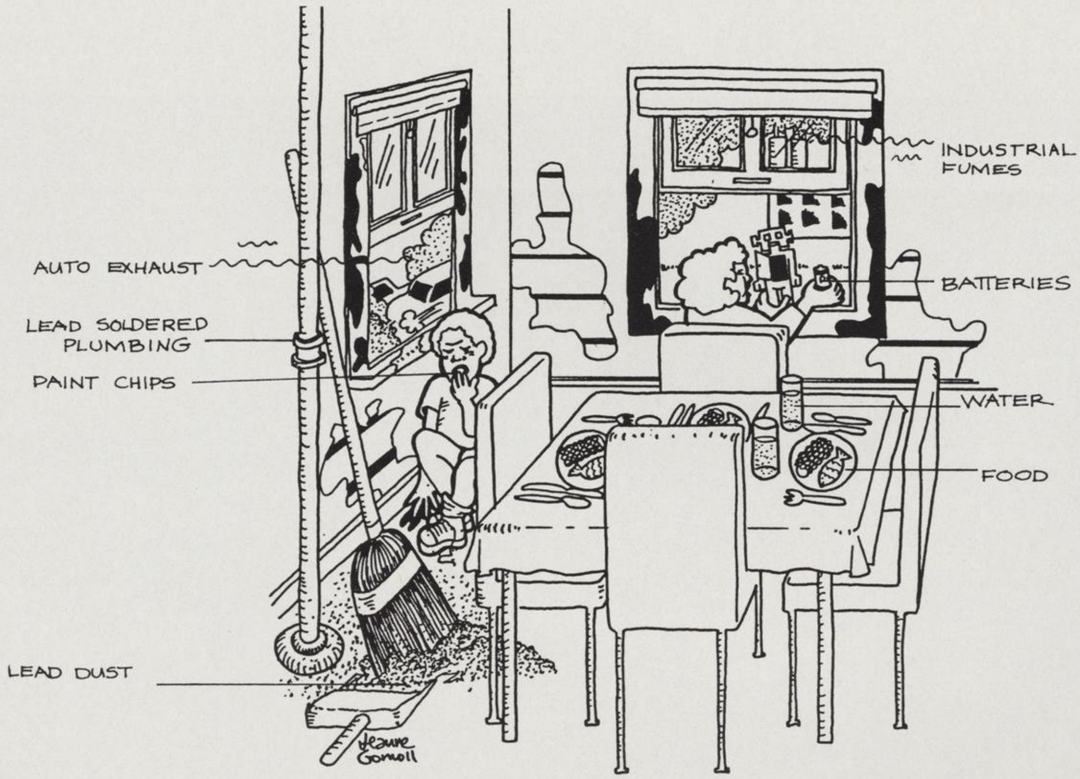
Perceptions and expectations

The boss expects you to get things done. All year you get compliments from everyone in the company about your ability to organize the last nine picnics in spite of adverse weather forecasts. You also get free advice on how to run the picnic from people who have an interest in this annual event.

State agencies also are expected to meet the mark of past expectations. The public demands to be protected against hidden or involuntary risks and should have a say in these important community matters. Wisconsin's tradition of strong environmental and health protection is an important reminder of the public's desire.

Each picnic and each regulatory decision is different. You have to watch your timing, weigh current versus future impacts of decisions, evaluate options for action, make sure that decisions are based on common sense . . . these and other elements are essential to finding the best solution to problems of public interest. The consequences of your choices are important to a lot of people.

Lyman F. Wible directs DNR's Division for Environmental Quality.



Most common sources of lead contaminants in homes. Jeanne Gomoll

Home improvements

A how-to lesson in handling two common household toxics.

Sharon Dunwoody, Joseph Schirmer and Daniel Wilson

People buying a home for the first time are always on the lookout for extras, like a spacious kitchen, a half-bath, or a spare bedroom. And long-time homeowners usually like to add a few extras — a finished basement or a new garage — to increase the value of the house. But many homeowners must also contend with two unwanted extras: asbestos and lead, the most common toxic materials found in Wisconsin homes.

The problems these two substances pose can be tackled by homeowners with sound, readily available advice from health professionals. Let's begin with asbestos.

