A River Network Publication Volume 14 | Number 1 - 2004

River Voices

Human Health, Environmental Justice and River Conservation in the 21st Century:

Building Bridges over Troubled Waters

By Steve Dickens, River Network Health Project Director

Rivers not only carry the vital minerals, nutrients and oxygen needed to sustain aquatic life, they provide vital sustenance for human civilization, providing drinking water and a critical food source to numerous human communities. As long as threats to the health of our watersheds and rivers exist, human health is also at risk.

As stated in EPA's most recent water quality (305b) report to Congress, "Toxic chemicals [found in surface water] have been linked to human birth defects, cancer, neurological disorders, and kidney ailments. Waterborne pathogens can cause acute respiratory illness, gastrointestinal problems, jaundice, dehydration, inflammation of the brain, eye infections, and heart anomalies."

Illustration credit: James Sullivan

Water pollution threatens public health directly through the consumption of contaminated food (e.g., through contaminated fish or through contamination of irrigated crops eaten directly or fed to cattle), through the consumption of drinking water (i.e., surface or ground water source contamination), indirectly through skin exposure to contaminants present in recreational and bathing waters, and through breathing air where contaminants from rivers (such as PCBs) have volatilized. To provide a sense of the scope of the problem, EPA reports that in 2000, there were some 2,828 consumption advisories pertaining to contaminated fish and wildlife in effect in 48 states. This is indicative of the continued upward trend of such advisories. Most of these advisories are the result of mercury, PCBs, chlordane, dioxins and DDT. According to a recent Natural Resources Defense Council (NRDC) report,[1] "The best available information suggests that these compounds are likely to be causing [ill health] effects at the doses that highly exposed populations of fish eaters now receive."

There are a plethora of examples of situations where water-based contamination has led to serious health problems. In northern California, the Yurok Tribe relies on the Klamath and Smith Rivers for drinking water. Yet, aerial spraying of herbicides by forestry and paper companies contaminates the waters with 2,4,5-T, 2-4D, Triclopyr, Glyphosate, Sulfometuron and other herbicides. Significant health concerns, including cancer and birth defects, abound. More than half of the pregnancies among the women in the Shoalwater Tribe on the Oregon Coast resulted in miscarriage or stillbirth, threatening the very existence of the 102-person tribe. Pesticide contamination from neighboring cranberry bogs and timberlands is the primary suspect. The communities located on Cattaraugus Creek in upstate New York, which includes the Seneca Nation, have dealt with concerns regarding sharp increases in childhood leukemia, lupus, colon cancer, pancreatic cancer and liver cancer. The concerns stem from contamination resultant from a closed tannery, now an EPA superfund site, and a nuclear reprocessing facility that has contaminated the banks of the river with radiation.

cont. on page 4

[1] "Contaminated Catch: The Public Health Threat from Toxics in Fish"

River Network

Connecting People, Saving Rivers

CONTENTS

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From the President

credit: River Network

HEALTHY WATERS, HEALTHY COMMUNITIES

Rivers are environmental mirrors. There is no such thing as a healthy river that drains an abused and polluted landscape. Rivers are our report cards, telling us how we are doing overall in terms of environmental protection.

By the same token, we are mirrors of our rivers. There is no such thing as a truly healthy community with an abused and polluted river at its heart. Some communities prosper in some ways for a time while enduring poor environmental conditions. But in the long run, healthy, happy people and communities that are prosperous, just and sustainable are possible only where environmental conditions are good.

Today, many people across the United States have serious concerns about the effect that pollution may have on their health. But most watershed groups and community groups with health concerns continue to find it difficult or impossible to prove that their concerns are—or are not—well founded.

Consequently, a great many communities suffer needlessly for years with worry, health problems or both. Low-income communities and communities of color tend to suffer disproportionately.

River Network's Healthy Waters, Healthy Communities project is designed to help people determine whether there is a link between area pollution and health problems, and if so, what to do.

We are developing practical, scientifically sound methods for conducting community-based environmental health assessments through information gathering, research and analysis. We are also making methodologies and resources available online for watershed and community groups across the nation; facilitating connections between groups addressing similar problems; and providing long-distance consultation to a growing number of groups each year. Last but not least, we are now working directly with a few groups to pinpoint problems, develop action plans to solve the problems, and secure the resources they need to succeed.

Just as our rivers mirror their valleys, our organizations mirror our thinking. Over the years in this nation, we have organized almost all of our environmental protection and public health interest groups as completely separate entities. This illustrates a fatal flaw in our national thinking. We hope to begin to correct that flaw by working with you in new ways in the years ahead.

Don Elder

Building Bridges, cont.

cont. from page 1

How dangerous are our waters?

In truth we know little of the full magnitude of these problems. According to EPA's latest 305b report, only 19% of the nation's river miles were reportedly assessed. In terms of human health impacts, of those river miles assessed, almost 40% were listed as impaired[2] with regard to fish consumption; 14% were impaired with regard to drinking water, and 28% were impaired with regard to primary recreational contact. This limited data is confounded by the fact that numerous states did not even report impairments related to mercury contamination. Specifically, Connecticut, Indiana, Kentucky, Maine, Massachusetts, New Hampshire, New Jersey, North Carolina, Ohio and Vermont did not report impairments related to mercury contamination; if they did, according to EPA, all of their river miles would have been impaired! And, what of the 81% not even assessed?

Part of the blame lies with the failure to fully implement the National Pollution Discharge Elimination System (NPDES) of the Clean Water Act as it was intended. Originally intended to reduce discharges to zero over time, many have charged that the system as actually implemented by EPA and the states has become little more than a system to excuse and institutionalize pollution through tax permits that protect polluters. While not exclusive to NPDES permits, the Toxic Release Inventory (TRI) provides us with a glimpse into the amount of toxic releases into our waterways. Environmental Defense provides figures,[3] based on the TRI for *releases into U.S. waters in 2001 of specific toxicants known or suspected to cause health problems:*

TOXICANT	AMOUNT ANNUALLY RELEASED INTO U.S. WATERS
Recognized Carcinogens	926,343 pounds
Suspected Carcinogens	911,088 pounds
Suspected Cardiovascular or Blood Toxicants	199,868,731 pounds
Recognized Developmental Toxicants	342,372 pounds
Suspected Developmental Toxicants	7,522,327 pounds
Suspected Endocrine Toxicants	433,968 pounds
Suspected Kidney Toxicants	2,494,489 pounds
Suspected Immunotoxicants	9,663,616 pounds
Suspected Gastrointestinal or Liver Toxicants	15,651,762 pounds
Suspected Musculoskeletal Toxicants	25,380 pounds
Suspected Neurotoxicants	21,955,958 pounds
Recognized Reproductive Toxicants	257,049 pounds
Suspected Reproductive Toxicants	8,905,613 pounds
Suspected Respiratory Toxicants	17,468,203 pounds
Suspected Skin or Sense Organ Toxicants	14,841,766 pounds

This list is only the tip of the iceberg; TRI only covers less than 1% of the some 80,000 industrial chemicals in use. In addition to these point sources, there are of course numerous non-point sources for toxic pollution, including:

- Inorganic contaminants, such as metals, which can result from urban stormwater runoff;
- Pesticides and herbicides, which may come from a variety of sources such as agriculture, stormwater runoff, and residential uses; and
- Organic chemical contaminants, including synthetic and volatile organic chemicals, which can come from gas stations, urban stormwater runoff, and septic systems.

Environmental Inequity

Who are affected most by these impaired waters and their associated human health effects? Almost all of us are to some extent. Many of these compounds persist for long

[2] Did not support or partially supported the specified designated use

[3] Based on the Toxic Release Inventory (TRI). Note: Some chemicals are associated with more than one health effect, so their release may be counted mulitple times. Therefore, it is not appropriate to sum releases sorted by health effect.

periods once released into the ecosystem; many bioaccumulate, reaching considerably more dangerous concentrations as they are passed up the food chain to humans. Their effects can be geographically far reaching, despite their point of release. One of the largest potential effects on the greatest number of us is through contamination of source waters, the water from streams, rivers, lakes and underground aquifers used to supply private wells and public drinking water.

