

THE EMPEROR OF RISK ASSESSMENT ISN'T WEARING ANY CLOTHES

[Rachel's introduction: The U.S. chemical regulation system was created 40 years ago to protect the most-exposed individuals, using numerical risk assessment to determine "safe" exposures. One unintended consequence of the system has been to contaminate the entire planet with industrial poisons. As a result, no one is safe.]

By Peter Montague

Some of my best friends still put their faith in numerical risk assessments. For example, over in Jersey City, N.J., local people are now debating "how clean is clean enough" for thousands of tons of cancer-causing chromium wastes. My friends argue that 30 parts per million (ppm) of chromium-VI ("chromium six") is a "science-based" number that will protect residents from lung disease caused by chromium. On the other hand, N.J. state government wants to save the chromium polluters some money by declaring 240 ppm "safe," thus requiring less cleanup. The experts are duking it out, debating 30 ppm vs. 240 ppm.

Over in New York, major polluters have convinced state officials that toxic waste cleanup standards are unnecessarily strict, so the state has proposed to relax its toxic cleanup rules. Citizens are pressing to maintain the existing standards, which they hope are "fully protective" of human health, fish, and all other critters. Again, we have dueling experts defending their favorite numbers.

It's the same all over, really. After decades of industry-written government-delivered propaganda, many people have become convinced that there is some "safe" amount of PCBs plus mercury plus lead plus benzene plus trichloroethylene (TCE) plus [you name it] that can be released into the general environment. But let's think about this for a minute.

This whole approach is based on protecting a most-exposed individual located in the immediate vicinity of the pollution source. Once the pollution-source has been declared "safe" from the viewpoint of that most-exposed individual, the toxic discharge becomes legal, and a continuous stream of contamination enters the environment. As time passes, this "safe" discharge (plus thousands more like it) creates a buildup of pollution and the entire planet becomes contaminated with industrial poisons. As a result, everyone is endangered -- the asthma rate rises, diabetes increases, and cancers proliferate, not to mention male fish turning into females, oysters dying from bacterial infections because their immune systems are damaged, sea turtles developing deadly growths and lesions, ducks that cannot eat because they are born with crossed bills... and so on and so on.

Let's face it, a regulatory system based on risk assessments to

protect the most-exposed individual ends up having one important effect: it legalizes the contamination of the biosphere upon which all life depends. It allows industrial poisons to pollute every living thing on earth. So it ends up not protecting anyone, despite its initial good intention.

Example: A factory is emitting cancer-causing benzene. A numerical risk assessment shows that only one-in-a-million individuals living near the factory will get leukemia from breathing benzene for a lifetime. Therefore the factory's benzene emission is declared "safe" and a permit is issued, making that factory's benzene discharge legal. But after 10 or 20 or 50 different benzene emitters have been licensed as "safe," the individual discharges have a cumulative effect: the entire area becomes contaminated with low levels of benzene. Eventually, you work your way up to our present situation -- benzene is measurable in the air everywhere, and thus poses a small but greater-than-zero cancer hazard to everyone who breathes the air (not to mention non-cancer harms that benzene may cause).

What is true for benzene is also true for mercury, PCBs, trichloroethylene (TCE), tetrachloroethylene (PCE), carbon tetrachloride, formaldehyde, xylenes, dioxins and furans, polybrominated diphenyl ethers (PBDEs), and on and on and on. There are 80,000 chemicals now in commercial use. Only a couple of thousand of these had undergone any testing for effects on human health and the environment. Only a few hundred are regulated in any way. For most chemicals, we are still living in the wild west: anything goes.

Even when a chemical is regulated, the regulatory system never asks, "What is the cumulative effect of all these small discharges of toxicants?"

To summarize: Our regulatory system was developed in the mid-1960s to protect the maximally-exposed individual. The idea was, if you protect that individual, then everyone else will be safe. We now know that this is completely backward. Some 40 years later, scientific knowledge has increased greatly and we now know that...

** "If chemicals are produced, either intentionally or as by-products of industrial activities, and not destroyed naturally or by humans, they eventually reach the environment." [1, pg. 815]

** Once chemicals enter the environment, they start moving around and eventually end up in living things (the food chain);

** some contaminants are harmful at much lower levels than we ever knew (for example some chemicals are biologically active at concentrations measured as parts per billion or even, in some instances, parts per trillion);

** harm can occur in ways we never suspected (for example, disrupting our hormones, which control growth, development, brain function, behavior, and sexual orientation, among other things);

** multiple stresses on an individual can add up (or even multiply) to create harm greater than the harm caused by any of the individual stresses. For example, children who don't have enough iron in their diet can be harmed by toxic lead much more than kids who get enough iron. Iron deficiency and toxic lead add up to a bigger problem than either iron deficiency or toxic lead alone.

Industrial poisons are now found everywhere on the planet, from the bottoms of the deepest oceans to the tops of the highest mountains. This has occurred because our regulatory system is set up to protect the most-exposed individual, but it is not set up to protect the world from the cumulative effects of releasing "safe" quantities of industrial poisons.