According to Bill Otto, public health educator in the Bureau of

Get the lead out. A 1984 ruling banned lead solder in home plumbing when studies showed corrosive water could naturally leach lead into drinking water. Daniel Wilson

Community Health and Prevention in the Department of Health and Social Services, any home built before 1976 that is equipped with a hot water heating system could have asbestos wrapped around the water pipes or around the boiler for insulation. Newer houses may also contain asbestos: it's been found in up to 50 household items, from the heating ducts of forced air systems to vinyl floor tiles.

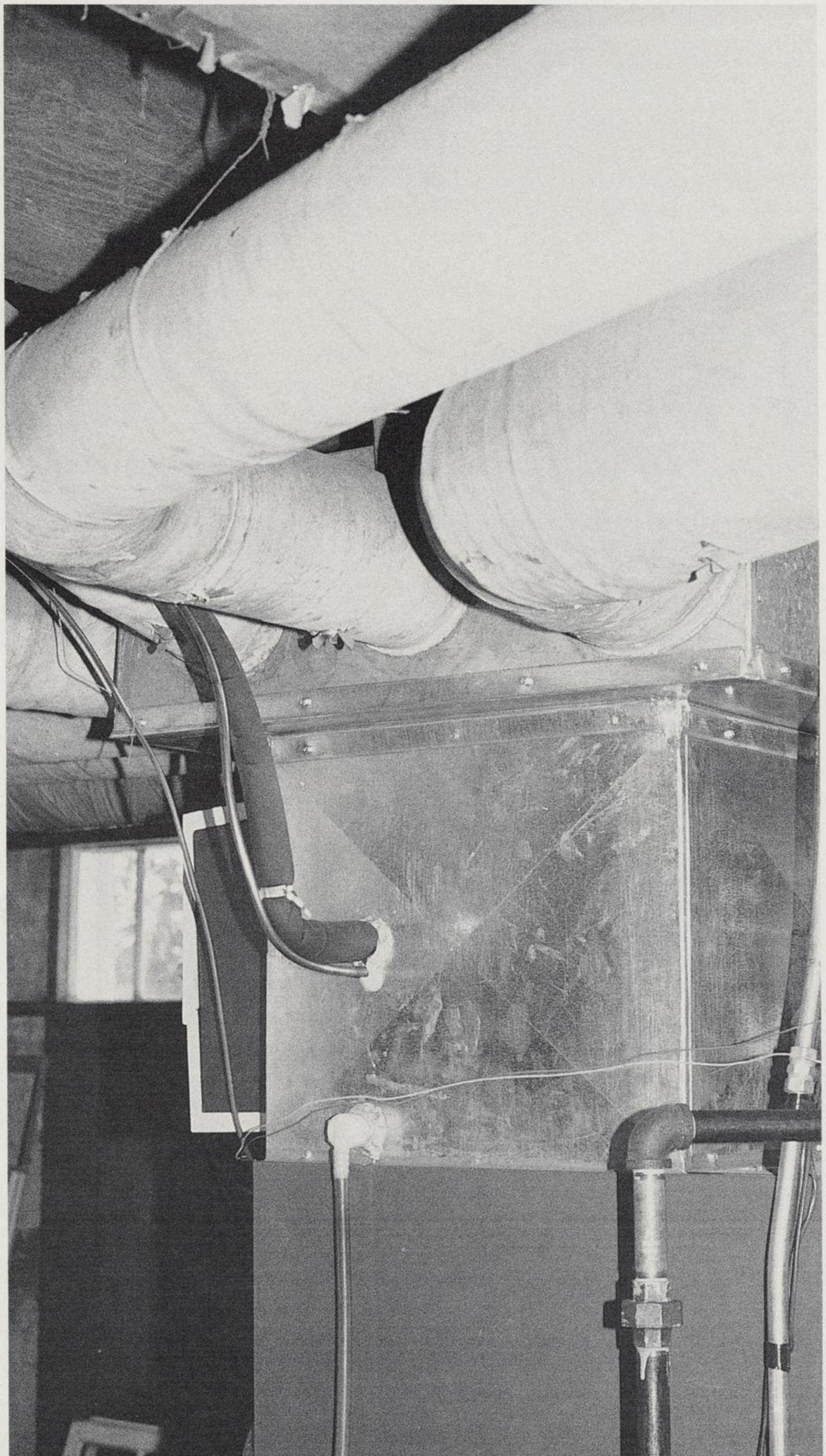
Asbestos is a fibrous natural mineral present in nearly 3,000 manufactured products. When the microscopic fibers are inhaled, they can imbed deeply in the lungs and cause scarring, known as asbestosis. Asbestos exposure may lead to cancers such as mesothelioma, which affects the lining of the lungs and abdomen and is almost always fatal. The likelihood of contracting these diseases is linked to length of time one has been exposed to asbestos and the amount of airborne fibers one has inhaled.