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Make no mistake however: despite the fact that we all face *potential* human health risks from the contamination of our waterways, the communities most at risk now are typically disadvantaged, and often comprised largely of people of color. The U.S. Environmental Protection Agency report *Environmental Equity: Reducing the Risk for All Communities*, found that people of color and low-income communities experience higher exposure to toxic pollutants than the general population. Sometimes, such as the case with some tribal communities, this is related to increased exposure associated with traditional uses and values. For example, many tribes still directly depend on their river as their primary source of food and drinking water. In other instances, the increased risk faced by these communities is purely the result of the deliberate siting of hazardous facilities in disadvantaged communities, which lack political influence. Numerous studies, including reports released by the General Accounting Office confirm this fact. Another fact is that once problems are documented, the least fortunate among us usually endure most of the suffering over the long term. This is because those who can afford to do so usually leave a polluted area, leaving behind those who cannot afford to do so. Once this happens, a vicious cycle has already begun. Property values plummet, driving those remaining deeper into poverty. Health problems rise, consuming remaining income. Desirable jobs leave the area, making economic conditions all the worse. New investment in the area is harder than ever to come by, making hope dwindle. Countless communities suffer from these effects for decades or even generations. Many never recover.

River Network's 2002 survey of communities with human health concerns related to water contamination revealed that numerous community groups were grappling with concerns related to many of these serious health concerns.

http://www.rivernetwork.org/health

Future Direction

The reality of the disproportionate impact of pollution on disadvantaged communities of color, coupled with commensurate disparities of serious health problems, some of which are directly related to environmental injustice is critical information for the river conservation community to address. Regardless of the ethical and moral imperatives involved, the realities of shifts in our nation's demographics in the next 30 years will

cont. on page 6

cont. from page 5

Building Bridges, cont

There is much that watershed groups can do to protect source waters, beginning with a thorough inventory of potential threats. Groups can then work with their elected officials and water utility representatives to address these threats, and to advocate for legislation to acquire protection of land, and/or to develop better pollution controls and stricter permits.

EPA provides a useful collection of available source water assessment and protection tools at: http://www.epa.gov/safewater/protect/sources.html#Anchor%20contam

The USDA also provides useful information on various ways to reduce the contamination to drinking water resources at the following site: http://www.usawaterquality.org/themes/health/research/swp.html

render our movement politically and socially less relevant, if we do not address these concerns. By current estimates, non-Hispanic whites[4] will become a minority group, possibly as soon as 2025, and almost certainly by 2050. Changing demographics will almost certainly mean changes in the political lay of the land. How will these changes affect the agenda of the environmental movement and our river conservation community? What actions on the part of our movement today will help ensure that our message is socially and politically relevant to the majority of Americans through the next century?

Many in the funding community have already come to these realizations. The Environmental Grantmakers Association, now compromised of over 250 foundations, recently formed an *Inclusive Practices Committee* to actively promote diversity to "increase the capacity of the environmental movement to systemically address the root causes of many problems, to remain vibrant and relevant, and to enlist potential allies." The Committee notes two primary motivations for these goals. First, the origins of numerous environmental problems are related to issues of equity and justice. And second, as demographics continue to change in the U.S. and globally, it's critical for environmental organizations and efforts to enlist the broadest constituency possible.

Todd Wilkinson, in a special to the *Christian Science Monitor,*[5] wrote: "The… perception among some civil rights activists [is] that the Caucasian-dominated conservation movement has been slow to integrate people of color…" and that "Given the country's rapidly shifting demographics, a failure to embrace ethnic groups who feel disenfranchised could have profound repercussions for environmental causes in the future. To neglect that reality—or, worse, to alienate minorities through actions viewed as hostile or indifferent—could result in the movement losing its effectiveness in the new America."

Several years ago, at a national environmental justice conference at Rutgers Law School, one of the speakers put up an overhead of a map of the United States that was covered with dots, each dot representing a People of Color environmental group. He surveyed the audience of several hundred, of which only a couple of people were white. "Where are all of the white people he asked?" Not a few months earlier many of us at a national River Rally, also attended by several hundred activists pondered, "Where are the people of color?"—wondering how we could reach out to more communities of color.

We are all here. And we can no longer afford to be "separate but equal!" Environmental health issues represent a golden opportunity for us to unite and further empower the environmental justice and river conservation movements well into the 21st century. It is an opportunity that we must not squander if our movement is to remain socially and politically relevant to the majority of Americans. And, it is the right thing to do. We have much to learn from one another.

[4] The U.S. Census collects separate information regarding ethnicity and race. People of Hispanic origin may so indicate that under ethnicity, but their only choices under race are black, white or "other"; some people of Hispanic origin choose white. People who do not indicate that they are Hispanic origin and indicate their race as white are termed "non-Hispanic whites".

[5] CSM Tuesday, November 23, 1999

Political Action:

Campaign Strategies

In 1976, Lois Gibbs, a resident of Niagra Falls, New York came to realize that many of the health problems affecting her family, friends and neighbors were caused by the 21,000 tons of chemicals buried in her neighborhood. Ms. Gibbs and her neighbors formed The Love Canal Homeowners Association *and called for closing the school and, indeed, the whole neighborhood. They were opposed not only by Occidental Petroleum, but also by government at all levels which, argued that their health problems had nothing to do with the toxic chemicals buried beneath them.*

By Lois Gibbs
Center for Health, Environment and Justice
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It's been 25 years since the struggle for the relocation of Love Canal residents, but the lessons learned by the community in their efforts to win that fight are as valid today as they were then.

Science vs. Politics

It is easy and reasonable to believe that when people can present compelling science that dictates clear direction and action, authorities will do the right thing.

When there is unmistakable, sound scientific evidence that fish are contaminated and river sediments pose serious human health threats, appropriate measures should be taken both by those with the authority to create the necessary change and by those who are directly affected. Unfortunately, that's not what usually happens. Nor does the legal system offer much help because it is not necessarily illegal to discharge chemicals into our rivers, lakes, ground or air. Corporations can receive a license or permit to discharge pollutants, and even when they exceed their allowable limits, a slap on the wrist is generally all the polluter gets.

Most people learn early on, as families at Love Canal learned, that science and the law are great tools but only when used within the context of a politically focused strategy. Consequently, groups need to strategize how to use their scientific and legal handles within politically focused strategies.

Goals, Strategies and Tactics

GOALS: Before you can define a strategy for your efforts you must have a clear set of goals, both long term and short term. You need to ask, "What am I trying to achieve?" If you don't have clear *goals*, the best strategy and most creative tactics will not accomplish anything.

What do I mean by strategy and tactics? A *strategy* is a plan that you undertake to achieve a goal or set of goals. *Tactics* are something you do to help move your strategies forward toward accomplishing your goal.

At Love Canal we had never heard of these specific terminologies. However, we did employ a similar technique including goals, strategies and tactics. We were very clear about our long term goal: if a family faced chemical exposure from the 20,000+ tons of

cont. on page 8

Campaign Strategies, cont.

cont. from page 7

wastes buried in the center of the community, the family should be relocated. Our short term goals were to extend the testing area and obtain temporary relocation for families with pregnant women or children under the age of two.

STRATEGY: In order to develop a strategy, the first step for the residents was to determine who had the funds and experience to relocate 900 families. We initially explored Occidental Petroleum; the company responsible for the situation had billions of dollars in assets. At an emotional level, recognizing their primary role in the situation, there was a need to focus on Occidental Petroleum, but we realized that would likely involve a ten-year legal battle. So, we looked at the Niagara County School Board, the City of Niagara Falls and the State of New York—all who shared some responsibility for the situation.

