For most of history, humans were so puny, compared to the rest of nature, that the speed of technological change didn't matter. But since 1945, humans have become a major force that nature must reckon with. Human activities now mobilize (pull from the deep earth and redistribute into surface soils and water) much larger quantities of many minerals than all the rest of nature put together. In other words, humans dwarf the rest of nature when it comes to moving nitrogen, phosphorus, sulfur, arsenic, mercury, lead, and a dozen other metals. In addition, we have invented and dumped into the environment enormous quantities of synthetic chemicals that nature does not ordinarily create. As a result, we puny humans are changing the chemical balance of the soils and waters of the entire planet. We are now waiting (without paying close attention) to learn what effects these changes will have on wildlife and on human health.[1]

As we saw last week, we are flying blind (see REHW #490). When we deploy new chemical technologies (and genetic engineering technologies), we have little or no idea what the consequences will be. We learn about the consequences by trial and error, exposing wildlife and humans and then waiting until harm becomes evident. Usually, we do not even study the exposed individuals in any systematic way. Wildlife may or may not be studied. In the case of humans, we almost invariably wait until they notice symptoms in themselves. Then we generally ignore them until they become desperately angry and get themselves organized into a political force. Then we may begin to look for harm, using crude techniques like epidemiology, which can only discover problems that affect a large proportion of the study population.[2] Such studies take years to complete; meanwhile exposure to the chemical continues. This is the "prove harm" philosophy of public health protection and it forms the basis of the public health system in the civilized world today. It is not a philosophy based on prevention. Victims have to prove harm before controls can be initiated.

After harm becomes evident, we may (or may not) take regulatory steps to control the source of the problem. Although corporate polluters complain bitterly that they are being strangled by environmental regulations, in truth, all of the nation's environmental laws, taken together, impose controls on only about 350 individual chemicals. There are 71,000 chemicals in commercial use today, so our regulatory system imposes controls on one-half of one percent of the chemicals currently in use. In other words, 99.5 percent of chemicals are entirely unregulated.

Under the "prove harm" pollution control system, the way we learn about chemical problems is by unpleasant surprises. We learn after the fact that we have begun to heat up the planet by our emission of greenhouse gases. We learn after the fact that our refrigerators and air conditioners have eaten holes as big as the United States in the atmosphere over the north and south poles. We watch cancer rates steadily rise and after about three decades of this, we begin to scrutinize trends. This is the way the "prove harm" public health protection system works.

The most recent tidal wave of bad news has to do with hormones. The new book, OUR STOLEN FUTURE, describes how scientists during this decade have pieced together the latest threat to the future of all life on earth. Hormones are natural chemical messengers that flow through the blood stream, providing chemical instructions that control growth, development and behavior in birds, fish, amphibians, reptiles, and mammals, including humans. No one knows how many of the 71,000 chemicals now in use can actually interfere with hormones; so far, 51 chemicals have been shown to have such an effect. The range of problems that may be caused by hormone disruption is large: cancer, birth defects, confusion in sexual preference (seen in wildlife and in laboratory animals), poor parenting (seen in wildlife), stunted growth, reproductive failure, diminished sperm count, endometriosis (a painful disease of the menstrual tissues), ectopic (tubal) pregnancies, damage to the immune system, impaired short-term memory, decreased ability to pay attention, diminished intelligence, violent behavior -- the list is long and unpleasant. There is no doubt that hormone-related damage is occurring in some wildlife populations. The case for damage to humans is less firm; however, it seems certain that this is a serious problem that the public health system must now gear up to define and then begin to solve.[4]

The main question raised by this most recent tsunami of bad news is this: given that we are flying blind, what public policies could we adopt that might reduce the number of unpleasant surprises we leave to our children?

The problem breaks down into two parts: (1) what should we do about existing chemicals? And (2) what should we do about newly-created chemicals?

For existing chemicals, OUR STOLEN FUTURE offers some useful suggestions:

** Greatly reduce the number of chemicals on the market. OUR STOLEN FUTURE describes an effort to find environmentally benign chemicals for use in the textile business. A group of researchers examined 7500 chemicals used to dye or process fabrics. They eliminated chemicals that were toxic, persistent, mutagenic, carcinogenic, or known to interfere with hormones. Of the 7500 chemicals, only 34 passed all the tests. As a result, an environmentally benign fabric is now being marketed.[5]

** Reduce the number of chemicals in products. Make products simpler.

** Make and market only chemicals that can be readily detected at relevant levels in the real world with current technology.

** Restrict production to only products that have a completely defined chemical makeup and disallow products containing unpredictable mixtures of chemicals. Such mixtures -- for example the 209 PCBs [polychlorinated biphenyls] -- are difficult to test for safety and to track after they are released into the environment.