If you think there's asbestos in your home, check if your suspicions are correct. The State of Wisconsin Lab of Hygiene will test samples of the suspect material, whether it's pipe insulation or tile adhesive, for $17.50 per sample. The lab needs a sample about the size of an acorn to run the test, and you'll have results back in four to six weeks. Call the lab at (608) 263-6326 for details.

If the test shows you have asbestos in your home, don't panic. Call your local public health agency and ask for information about your level of risk. Bill Otto at the Department of Health and Social Services, (608) 266-9337 or Joe Brehm, an environmental specialist in DNR's Bureau of Air Management, (608) 267-7541 can help you assess the situation.

There are pros and cons to having asbestos removed from pipes or other items. Asbestos in good shape is best left undisturbed. But if the asbestos is old and flaking off the pipes, for example, then removal is a sound strategy.

Removing asbestos without releasing fibers into the air is difficult and requires special training and equip-



Courtesy of Stan Curtis

This older furnace looks like a metal octopus with asbestos-wrapped arms. Asbestos was commonly used to fireproof and insulate homes and businesses. More than 1,500 common building materials contained this mineral, which remains useful until age and wear cause it to flake and crumble, releasing fibers into the air.

ment. City or county public health agencies can send you a list of state-certified contractors that have participated in asbestos removal training and passed an examination. Expect to pay between $1,000 and $2,000 for a contractor to remove asbestos from a three-to-four bedroom home.

Don't be lead astray

In their homes, people are exposed to lead from three sources: The metal dissolves from plumbing solder into drinking water; it is an ingredient of some paints; and it is used in ceramic glazes on some pottery.

The health effects from exposure to this toxic metal include damage to the nervous and reproductive systems, the blood and kidneys. There is evidence that levels of lead once considered safe can be harmful, particularly to small children and developing fetuses.

The use of lead solder for residential water supply plumbing has been banned in Wisconsin since 1984. In homes with lead-soldered plumbing, water will dissolve lead from the solder at a rate that varies depending on the corrosiveness of the water and the age of the pipes. (Most water in Wisconsin is corrosive enough to dissolve some amount of lead.) When the water stands motionless for extended periods of time — overnight, for instance — lead concentrations in the water can increase.

Unless you're certain that your plumbing is indeed lead-free, it's a good idea to run water from the tap in the morning for several minutes before drinking or cooking with it. Use cold tap water for cooking and drinking, especially when preparing baby food and formula, since hot water dissolves more lead from plumbing than cold water.

If you want to have your water tested for lead, contact the water quality specialist at your nearest Department of Natural Resources office and ask for a list of labs certified to do the test. The specialist can also send you the brochure "Lead in Drinking Water."

The State Lab of Hygiene can test pottery for the presence of lead, but cannot return pottery samples by mail. For details, call the lab at (608) 262-1146. Commercial laboratories may also be able to test pottery for lead.

Lead in paint can be released over time as the paint weathers and ages, either as dust or paint chips. Both chips and dust are hazardous. Pediatricians report that most cases of extreme lead poisoning are caused by ingestion of lead paint chips. Lead in dust and soil are sources of intermediate rather than high doses of lead, but they also deserve attention.

Infants and toddlers are at risk from lead-contaminated chips and dust for three reasons. First, their normal behavior involves a lot of hand-to-mouth activity, which results in their eating five times as much dust as adults according to Environmental Protection Agency estimates. Second, children absorb as much as 50 percent of the lead that enters their digestive systems, while adults typically absorb only 10 to 20 percent. Finally, in contrast to adults, for whom the effect of intermediate-level lead exposures are often reversible, the damage inflicted by lead to the developing nervous systems of infants and children is more likely to be permanent.