After looking at all of the potential possibilities, it was decided to focus on the State of New York. Within the state government we needed a person to focus the attention. All strategies need to have such a "person." Our mothers were right when they said, "You can't fight city hall." City hall is a building, a bureaucracy; the governor is another story.

A strategy needs to focus on the "who"; who can give you what you need? The state had the resources, but we needed to determine the "who" within the state that possessed the authority to command action. Since he was up for reelection, residents decided the "who" would be the governor. To achieve success, our group needed to convince the Governor that the voters wanted him to move families, and if he refused, he could lose their vote.

The Love Canal Homeowners Association (LCHA) leadership came up with a plan. Both the media—to inform voters of the situation—and the governor's campaign activities—to directly influence him to take action—were critical to the plan.

The plan included:

- **Using science** about the extent of contamination and subsequent human health affects and to justify the moving of the families.
- **Following the Governor across the state** and using his public appearances to expose our plight and his lack of action to the public (i.e., to the voters).
- **Making the Love Canal issue a political issue** in the gubernatorial campaign by asking voter and campaign donors help in convincing the governor to evacuate families.

TACTICS: Tactics are activities within your strategy to create pressure on the person you seek to influence.

The tactics used at Love Canal included:

- **Using the Governor's name every time residents talked with the media:** "My child is sick because the Governor refuses to move our families and sue Occidental for reimbursement."
- **Faith based leaders holding prayer vigils** and "walks of concern" around the dumpsite asking for the Governor to take immediate action.
- **Residents leafleting outside the Governor's thousand dollar-a-plate dinners**, asking donors to help convince the Governor to move the residents, and warning that LCHA efforts could hurt his campaign.
- **Building strong alliances with several labor unions and labor organizations**, of which many of the affected families were members, and writing letters supporting the need for evacuations.

Residents knew their strategies and tactics were working when the governor was quoted several times saying he had "no comment;" that meant the media asked the right questions. The Governor was unable to escape the visuals on TV night after night of teary-eyed women, holding their small children, saying the governor wouldn't help their innocent families. His public relations people were at a loss of how to "spin" the mother and apple pie appeal, to keep the governor from being held publicly responsible.

Results

LCHA won the total relocation of 239 families living closest to the canal, temporary relocation of all pregnant women and families with children under the age of two, extension of the testing to a larger impacted area and more. There was little else that the LCHA thought they could win from the state.

Therefore, using the same strategies and tactics, we focused on a different target at the national level. President Carter was running for reelection. The image of mothers and fathers with sick children in tow was too much for him as well. On October 1, 1980, a year and a half after LCHA first organized, relocation benefits were offered to all residents living within a 10-block area.

Both our long term and short term goals were won using the strategy which personalized the focus on the decision makers. Rarely, would you hear about the Environmental Protection Agency or Health Department when LCHA asked for assistance. That is because it's easy for agencies to pass off responsibilities to others within the agency, or to another agency. The people who are in charge of government agencies report to someone above them; that is the person who holds the power to create the change you need.

credit: CHEJ

This is not to mean you skip the lower level government bodies altogether, only that you think about who has the power and use that person to nudge and drive the others. For example, when we wanted the area to be tested beyond what was initially proposed, we contacted the responsible agency representative first. When we were stalled or told "no," we asked the governor's office to direct his agency to test further. Our media releases said, "LCHA is imploring the governor to make his agency respond responsibly and test a wider perimeter around the canal."

Although it's been 25 years since the first activities at Love Canal, the strategies employed there have been proven to work in communities across the country. It is a matter of taking the time to plan, and develop clear strategies and tactics. It is about discipline and articulating a clear and consistent message to the public. And, it is about not getting off track by stakeholder meetings or other activities and staying focused on the person identified as the one with the power to create change.

Water Quality Criteria and Human Health

By Steve Dickens
River Network
Health Project
Director

Have you ever wondered where those numbers for water quality criteria for the protection of human health come from? Are they based primarily on scientific rationale or public policy decisions? Have you ever wondered if you have a basis to challenge those numbers? The derivation process, recently updated by EPA, includes a series of complex equations and assumptions. This article presents an introductory overview and critique of how these numbers are derived.[1]

Section 304 of the Clean Water Act requires the Environmental Protection Agency to establish criteria for water quality based on the latest scientific research. The criteria are guidelines for states and tribes, which under Section 303 of the Clean Water Act must adopt numerical water quality standards based on EPA's criteria, modifications to EPA's criteria based on local conditions, or "other scientifically defensible" methods.

The process starts with the science of toxicology. In toxicology, experiments are done to determine the dose of a particular chemical that causes an "adverse response" in an organism. Laboratory experiments in toxicology are performed on a variety of species, often mice and rats.[2] How the data is used from these experiments differs somewhat depending on whether or not the chemical causes cancer.

Non-Cancerous Chemicals

Let's consider the case of non-cancerous chemicals. First, a particular value is highlighted, called the "No Observed Adverse Effect Level" (NOAEL)—NOAEL the highest dose that does not result in an adverse effect or "Lowest Observed Adverse Effect Level" (LOAEL)—the lowest dose where adverse effects are first noticed.

What constitutes an "adverse effect?" Here we encounter our first departure from pure science into the realm of public policy. Different scientists exhibit different judgments about what is adverse. Consequently, different scientists may choose different figures for the NOAEL or LOAEL.

The Uncertainty Factor

Continuing our foray into the policy realm is the question of how we move from figures indicative of an adverse response in a laboratory animal to figures that might cause harm in humans. If the substance does not cause cancer in laboratory animals, the dose is divided by something called an uncertainty factor. The uncertainty factor may be a factor of 1, 3 or 10 and is used to extrapolate the results from laboratory animals to humans. Additional uncertainty factors may be used for other purposes as well, such as to extrapolate from experimental data based on acute (short-term) exposures to doses that may be harmful in chronic (long-term) exposure.

Why divide by a factor of 1, 3 or 10? Doesn't it matter what the chemical of concern is? It makes no difference what the chemical of concern is because there is no specific scientific rationale for using 1, 3 or 10; again, it's primarily a public policy decision. The grand assumption is that by dividing the dose known to be harmful to a small animal by a factor of 10, we are being very cautious and will render a number protective of human health insofar as humans are typically much larger than laboratory animals.

[1] Details may be found in the EPA document *Methodology for deriving Ambient Water Quality Criteria for the Protection of Human Health* available at: http://www.epa.gov/waterscience/humanhealth/method/complete.pdf

[2] Occasionally actual research is available based on humans. Usually these are toxicology studies in workplaces where people have been exposed to high levels of contaminants, or epidemiological studies such as health surveys done on the number of individuals who become sick after swimming in water with various levels of e.coli.

Unfortunately there are problems with such assumptions. First, such assumptions do not consider the fact that human embryos may be smaller and more susceptible to harm than certain laboratory animals. Second, one must consider the specific types of "adverse effects" toxicologists may have designed their laboratory experiment to detect. Perhaps it was an experiment designed to assess a chemical's adverse reproductive effects only. The experiment may consider numerous possible adverse effects ("endpoints") for reproduction but not consider any affects on embryonic brain development. Should the tests reveal an adverse affect for the latter but not the former, the assumption would be that the chemical was safe.[3] Third, even if the experiment were designed to look at all possible adverse effects (and few are), how do you assess the potential effects possibly unique to complex organisms like humans—effects such as psychological impacts, for example—based on data from a small organism that may not exhibit such impacts no matter what the dose?