These are useful suggestions for altering our approach to EXISTING CHEMICALS. But the issues involved are very complicated and hard for most people to understand. A campaign to achieve these changes would quickly bog down in debates between "dueling experts." The public would be left out and would sleep through the debates. EXISTING CHEMICALS, therefore, offer limited opportunities for initiating needed changes.

On the other hand, NEW CHEMICALS offer much greater opportunities.

** OUR STOLEN FUTURE points out (pg. 219) that we need to reverse the burden of proof for safety of new chemicals. Presently new chemicals are considered innocent until proven guilty. This should be reversed. New chemicals should be assumed harmful until they have been thoroughly tested for all the kinds of harm we presently know about. (This will still not prove that any chemical is "safe" because history tells us that, in the future, new kinds of harm will become apparent, and furthermore we can never test for all the possible interactions between existing chemicals and new ones.)[6]

Requiring that new chemicals be thoroughly tested, then banning the bad ones, is the essence of pollution prevention. Despite this, most corporate polluters -- even those claiming to be green as grass -- would almost certainly oppose it. A campaign to make this one fundamental change -- to reverse the burden of proof for chemical safety -- might quickly reveal the amorality and the raw power of corporate polluters. This would be a win-win battle, well worth taking on. Even if such a campaign did not initially succeed in reversing the burden of proof, it might lead to wider understanding
that (a) corporations cannot reform themselves and (b) that the corporation form itself will have to be addressed before we can significantly improve chemical safety. (See REHW #489, #488, #455, and #449.)

Strategically, it makes good sense to start with a campaign to reverse the burden of proof for chemical safety. It is an issue that everyone can understand. It's simple: if a chemical hasn't been thoroughly tested, it's assumed dangerous and can't be manufactured. The morality is clear: every baby has the right to be born free of poisonous chemicals. No corporation has the right to chemically trespass, to penetrate our bodies with poisons. Pharmaceutical drugs have to be thoroughly tested before they can be sold; for the same reasons, all chemicals should have to be thoroughly tested before they can be sold. Who would oppose this change? Few people have anything at stake if a chemical gets banned before it is ever manufactured. Therefore, most people have no reason to oppose thorough testing of new chemicals. A campaign to shift the burden of proof for chemical safety would starkly expose the power relationship between the public and the corporate polluters. Corporations campaigning for the right to release untested poisons into the environment would be shooting themselves in the foot.

True, shifting the burden of proof for chemical safety would slow the speed of chemical innovation -- but that's part of the point. Evidence accumulated during the past 25 years (see REHW #490) strongly suggests that, when you are flying blind, you should fly more slowly than we are presently doing. That way, even if you hit a mountain, there still might be a chance for survival.

-- Peter Montague


[2] In principle, epidemiology can discern small effects, but this requires studying large groups which, under most circumstances, is not practical.


[4] See, for example, ENVIRONMENTAL HEALTH PERSPECTIVES SUPPLEMENTS Vol. 103 Supplement 4 (May, 1995) devoted to the subject of "Wildlife Development." And see ENVIRONMENTAL HEALTH PERSPECTIVES SUPPLEMENTS Vol. 103 Supplement 7 (October, 1995) devoted to the subject of "Estrogens in the Environment." And see ENVIRONMENTAL HEALTH PERSPECTIVES SUPPLEMENTS Vol. 103 Supplement 9 (December, 1995) devoted to the subject of "Great Lakes and Human Health." ENVIRONMENTAL HEALTH PERSPECTIVES is a peer-reviewed journal published by the National Institute of Environmental Health Sciences (NIHES), a federal agency.


[6] Present tests are inadequate for defining the various kinds of harm that are possible. To begin with, when a chemical is tested, its metabolites and degradation byproducts should be tested as well. The chemical and its metabolites and degradation byproducts should be subjected to an improved battery of tests which would examine 3 generations of various animals species, with exposure occurring at various times in the life of the first and second generations (because the TIMING of exposure is critical for certain effects to be revealed). The battery of chemical tests should be done in an uncontaminated environment (as is present practice) but also should be done under pseudo-realistic conditions, with the test animals simultaneously exposed to various "background" conditions, such as farmers might endure, or city dwellers, or workers in factories or in offices. By this means, the interactions between a new chemical and existing "background levels" of chemicals might be revealed. If any diminished capacity or altered function in the nervous system, immune system, endocrine (hormone) system or any organ system is revealed during the full battery of tests, or if any disease condition or genetic damage is initiated or promoted by the chemical being tested, of if the chemical is persistent or bioaccumulative, (see REHW #378) then the principle of precautionary action would be invoked: given that harm can be reasonably expected or suspected, even before scientific consensus is achieved the new chemical would be abandoned for commercial purposes.

Descriptor terms: technological change; biogeochemical cycles; prove harm philosophy; pollution prevention; regulation; our stolen future; hormone disrupters; endocrine disrupters; endocrine system;