Commercial laboratories in your area may be able to test for lead in paint; check your local yellow pages for phone numbers. Labs certified to test drinking water for lead may also analyze paint samples for lead. If there's no lab near your home, contact the State Lab of Hygiene at (608) 262-1293 for lead testing information.

Cleaning and covering are two short-term strategies for handling surfaces painted with lead-based paints. Walls can be covered with wallpaper, wallboard or paneling. To reduce exposure to lead dust, surfaces containing lead paint should be washed at least twice a month with phosphate-based cleaners. Children should be encouraged to wash their hands often.

The most effective way to prevent exposure is to remove the paint, but removal must be done carefully to avoid creating an additional hazard. Don't sand lead paint. Heat guns can be used to soften paint for easy scraping, but too much heat or the use of an open-flame torch will melt or burn the paint, creating poisonous lead fumes. The safest method is to use chemical, water-based paint strippers. Cleanup and removal of paint and dust must be done carefully, preferably with the lead paint in a wet or damp condition to avoid spreading the lead dust. For a copy of the booklet "Deleading Your Premises," send a self-addressed, stamped envelope and 10 cents to the Division of Health Education, City of Milwaukee Health Department, Room 209, 841 N. Broadway, Milwaukee WI, 53202-3653. ■

Sharon Dunwoody, associate professor of journalism and environmental studies at the University of Wisconsin-Madison, recently had asbestos removed from her home. Joseph Schirmer is a public health educator and epidemiologist in the Department of Health and Social Services' Bureau of Community Health and Prevention. Daniel Wilson is an environmental specialist in DNR's Bureau of Water Supply.

The rest of the story (about risk)

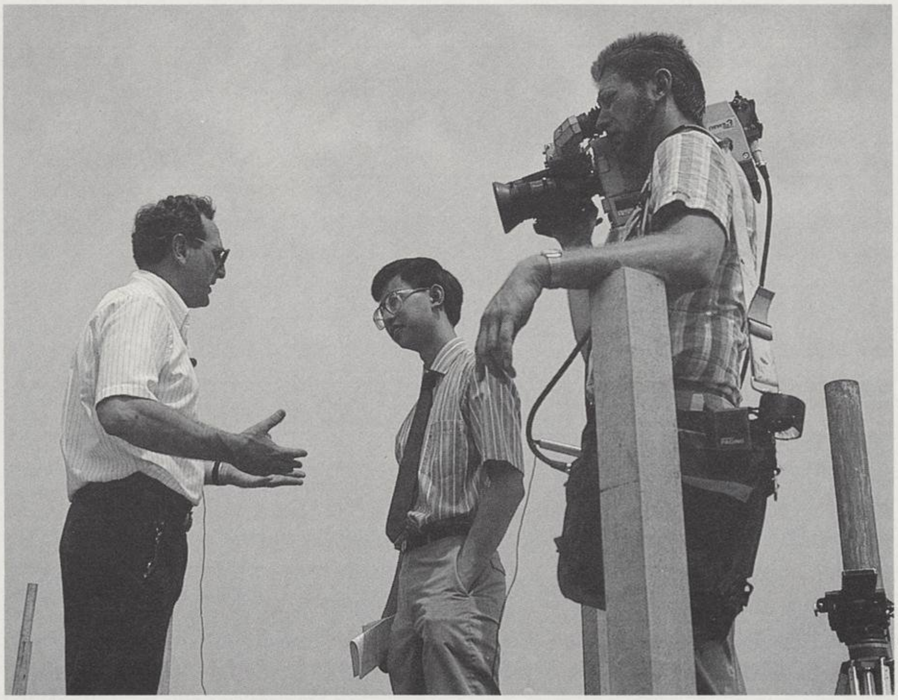
Put down the newspaper, turn off the television and do a little digging on your own.

Sharon Dunwoody

A recent story in a Sunday newspaper magazine listed the 70 most dangerous blue-collar and white-collar jobs in the United States. A few months ago radio stations around the state aired reports about the presence of dioxin in paper milk cartons. Stories on mercury-contaminated fish caught in Wisconsin lakes made a big splash last summer on television.