Cancerous Chemicals

With chemicals known to cause cancer, the process of deriving a reference dose is slightly different, but it too is based as much on public policy decisions as it is on science. First, the dose considered to have an "adverse impact" is the dose that is associated with an increased risk of cancer of 10-6 or 1 in 1 million. Basically, a policy decision determined that it is acceptable for there to be a 1 in 1,000,000 (1:1,000,000) increased chance of cancer. Some states have decided that it is more appropriate to use figures associated with a 10-5 or 1:100,000 increased risk of cancer. Quite a difference, especially if you happen to be one of those 1 in 100,000 people. Should we consider any increased risk of cancer as acceptable?

Consider the following example where chlorine-using pulp mills were permitted to discharge dioxin & other organochlorines into the Columbia River. Many tribal members in the basin consumed 6 -11 times more fish than consumption rates upon which EPA/state standards of "acceptable" dioxin discharges to Columbia were based.4 Tribal members therefore were exposed to higher than "acceptable" doses. Chlorine makes paper white; safer alternatives exist that make paper white, but not ultra white. As Mary O'Brien points out in *Making Better Environmental Decisions – An Alternative to Risk Management*, the right of tribal members to nurse infants without poisoning them with dioxin in breast milk must surely rank ahead of society's desire for especially white paper.

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So, how do we calculate doses indicative of an increased risk of cancer in laboratory animals to doses pertinent to humans? The dose is scaled in proportion to the body weight raised to the 3/4 power. That adjustment factor is used because metabolic rates tend to scale that way. That's science. Now back to public policy. It is important to note that a huge assumption is made here: a substance that causes cancer in laboratory animals will also cause cancer in humans, and more importantly, a substance not causing cancer in laboratory animals will not cause cancer in humans.

[3] O'Brien, Mary (2000). *Making Better Environmental Decisions - An Alternative to Risk Assessment,* MIT Press

[4] Columbia River Inter-Tribal Fish Commission

cont. on page 12

Water Quality Criteria and Human Health, *cont.*

cont. from page 11

From Labs to Life

Several other noteworthy problems can result from assumptions made using data from laboratory experiments to assess potential levels of harm to humans. First, published research findings may be outdated. There are examples where contemporary research findings indicate that exposure to certain contaminants at levels that were previously considered safe actually cause adverse effects below those levels.[5]

Another problem is that the real world rarely operates as simply as a laboratory. In laboratory experiments, toxicologists carefully control exposure to ensure that the only adverse effects they may observe come from the primary chemical of concern. In the real world, humans—and other animals as well—are often exposed to a range of potential contaminants, some of which may act in synergistic fashion to cause adverse effects at concentration levels where either chemical alone might not produce an adverse effect.

The Reference Dose

Let's return to the derivation of water quality criteria. Once doses producing adverse effects in animals are converted to doses considered safe for humans, we arrive at something called the reference dose. The reference dose is then converted to a number representing the concentration of that chemical that is considered safe in a particular medium (soil, air or water). For simplicity, we'll restrict our discussion to water. In order for this conversion to be made, several assumptions must be applied: (1) the amount of water a person drinks per day; (2) the amount of fish a person consumes per day and (3) the amount a person weighs. Basically you're taking a dose, measured in mg/kg/day and dividing that by consumption rates in liters/day (water) and kg/day (fish) and multiplying it all by body weight (kg) to render a concentration measured in mg/l.

Estimations and Assumptions

EPA estimates that drinking water intake varies by about a three-fold range and fish intake can vary by 100-fold. Indeed, in their most recent changes in the methodology for deriving water quality criteria for the protection of human health, EPA now recommends an increased fish intake rate of 17.5 grams per day be used, representing the 90th percentile of those participating in a USDA survey. In addition, EPA recognizes that there could be large variations in fish intake levels and suggests that appropriate local data for fish consumption amounts be used. Hence, local groups should employ fish consumption surveys and insist on the use of such data for state and tribal water quality standards.

Still controversial is the fact that EPA recommends 70 kg as default body weight in these calculations. The median weight for adult women is about 65 kg, meaning that half of all women weigh less than that, and of course, most children weigh even less.

The derivation of ambient water quality criteria for the protection of human health is both a scientific process and a public policy process. Groups would do well to investigate contemporary peer reviewed studies to ensure that experiments on which reference doses are based are accurate and up-to-date. And with regard to policy decisions, it is vital that groups provide local input with regard to assumptions concerning which individuals are to be protected, and whether or not those assumptions should be based on protecting those who may be most vulnerable, such as small children and groups dependent on rivers for their primary source of drinking water and food.

[5] See the Environmental Working Group's Body Burden Report at: http://www.ewg.org/reports/bodyburden/findings.php

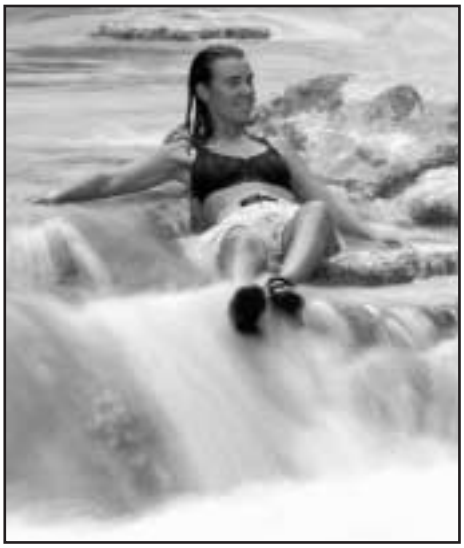
Making the Case for Alternatives to River Risk Assessments

Risky Business

By Mary O'Brien

Early September last year, I was snorkeling with fish biologist Joe Ebersole in the Imnaha River of northeastern Oregon. At one point, we held steady alongside a dozen Snake River chinook salmon. Two to three inches long, they faced upstream into the current, ready to dart toward whatever flies, midges, and caddisfly larvae the river might bring their youthful mouths. They were unforgettable.

We were wearing dry suits, with only our faces exposed. Joe suggested I spit when removing the snorkel mouthpart, so all traces of river water would go out, not in. His intestines once had been placed in battle status for a year after snorkeling in nearby Joseph Creek and Grande Ronde River for research on the use of cool refuges by fish.



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Although flowing through the Hells Canyon National Recreation Area, the Imnaha River is lined with private cattle feedlots, homes and the upstream town of Imnaha. While Joe and I were taking care to keep river water out of us, I thought of the endangered chinook developing, breathing, reproducing, and eating in this river water suffused with fecal coliform, nitrates, pesticides, and excess algae and warmth. Downstream, for instance in Hermiston, Oregon, some of this same water is used for human drinking water supplies.

The main manner in which all these stresses on the Imnaha and other streams and rivers is currently being approached by decisionmakers is through risk assessment. This needs to change.

What is a Risk Assessment?

Risk assessment is the process of estimating how much can be done to humans, other species or ecosystems, without bringing those humans, other species or ecosystems to their knees. Usually each stress is examined in isolation. In the case of a river, for instance, separate risk assessments are used to determine the maximum amount of a particular toxic; the least dissolved oxygen; the lowest or slowest flow; the maximum temperature; the maximum amount of fine sediments, or some other stress to which a stream can be subjected without becoming too dangerous or dysfunctional in some way. For example, causing "unacceptable" rates of cancer in humans using it for drinking water. Or smothering too many eggs of endangered salmon. Or making certain fish too dangerous for humans to eat. Always, the risk assessment fails to include all inhabitants, all ages, and accumulated stresses in the chosen models and estimates.

The language of risk assessment-based standards is revealing: Total *Maximum* Daily Load; *Maximum* Contaminant Level; *Minimum* Stream Flow; *Minimum* Viable Population. In other words, we calculate how callously humans and commercial operations will be allowed to treat our communities' rivers, inhabitants and water, regardless of whether the callousness is necessary.