All of this was summarized clearly by researchers at Oak Ridge National Laboratory (ORNL) 14 years ago, in 1991:[1]

Writing in [Environmental Science & Technology](#), Curtis Travis and Sheri Hester said in 1991:

** "If chemicals are produced, either intentionally or as by-products of industrial activities, and not destroyed naturally or by humans, they eventually reach the environment." (pg. 815)

** "Chemicals, once they are released into the environment, seek out the environmental media (air, water, soil, or biota [living things], in which they are most soluble." (pg. 815)

** "Once in the environment, [chemicals] are transported globally, partition into biological media [some preferring to stay in the air, others preferring soil or water or living things], and result in essentially the entire world population being exposed to trace levels of chemical contamination." (pg. 815)

** "... a consensus is emerging that even trace levels of environmental contamination can have potentially devastating environmental consequences." (pg. 815)

** "With alarming regularity we find reports of chemical contamination in parts of the world previously thought to be pristine."

** "Aerial fluxes of these pollutants contribute a major portion of pollutant loadings to the Great Lakes, the Chesapeake Bay, and other lakes." (pg. 815)

** "Humans are exposed to hundreds of synthetic organic chemicals daily." (pg. 817)

** "...the true extent of human exposure to environmental pollution has never been quantified." [And this remains true today.]

Back in 1991, the Oak Ridge researchers pointed out another basic

feature of the U.S. regulatory system: To protect the most-exposed individual, locally high concentrations of pollution are decreased not by destroying the chemicals or decreasing production, but by moving them to a different environmental medium (moving them from air to water, for example).

Here's how it works: stack emissions are reduced by installing stack scrubbers which use water to remove gases and soot from stack emissions. Scrubber water is typically then sent to a municipal sewage treatment plant. During water aeration at such plants, up to 99% of volatile chemicals are discharged into the air. A study of toxic exposures in Philadelphia found that more than half of the local exposures to cancer-causing chemicals came from the local sewage treatment plant. (pg. 817)

At the great majority of toxic [Superfund](#) sites, contaminated groundwater is cleaned by "air stripping" volatile organic chemicals from the groundwater, releasing the toxicants into the air. Very few Superfund cleanups actually produce "permanent" remedies, in the sense of actually detoxifying any chemicals. Usually, toxic chemicals are just moved around in a "shell game" that passes the problem on to someone else. This is certainly the case in New Jersey where the preferred remedy for contaminated sites is to place a "cap" over them. A typical cap is a plastic tarp or a parking lot or a shopping mall or a school. As chemicals ooze out from under the cap (or through the cap) [the entire environment of New Jersey and beyond has become contaminated with low levels of industrial poisons.](#)

As the Oak Ridge researchers pointed out in 1991

** "The only way to diminish global cycling of contaminants is to decrease production of pollutants or to destroy pollutants before they are released into the environment." (pg. 818) Think about that: there are only two ways to diminish global pollution. Are our regulatory agencies set up to diminish global pollution? Not even close.

** And: "EPA's regulatory focus is on controlling local exposure to large point sources of pollutants.... Thus EPA regulations, although protective of the maximum exposed individual, do little to reduce the overall U.S. rate of cancer resulting from exposure to toxic pollutants." (pg. 818)

** And: "The difficulty with regulating background risk is that it results from widespread global pollution from a multitude of widely dispersed sources. This pollution cannot be reduced significantly by controlling emissions associated with production and use. When these chemicals are produced and not destroyed naturally or by humans, they will eventually reach the environment." (pg. 818)

** And: "If we do not want to change our standard of living, the only way to reduce global chemical pollution is to make our production and consumption processes more efficient and to lower the levels of production of these toxic chemicals. Thus the only reasonable solution

to global pollution is not increased regulation of isolated point sources, but rather an increased emphasis on waste reduction and materials recycling. Until we focus on these issues, we will continue to experience background cancer risk in the one-in-a-thousand range." (pg. 818)

In sum: The use of numerical risk assessment to determine a "safe" level of exposure for the most-exposed individual is a way of pretending to protect public health without actually protecting it.

When we create toxic chemicals that we do not destroy, and that nature cannot rapidly destroy, those chemicals come back to bite us. That is why it is so important that we press ahead with [green chemistry](#) [and see [this report](#)], [green engineering](#), [clean production](#) and [biomimicry](#) (learning how nature does things, to make our chemicals and processes compatible with nature). Most of our industrial system will have to be redesigned from the bottom up to be compatible with nature. Doing so will create tens of millions of good jobs.

In the meantime, government, industry, and my friends could stop pretending that numerical risk assessment of the most-exposed individual protects public health. It doesn't. Everyone knows it doesn't. Ending the pretense would go a long way to restore confidence in government. That in itself would be a huge benefit.

=====

[1] Curtis C. Travis and Sheri T. Hester, "Global Chemical Pollution," *Environmental Science & Technology* Vol. 25, No. 5 (May 1991), pgs. 815-818. Available [here](#).