Risks of all kinds get coverage in the mass media. When you're bombarded with images of distraught families leaving behind their dioxin-laden homes, or hear of yet another warning from the Surgeon General, it's easy to become frightened. One more story about pesticides or asbestos and you're ready to catch the next plane off the planet.

To successfully interpret media reports about environmental risk, it's best to set emotion aside and take a hard, critical look at your sources of information. Here are four tips for evaluating risk stories presented by the newspapers, magazines, television and radio stations you consult for a view of the world.



Robert Queen

Talk is cheap. Weigh risk information from several sources before forming an opinion.

1. *Understand how the media choose risk stories to highlight.* Mass media focus on risks for a variety of reasons: something horrifying may have happened (Bhopal, Chernobyl); a press release or press conference may call attention to an issue (the Environmental Protection Agency's recent recommendation to test for radon in Wisconsin homes); or a reporter may have been following an issue (toxics in the Great Lakes) and decided to write a story about it.

Media coverage generally *touches* on the risk itself — the danger of breathing chlorine fumes from a ruptured tank truck, for instance — but *dwells* on the more newsworthy aspects of the situation: How the tank burst, if the trucking company had no regular tank maintenance schedules, when the highway will be open again. News stories are designed to get and hold your attention; if there's no "news peg" (a spill or explosion, new research data, etc.), it's unlikely that a risk will make the front page or the six o'clock news. Don't assume that a lack of media coverage on a risky issue means the risk is trivial.

2. *Distinguish the emotional from the factual.* Media stories usually contain two types of information: details about the risk in question and people's reactions to that risk. In a report about AIDS, this statement is a fact: Individuals getting a blood transfusion have a 1 in 50,000 chance of contracting the AIDS virus. These statements, however, are people's emotional reactions to the risk: "I simply wouldn't worry about having an operation and getting a blood transfusion" or "I would refuse to be operated on if I needed a transfusion of someone else's blood."

Two people who know the same things about a risk can have different levels of concern. Reporters use individual "worry estimates" when they want to add a human dimension to what might otherwise be a dry, matter-of-fact story. People's emotional reactions to a risk can be taken into account, but it's most important to focus on the facts when interpreting a risk story.

3. *When it comes to the facts, look for multiple sources.* Often there is little concrete information about a risk making the headlines. In this situation, it's not uncommon for experts to disagree on "facts" such as the degree of exposure necessary to cause harm or the conditions that put some peo-

ple at greater risk than others. A journalist asking two experts to estimate the harm a risk could cause may get two different answers.

A story that relies on only one source should be questioned. While several sources may express different views on an issue, the hodgepodge honestly depicts what experts know about the risk.

4. *Don't rely solely on the mass media for information about a risk.* The media can alert you to a risk, but you'll need to find other sources of information for more details. You might contact sources named or quoted in the story, or call the agencies or organizations that were mentioned in the report. Check your local library for books or articles on the topic. Talk to friends and neighbors who face the same risk.

Getting accurate, helpful information about a risk is seldom a quick, simple task. But better informed people make better choices when dealing with a risk. Use media stories as a place to begin your search for knowledge, but don't stop there; your decision shouldn't hinge on a 10-second sound bite.

Sharon Dunwoody is an associate professor of journalism and environmental studies at the University of Wisconsin-Madison.

Join the debate

Citizens are encouraged to participate in public hearings on proposed environmental regulations. For a taped schedule of hearings held by the Department of Natural Resources, call DNR Dialog at (608) 267-7787.

Exercising discretion

We can choose to have a healthier, safer environment.

Henry Anderson and David Belluck

"If we think the people not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion."

—Thomas Jefferson

Robert Queen

Pick your poison.

The 1980s could well be described as the environmental information proliferation decade. Through community right-to-know legislation, advocacy groups, aggressive environmental monitoring programs and television, newspaper and radio reports of technical advances and spectacular failures, Jefferson's admonition is dynamically alive and well.

The challenge facing each of us is how to weigh large amounts of highly complex and confusing information with conflicting opinions about the effects of chemical contaminants on human health and the environment. Understanding the risks posed by these contaminants allows us to make decisions on how much risk we are willing to accept in our daily lives.