Imagine raising your child according to risk assessment. You would assess the least amount of the cheapest food she needs to

cont. on page 14

Risky Business, cont.

cont. from page 13

eat in order to function, the least amount of time you will need to spend with her in order for her to learn how to talk, the maximum amount of noise that she can be expected to sleep through, the earliest age at which you can expect her to come home and fix her own dinner, and so on. In other words, what is the least you have to be inconvenienced to maintain her minimum functioning systems?

Supportive parents, however, practice benefits assessment and alternatives assessment. What healthful and fun activities can I offer my child? What books would she like me to read to her? What school or teacher will respond to the way she learns? How can I encourage her when she is sad? In other words, what am I able to do so my child will grow up happy, healthy, self-confident and kind?

Why, then, do we employ benefits and alternatives assessment for our child, but risk assessment for our streams and rivers? Some reasons come to mind: We know our child intimately; we feel a connection to our child; perhaps we see our child as a reflection on us as a parent. We speak of the responsibility we feel for our child and her future.

Contrast this with those who risk-assess a river: Are they acquainted with all the creatures who depend on the river? Do they understand (and feel) that the water in their bodies is connected to streams? That they drink from, play in and eat food nourished with the water from the stream? Do they see the turbidity, heat, toxicity and excessive algae in streams and rivers as a reflection on themselves as persons, businesses or communities? How often do we hear risk assessors—governments, industrial or agribusiness—talking about their personal responsibility to rivers and their inhabitants?

The Alternative

What if we were to regard our rivers and streams as we do our children? We would focus on how much we can give back to the river so that it will be healthy. We would look at alternatives we have for avoiding harming the river's native inhabitants; alternatives for drawing the least water. We would feed toxics into it only when non-toxic alternatives were infeasible. We would allow riparian areas to recover naturally, and banks to overflow. We would recognize that a stream is reflective of the community through which it flows and would feel responsible for its health.

The reality is that streams run in our veins. A stream runs through our toilet, through our faucets. What do we give to all these streams? One of the higher-concentration

pollutants in the Willamette River downstream of my town of Eugene, Oregon is peed-out caffeine. Scientists are measuring psychiatric drugs and birth control chemicals in streams flowing toward the fish and humans downstream. Individually, then, we mirror the industries we challenge.

We say, "River, wash away our unwanted wastes. Wash away our sins." But there is no "away." There are only interdependencies, losses and opportunities for reconciliation.

I urge unremitting opposition to risk assessment, and replacement of risk assessment with assessment of the pros and cons (costs and hazards) of a full range of alternatives for respectful treatment of rivers. I know many laws, industries, agencies, environmental consultants and courts currently base treatment of rivers and streams on risk assessments, most of which are inadequate to the point of fiction, if not deliberately manipulated. But always there are ways to work all or some of the following into your river advocacy work, in some form:

1. Articulate positive goals and compelling visions for the river(s) you are helping protect.
2. Question the necessity of subjecting the river to any given stress.
3. Propose feasible, attractive alternatives to current treatment of the river(s).
4. Candidly examine (and document, where possible) the social, economic, ecological, aesthetic and cultural pros and cons of all alternatives.
5. Tap into people's memories, feelings, stories, knowledge and art about the river(s) you're addressing. These bases for caring nearly always exist, often untapped, right alongside the callousness.

Hold steady, facing into the current, for whole, thriving rivers and healthier communities.

Mary O'Brien (Ph.D., botany) is author of Making Better Environmental Decisions: An Alternative to Risk Assessment *(MIT Press, 2000). She is currently writing a book on Hells Canyon, and working with a coalition to write alternatives for three forest plans in southern Utah. Email: mob@darkwing.uoregon.ed*

Community-based Health Surveys

By Dr. Richard Clapp

Citizens of contaminated communities concerned about their health may choose to conduct a health study in order to learn more about their community and to stimulate action by government or other institutions. Such community-based health surveys serve to better inform community members about the nature and implication of environmental contamination in their communities. The results, while rarely acceptable by academic publications, can serve to substantiate community member concerns and influence decision-making that may result in needed clean-up. This article reviews four case studies involving various types of community-based or community initiated health surveys.

While there is much resistance to community-based studies in academic circles, there have also been academics willing to assist the efforts of community groups. In some instances, government agencies or universities have conducted well-funded and more detailed studies that corroborated the community groups' initial findings. Two of our four case studies include examples of this.

Lipari Information Network

One of the worst hazardous waste sites in the U.S. was located in central New Jersey. For twenty-five years, a 16-acre site was contaminated with a variety of toxic chemicals and metals, some of which leached from the landfill into streams, lakes and nearby residential areas. After much publicity, the clean-up process began in the mid-1980s and a citizens' group, the Lipari Information Network (LINK) was formed to monitor the process and keep residents near the site informed of available information.

A national magazine ran a story about one particular group—those who had attended a Girl Scout camp on a small lake near the Lipari site—and the possibility that they might have gotten cancer from exposures while attending camp. In the early 1990s, LINK sought funds from the Agency for Toxic Substances Disease Registry (ATSDR) to conduct a health survey of those in its database, including some who had attended the Girl Scout camp. The organization sought the assistance of a professional research group to help design and analyze the results of a mailed survey.

The questionnaire was developed in consultation with LINK's Executive Director and volunteer staff. Many of the questions were about medical symptoms or conditions that were also included in the National Health Interview Survey conducted by the National Center for Health Statistics. For the medical conditions, the respondents were asked whether a doctor had told them they had the condition, and in what year the doctor had first told them. Additional questions were about activities specific to the area, including swimming in nearby lakes, eating fish from specific lakes and streams, entering beyond the chain link fences on the site, eating vegetables from backyard gardens near the site, etc. Questions about occupations and hobbies were included, as were detailed questions about smoking status and whether the respondent thought neighborhood exposures had made them sick.

2,483 completed questionnaires (66%) were returned for coding and analysis. The key step in the analysis was the creation of an activity score that combined several of the responses about activities such as swimming in potentially contaminated ponds, fishing or hunting or other recreation in areas near the Lipari landfill.

Results of the analysis of health outcomes in relation to activity scores were particularly striking. The prevalence of

many reported symptoms and medical conditions increased with increasing activity score. The most frequent symptoms that were significantly related to increasing activity scores were "cough or sore throat lasting two weeks or more," followed by "skin rashes, dry, itching skin, or severe acne," and "frequent or severe headaches." Less common symptoms that were still related to increasing activity scores included "frequent periods of anxiety, nervousness or depression," and "wheezing or shortness of breath not related to exercise." Medical conditions that were significantly related to increasing activity scores included "ulcers, gallbladder trouble, stomach or intestinal problems," followed by "asthma, bronchitis or emphysema" and "eczema, psoriasis, dermatitis or other skin trouble." All of these are plausibly related to the types of exposures that occurred near the Lipari site.

The results of the survey were discussed first with the LINK staff, and reviewed by ATSDR. Following this, a press conference was held in the summer of 1998 and a summary of the survey was sent to LINK registry participants. The striking results confirmed what citizens had thought to be the case.

Housatonic River Initiative

Pittsfield, Massachusetts is the location of a General Electric (GE) plant where PCBs were used in the process of manufacturing power transformers for many years. The operations of the plant resulted in pollution of the Housatonic River, which flowed past the plant, and fish contamination for many miles. In 1990, concerned citizens downriver formed the Housatonic River Initiative (HRI) to press for studies of the extent of contamination and a clean-up strategy.

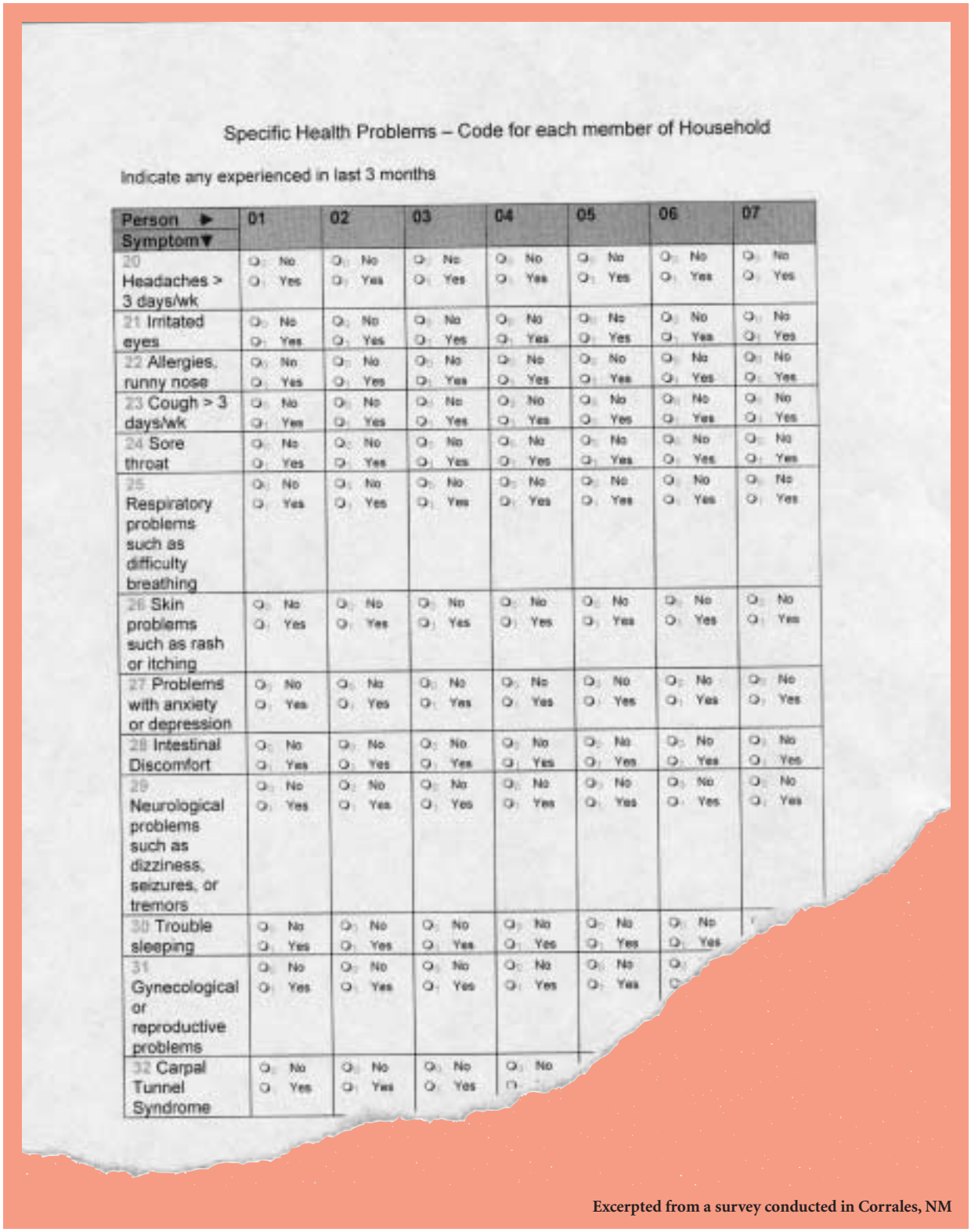
In the summer of 1999, it became widely known that almost forty years earlier, residents of the Lakewood community in Pittsfield landscaped their backyards using soil provided by GE. Adult residents reported health problems such as skin rashes and concern regarding their children's health. The HRI sponsored several community meetings at which residents spoke about their concerns and their recollections of the extent of

contaminated soil that was spread through the neighborhood. As a result of these meetings, the HRI applied for funds from the EPA to conduct its own survey of the health of the residents of the Lakewood section. They contacted the John Snow Institute Research and Training Institute (JSI), in Boston, and developed a plan to modify the questionnaire used in the Lipari Landfill study.

The questionnaire included questions about the same medical symptoms and conditions as the Lipari survey, but the list of activities was modified to include questions about

cont. on page 20

Sample Health Survey Excerpt



Specific Health Problems – Code for each member of Household

Indicate any experienced in last 3 months

Person ▶ Symptom ▼	01	02	03	04	05	06	07
20 Headaches > 3 days/wk	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
21 Irritated eyes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
22 Allergies, runny nose	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
23 Cough > 3 days/wk	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
24 Sore throat	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
25 Respiratory problems such as difficulty breathing	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
26 Skin problems such as rash or itching	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
27 Problems with anxiety or depression	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
28 Intestinal Discomfort	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
29 Neurological problems such as dizziness, seizures, or tremors	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
30 Trouble sleeping	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	
31 Gynecological or reproductive problems	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes		
32 Carpal Tunnel Syndrome	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No			

Excerpted from a survey conducted in Corrales, NM

	○ Yes	○					
	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
ptoms	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
38 Seen healthcare provider (3 mos)	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
39 What for?							
40 Hospitalized (past year)	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes	○ No ○ Yes
41 What for?							

42 Of the individuals in your household who work, where are they employed?

_____

_____

_____

_____

○ ○

NOTE FOR INTERVIEWERS: Only ask Questions (Do NOT read the answer options)

43 **Have you or anyone in your household visited a healthcare provider for any of these symptoms within the past 3 months?**

○ Yes ○ No

If no, skip to Question 45

44 **What was the visit for?**

_____

45 **Has anyone in your household been hospitalized in the past year?**

○ Yes ○ No

If no, skip to Question 47

46 **What was the hospitalization for?**

_____

Community-based Health Surveys, cont.

cont. from page 17

areas of concern near the GE plant, schools attended, employment at the GE plant, and time spent working in the backyard. As work on the questionnaire progressed, soil testing to determine the PCB levels in a large number of properties also took place. Some properties had such high levels of PCBs in soil that GE paid to have it removed and replaced with new soil.

The HRI administered the questionnaire, primarily by mail, but also door-to-door. The questionnaires were sent to JSI for key entry and construction of a spreadsheet data file for HRI staff. JSI staff did some initial analyses of prevalence of skin rash, thyroid conditions and miscarriages. The primary comparison in these initial analyses was the prevalence of symptoms or conditions in the Lakewood neighborhood compared to the prevalence in the National Health Interview Survey conducted in 1996. Using the same age groups as the NHIS, the prevalence of skin rash and thyroid disease in Lakewood males and females was consistently higher than in the national data, although the numbers of responses in individual sub-groups were small and statistical significance was not calculated. Further analyses of the Lakewood data are anticipated. Here, as in previous examples, the results are not unexpected, especially given HRI's concerns at the outset.

The fact that a survey was carried out by the HRI, with professional input and guidance from JSI has aided the group in bringing the health issues to higher visibility in the community and with health and environmental agencies. It has also further demonstrated the competence and accomplishments of the community group.

Following are two examples of communities where well-funded formal health studies confirmed initial community surveys and concerns. The community mobilization to demand answers is what pushed the various elected officials, agencies and universities to do the necessary work.

For a Cleaner Environment

Parents and neighbors of the East Woburn neighborhood, near the Aberjona River in Massachusetts, investigated and produced a map showing an excessive number of childhood leukemia cases within a few blocks of each other. In the mid-1970s, the parents of five children were all taking their children to the same pediatric hematology clinic at Massachusetts General Hospital for treatment. The mother of one of these children, Anne Anderson, convinced her doctor and her minister that there was something unusual happening in the community. Testing of the drinking water for chemical contamination showed dramatically elevated concentrations of trichloroethylene and perchloroethylene; two East Woburn wells were shut off in 1979.