Everyday activities pose personal risks, both large and small. We choose to take part in these activities based on our understanding of the relative risks involved. Driving a car is dangerous, yet we continue to drive. But we attempt to control the hazards of driving by wearing seat belts, keeping the tires properly inflated, obeying speed limits and traffic lights and staying home when roads are icy. It's important that we understand the consequences of our activities and consent to accept them only after we are fully aware of the choices available to us. We must have the opportunity to choose the hazards we are prepared to live with.

We manage risks in several ways. Most of us become sick at some point in our lives. The illness can range from a simple cold to terminal cancer. To lessen the financial impact of a severe illness, many people purchase health insurance. To lower the possibility of a customer filing an expensive claim, an insurance company may offer complete coverage on preventive health measures, such as annual physicals, stop-smoking and stress-reduction classes, and semi-annual dental exams and teeth cleaning. Insurers are aware that if customers are encouraged to take better care of themselves, the company will have fewer claims to process and can reduce the risk of having to raise premiums and lose business. The risk management strategies of both the individual and the company are designed to prevent serious financial difficulties.

By learning to recognize health risks and avoiding unhealthy situations or behaviors, we can significantly reduce our chances of becoming ill. Many infectious diseases, such as polio and typhoid fever, are prevented through immunization, sanitary sewer systems and safe municipal drinking water. Environmental diseases, such as lead poisoning, are now being handled through preven-

Everyone affected by environmental risks brings unique values and judgments to the table. Take part in community decisions about health and environmental issues.

tion programs. Removing lead from house paints and gasoline has greatly reduced the risk people face from exposure to this toxic element. Radon, asbestos, tobacco smoke and other indoor pollutants have been the targets of recent prevention efforts.

While some risks apply only to the risk taker, others affect everyone. Improper disposal or careless handling of hazardous materials by individuals may contaminate an entire community's drinking water supply; careless use of pesticides by a single person can poison food, water and air.

When a risk-causing activity does not benefit the people directly affected by it, we're left with a "my risk, your benefit" situation. A rendering plant emitting a foul stench, a foundry carelessly disposing of toxic wastes formed during the casting process — these companies and their customers profit from activities that may be hazardous or annoying to people who live in the surrounding area. It's often necessary to enact laws to regulate various human activities in order to balance the risks and benefits they pose.

In Wisconsin, people are encouraged by state agencies to participate in public hearings on proposed environmental regulations. Public involvement can make a difference: many of our clean air laws, for instance, came about because citizens cared enough to voice their concerns and take action. Citizens without technical backgrounds are often the sentinels who alert public agencies to new environmental health issues or remind them of old problems that must be given a higher priority.

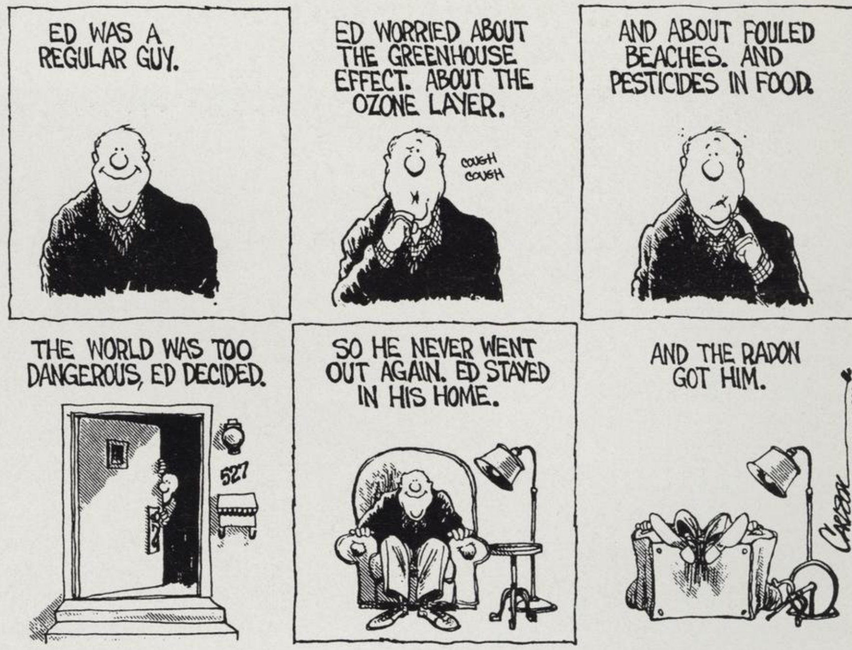
Experience shows that the most successful programs to reduce human health risks to environmental contaminants are *consumer passive*. This means we decide as a society that we will assume the cost of the action required to reduce a risk and make that reduction mandatory. Banning the use of DDT and PCBs, the pasteurization of milk, immunization of schoolchildren, building and well codes, and smoke-free public buildings and airplanes are examples of *consumer passive* programs.

Consumer active programs provide information and advice to people on how to avoid or minimize risks. Individuals have the option to follow the advice or not, and must personally bear the responsibility for their choices. Consumer-active techniques include cigarette package warning labels from the Surgeon General, health advisories on the consumption of contaminated private well water, Wisconsin's sport-caught fish consumption advisories, and recommendations to install smoke alarms in private homes.

As our values and expectations evolve over time, we may find that risks once considered tolerable are no longer acceptable. It's crucial that we keep ourselves informed about environmental health issues. By participating in public hearings and letting elected officials know how we feel, we can help form public policy on environmental issues that affect our lives. We face major environmental challenges; to resolve them successfully, it's vital that we are all involved in seeking solutions to our common problems. ■

Henry Anderson, MD is chief of the Environmental and Chronic Disease Epidemiology (ECDE) Section and David Belluck is a toxicologist in the ECDE section of the Division of Health, Department of Health and Social Services.

Risk roulette



Stuart Carlson, Milwaukee Sentinel

You may not know it, but every day you gamble with the most precious thing you own — your life.

Consider your daily activities: Driving a car or riding a bicycle to work, crossing the street to the office, taking a mid-morning break with a cup of coffee and a cigarette. After work or on the weekends, you relax with friends and family, playing sports, enjoying the outdoors, puttering around the house.

All these common activities carry a certain degree of risk. We tolerate the risks they pose because, quite simply, we have to live, and risk is a part of everyday life. Even sitting in the house doing absolutely nothing is risky.

That doesn't mean we *accept* those risks. It isn't acceptable to anyone that thousands of people are maimed or die each year in automobile accidents. So we test drivers for their skill behind the wheel, post speed limits and stop signs, hire police to enforce traffic laws, insist that people wear seat belts, design cars with shatterproof glass, air bags and other safety features . . . and despite our best efforts, people still run the risk of being killed in car accidents.

While the elimination of environmental or other risks is an admirable goal, it's seldom possible. All we can do is attempt to keep risks under control through more effective safety measures.

The statistics that follow no doubt will pique your curiosity, but remember that statistics tell only part of the story. Circumstance — being caught out on a golf course during a lightning storm or being inside the house when the storm hits — can magnify or minimize the potential for risk.

Here are a few one-in-a-million risks — activities estimated to increase your chances of injury or disease in a lifetime by one in a million:

ACTIVITY	RISK
smoking 1.4 cigarettes	*cancer, heart disease*
living two days in New York City or Boston	*air pollution*
traveling six minutes by canoe	*accident*
traveling 10 minutes by bicycle	*accident*
traveling 150 miles by car	*accident*
flying 6,000 miles by jet	*cancer caused by cosmic radiation*
living two months in a stone or brick building	*cancer caused by natural radioactivity*
living two months with a cigarette smoker	*cancer, heart disease*
eating 40 tablespoons of peanut butter	*liver cancer caused by aflatoxin B, a naturally occurring carcinogen*
eating 100 charcoal-broiled steaks	*cancer from benzopyrene*

Life is short; the following actions may make it even briefer:

estimated average loss of life expectancy in days

being an unmarried male	*3,500*
smoking cigarettes and being male	*2,250*
being an unmarried female	*1,600*
being 30 percent overweight	*1,300*
having less than an 8th-grade education	*850*
smoking cigarettes and being female	*800*
smoking cigars	*330*
smoking a pipe	*220*
increasing daily food intake by 100 calories	*210*
driving a motor vehicle	*207*
misusing legal drugs	*90*
walking down the street	*37*
being exposed to natural radiation	*8*
drinking coffee	*6*
drinking diet sodas	*2*