A citizens group called FACE (For a Cleaner Environment) formed, and two of its representatives approached researchers at the Harvard School of Public Health for a study. The study included a fairly crude model of the water distribution system, and the results showed excessive exposure to water was statistically linked to about half of the twenty childhood leukemia cases. This study was released in 1984, about the time that the lawsuit described in "*A Civil Action*" (later made into a book and a movie) was filed.

The lawsuit initially named three defendants, all companies that polluted groundwater with solvents found in the two contaminated wells. The plaintiffs were the families of seven children with leukemia and one adult with leukemia who were exposed to the contaminated well water. One of the defendants settled very early in the process. The upshot of the trial was that one of the defendants was found guilty of polluting the groundwater and probably the drinking water in a time period relevant to the plaintiffs' exposure. At this point, the defendant, W.R. Grace Company, settled and the remainder of the trial never happened. As a result of the contamination of the East Woburn wells, the town reconfigured its water supply and an extensive clean-up of the groundwater was undertaken.

In the 1990s, the Massachusetts Department of Public Health did an additional study of the childhood leukemia cases that had occurred up until 1986. The later study incorporated a much more detailed model of the water distribution system in the 1970s and 1980s, and showed that the greatest risk of leukemia was in children whose mothers had been exposed to the contaminated East Woburn well water while they were pregnant. The excess risk was eight-fold and the risk increased with

increasing exposure to the water. This was the most convincing study yet which linked the water to the childhood cancer.

Ocean of Love

In the 1990s, a similar pattern of excessive childhood cancer was noticed by parents in Tom's River, NJ. The parents formed a support group called Ocean of Love. It didn't take long to realize that, given the size of the region, there were far too many participating members. They called on the New Jersey Health Department to investigate the childhood cancer rate and the state statistics confirmed that there was an excess of childhood leukemia and brain cancer in the community in the 1980s. The parents also got the attention of the Governor and one of the Senators and pressed for more extensive research and examination of the contaminants in the drinking water.

The New Jersey Department of Environmental Protection also confirmed that the drinking water was contaminated with chemicals. The chemicals were likely

Community-based Health Surveys, cont.

cont. from page 21

from a landfill and a chemical company in the town. Here again, the contaminated wells were serving parts of the town and the excess childhood cancer seemed to be concentrated near the wells.

While the additional chemical testing was being done by the New Jersey DEP and the U.S. EPA, the ATSDR provided funds and support to the New Jersey Department of Health and Senior Services to do a study of the forty childhood leukemia and brain cancer cases. The results were similar to the Woburn results; the highest risk of leukemia was in the children whose mothers had been exposed to contaminated well water during their pregnancy.

Meanwhile, a legal case was prepared on behalf of over sixty families who had children with cancer and who were exposed to the contaminated water in Tom's River. The process differed from the Woburn lawsuit, however, as the multiple defendants and plaintiffs agreed to meet with a mediator for about two years before filing a lawsuit. During this two year period, while the New Jersey/ATSDR childhood cancer study was underway, the plaintiffs' attorneys using the same questionnaire as the health study, developed their own survey of the cases. The plaintiffs also had access to the water model developed by Federal scientists and released to experts working for the attorneys. This information was compiled and presented in a mediation session while defendants' experts listened and asked critical questions.

At the end of the mediation period, and shortly before the official release of the New Jersey Department of Health and Senior Services final study report, the potential defendants offered a settlement that the families accepted. The details of the settlement are secret. The New Jersey/ATSDR study results were announced in 2001 and will eventually be published in the scientific literature.

These stories of water contamination and community health problems serve as a warning and an inspiration to groups working for safe water everywhere. All involved committed parents and neighbors pressuring state and federal agencies, and getting help from concerned professionals and universities to answer their questions. All resulted in substantiation of community concerns. Some received national attention in the media, and two involved legal actions that resulted in at least some compensation to the families affected by the contaminated water. These stories illuminate the steps and the commitment needed to protect our water supplies, and serve as cautionary tales of what can happen if we don't.

Dr. Clapp established the Massachusetts Cancer Registry and was its first Director, from 1980-1989.
Dr. Clapp later directed the Center for Environmental Health Studies at the John Snow Institute. In 1993 he joined the staff of the Boston University School of Public Health where he is an Associate Professor.
He serves on several advisory boards and is on the Governing Council of the International Society for Environmental Epidemiology.
Dr. Clapp is an Advisor to the River Network Health Project.

Monitoring Bacteria:

The Basics

By Geoff Dates
River Network
River Watch Director

When you swim in lakes and streams, you run the risk of swallowing water laced with disease-causing organisms. So, what is the risk of getting sick at your favorite swimming hole? That's where bacteria monitoring comes in.

Before we start in on the danger of bacteria, it's important to remember that many bacteria perform essential functions in nature, such as decomposition, carbon cycling and nitrogen cycling.

What Are Fecal Bacteria and Why Are They Important?

When people drink, play in or water their crops with contaminated water, they are exposed to not only bacteria, but other pathogens that are found in human waste, including viruses (like influenza) and protozoans (like cryptosporidium).

Bacteria are single-celled microorganisms, some of which are used as indicators of the presence of disease-causing organisms (pathogens). Because it's too difficult to test for the pathogens themselves (there are too many and they tend to mutate more quickly than tests can be developed), members of two bacteria groups, coliforms and fecal streptococci, are used as indicators of possible sewage contamination. Although they are generally not harmful themselves, they indicate the possible presence of disease causing organisms that live in human and animal digestive systems and are found in their feces. If you find high levels of fecal indicator bacteria in your swimming hole, jumping in may be a health risk.

Monitoring bacteria is challenging: There are many that are naturally-occurring in surface water. There are many sources of contamination water gets contaminated:

- Malfunctioning septic tanks
- Untreated/poorly treated wastewater
- Combined sewer overflows
- Leaking sewer lines
- Polluted runoff
- Wildlife

A good indicator bacteria needs to:

- be there all the time
- be consistently and exclusively associated with human feces
- be easily and quickly detected
- able to be cultured predictably and reliably
- mimic the survival of pathogens
- provide a good association with health risk

Monitoring Bacteria, cont.

Indicator Bacteria Types and What They Can Tell You

credit: Mark Bühler

The most commonly tested fecal bacteria indicators are the groups total coliforms, fecal coliforms and fecal streptococci. All are comprised of a number of species of bacteria that share common characteristics such as shape, habitat or behavior. Within these groups, enterococci and Escherichia coli (E. coli) are tested. E. coli is a single species in the fecal coliform group.

Which bacteria you test for depends on what you want to know. Do you want to know whether swimming in your stream poses a health risk? Do you want to know whether your stream is meeting state water quality standards?

Studies conducted by EPA to determine the correlation between different bacterial indicators and the occurrence of digestive system illness at swimming beaches suggest that the best indicators of health risk from recreational water contact in fresh water are E. coli and enterococci. Interestingly, fecal coliforms as a group were determined to be a poor indicator of the risk of digestive system illness. However, many states continue to use fecal coliforms as their primary health risk indicator.

If your state still uses fecal coliforms, you should monitor them if you want to know whether the water meets the state water quality standards,. However, if you want to know the health risk from recreational water contact, consider testing for E. coli.

In addition to bacteria testing, some groups have been looking at other indicators of the presence of sewage, such as optical brighteners used in many detergents. Still others are focused on identifying the source of the bacteria by phenotyping or genotyping, very complex and expensive procedures that look for a genetic "signature" of a particular critter.

Which Method?

Bacteria can be difficult to analyze, even in a laboratory. This is primarily because the procedures are complex and absolutely sterile conditions are required. There are two basic methods for analyzing water samples for bacteria:

1) The **membrane filtration method** involves filtering the water sample using standard filters, placing each filter on a nutrient medium in a petri plate, incubating the plates at a specified temperature and time period, and then counting the colonies that have grown on the filter. This method varies for different bacteria types. Some tests use high temperature incubation or substances in the medium to inhibit the growth of unwanted colonies. Others use dyes that are keyed to the byproducts produced when the bacteria consume nutrients. Examples include the mFC method for fecal coliform, mTEC for E. coli, MI for total coliforms and E. coli, and EasyGel. In any case, bacteria are counted and reported as colony forming units (cfu) per 100 milliliters.

2) The **multiple-tube fermentation method** involves adding specified quantities of the water sample to tubes containing a nutrient broth, incubating the tubes at a specified temperature for a specified time period, and then looking for the development of gas and/or turbidity that the bacteria produce. The presence or absence of gas in each tube is used to calculate an index known as the Most Probable Number (MPN). A recent variation on this is the Quantitray Method.

There are many variations on these two basic methods.

Bacteria results are usually compared with state water quality criteria, which describe levels which should not be exceeded for different forms of recreation or drinking water. Monitoring for fecal bacteria, and using these criteria as benchmarks, might enable your group to help people decide whether it's safe to jump in.

Bacteria plates going into the incubator

credit: Geoff Dates

RESOURCES & REFERENCES

The Agency for Toxic Substances and Disease Registry (ATSDR) is the federal agency primarily responsible for protecting the public from harmful exposures and disease related to toxic substances. ATSDR does public health assessments and has the authority to order EPA to clean up contaminated sites. ATSDR has some wonderful people and resources, but some have charged the agency applies impossible standards to substantiate real world health problems, and hence may fail to adequately protect public health. http://www.atsdr.cdc.gov/

Center for Health, Environment and Justice was founded in 1981, as the Citizens Clearinghouse for Hazardous Waste (CCHW). CHEJ seeks to help local citizens and organizations come together and take an organized, unified stand in order to hold industry and government accountable and work toward a healthy, sustainable future. PO Box 6986, Falls Church, VA 22040; 703/237-2249; chej@chej.org. http://www.chej.org/

The Children's Environmental Health Network is a national multi-disciplinary organization whose mission is to protect the fetus and the child from environmental health hazards and promote a healthy environment. Their webpage provides information on the Network, the issue of children's environmental health, and links to sources of information and resources in the field. http://www.cehn.org/

Children's Health Environmental Coalition is a national nonprofit organization dedicated to educating the public, specifically parents and caregivers, about environmental toxins that affect children's health. CHEC, PO Box 1540, Princeton, NJ 08542; 609/252-1915; 609/252-1536 (f). http://www.checnet.org/

As the Nation's natural resource science agency, the **U.S. Geological Survey (USGS)** plays a significant role in understanding environmental contributions to diseases and human health. Environment and Human Health, a site hosted by USGS, highlights various reports, fact sheets, upcoming events and databases related to health. http://health.usgs.gov/

The Environmental Working Group and its team of scientists, engineers, policy experts, lawyers and computer programmers pores over government data, legal documents, scientific studies and our own laboratory tests to expose threats to your health and the environment, and to find solutions. Washington, D.C. office, Environmental Working Group, 1436 U Street NW, Suite 100, Washington, D.C. 20009; 202/667-6982; 202/232-2592; info@ewg.org. http://www.ewg.org/

The Indigenous Environmental Network is an alliance of grassroots indigenous peoples whose mission is to protect the sacredness of Mother Earth from contamination and exploitation by strengthening maintaining and respecting the traditional teachings and the natural laws. http://www.ienearth.org/

The National Center for Health Statistics' webpage, a rich source of information about America's health, compiles statistical information to guide actions and policies to improve the health of people. http://www.cdc.gov/nchs/about.htm

The National Environmental Justice Advisory Council is a federal advisory committee that was established by charter on September 30, 1993, to provide independent advice, consultation and recommendations to the Administrator of the U.S. Environmental Protection Agency on matters related to environmental justice. http://www.epa.gov/compliance/environmentaljustice/nejac/index.html

The Right-to-Know Network provides free access to numerous databases, text files, and conferences on the environment, housing and sustainable development. With the information available on RTK NET, you can identify specific factories and their environmental effects; analyze reinvestment by banks in their communities; and assess people and communities affected. http://www.rtknet.org.

The National Library of Medicine (NLM), part of the National Institutes of Health, is the world's largest medical resource library. NLM's Toxicology and Environmental Health Program has implemented the TOXNET® (Toxicology Data Network) system of databases on toxicology, hazardous chemicals and related areas. http://toxnet.nlm.nih.gov/

Trust for America's Health is a nonprofit, non-partisan organization dedicated to saving lives by protecting the health of every community and working to make disease prevention a national priority. Trust for America's Health, 1707 H Street, NW, 7th Floor, Washington, D.C. 20006; 202/223-9870; 202/223-9871 (f). http://healthyamericans.org/

River Network Resources for Investigating Health Problems

1. **Health Assessments.** River Network can provide general guidance on how to conduct area health assessments. From investigating potential sources of contamination to identifying exposure vectors and researching the known health effects of contaminants, our Health Project can walk you through the basic protocol.
2. **Health Surveys.** A frequent component of health assessments are surveys designed to assess the relationship between exposure variables (e.g., how much fish someone consumes) and health outcome variables (e.g., a specific illness). Our Health Project can provide you with basic guidance on the dos and don'ts of the complex methodological choices involved in conducting an epidemiological study.
3. **Bacteria Monitoring.** When water based pathogens are of primary concern, our River Watch program can provide you with appropriate guidance on the myriad of choices available for monitoring bacteria. Our *Testing the Waters* manual has a small section on bacteria, and staff can provide additional guidance and information.
4. **Biomonitoring.** Benthic macroinvertebrates (BMIs) are the canaries in this coalmine. These bottom dwelling creatures in streams that fish feed upon, which are excellent indicators of overall water quality. Wanting to check out the potential effects of toxic contamination on the aquatic ecosystem? BMIs are your first stop. Our River Watch program's *Living Waters* manual is an excellent reference guide.

For additional information check out the River Network Health site at http://www.rivernetwork.org/health

LET RIVER NETWORK HELP YOU KEEP YOUR HEAD ABOVE WATER.

Join the River Network Partnership and connect to the information and resources you need to stay afloat!

- **Access our River Source Information Center with the 1-800 hotline:** Let us help you research a particular issue and put you in touch with the necessary contacts and resources through one-on-one consultations.
- **Log onto our Partner-only website:** Browse the updated postings of funding sources, upcoming events and trainings, and download river clipart.
- **Receive the myriad of Partner benefits**, including subscriptions to *River Voices* and *River Fundraising Alert*, a copy of the *Directory of Funding Sources for River and Watershed Conservation Organizations*, and a copy of either *Starting Up: A Handbook for New River and Watershed Organizations* or *How to Save a River*…and more!

www.rivernetwork.org

SIGN ME UP!

Annual Partner Dues are only $100

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Name _____ Phone ( ) _____

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Address _____

City _____ State _____ Zip _____

❑ My check is enclosed

Please charge my credit card: ❑ VISA ❑ MasterCard

Card# _____ Exp. Date _____

Signature/Name on card: _____

You will receive your initial set of Partner materials, including your choice of: (check one)

❑ ***How to Save a River*** ❑ ***Starting Up: A Handbook for New River and Watershed Organizations***
❑ ***River Talk!*** ❑ ***Listening to Watersheds*** ❑ ***Testing the Waters***

Please make your check payable to River Network and return this form to:

River Network, 520 SW 6th Ave., Suite 1130, Ptld., OR 97204-1511 Phone: 503/241-3506

River Network works to support you and your needs. We provide training and technical assistance to our Partner groups. River Network does not promote legislation or represent your organization in legal matters.

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Connecting People, Saving Rivers
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For more information, contact Michael Curnes at 503/ 542-8396 or eamil mcurnes@rivernetwork.org.