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Risk in Perspective

Optimal use of "Toxic Chemicals"

"All TUR legislation should include a significant-risk requirement designed to focus scarce public and private sector resources on specific industrial processes and applications that are known or suspected to cause significant risks."

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A new concept in environmental policy is "toxics use reduction" (TUR). The basic idea is to protect human health and the environment by reducing the use of chemicals judged to be toxic. Massachusetts and Oregon were the first states to enact TUR laws, and other states are considering similar laws. National TUR legislation is also likely to be debated in the years ahead. This issue of RISK IN PERSPECTIVE offers an evaluation of the TUR concept using the principles of risk analysis.

The Case for TUR

Proponents of TUR believe that toxic chemicals are bad and that less of a bad thing is a good thing. According to Dr. Kenneth Geiser of the University of Massachusetts at Lowell, an advocate of the Massachusetts TUR legislation, "these laws bypass debates over acceptable levels of toxicity and the risk of specific levels or releases. They rest on a simple argument: the use of every toxic chemical should be reduced or eliminated."

TUR laws establish planning procedures that are designed to encourage commercial firms to identify new production strategies that are less reliant on toxic chemicals. By reducing the use of such chemicals, TUR can theoretically result in less exposure to workers and consumers, diminished air and water pollution, fewer transport and storage accidents involving chemicals, and fewer waste disposal problems. In addition to protecting the environment, TUR may also offer potential economic savings to users in the form of lower chemical costs, more economical and productive ways of doing business, fewer pollution control expenditures, and diminished health and environmental liabilities.

Some proponents of TUR see it as a first step toward banning toxic chemicals. At a recent conference sponsored by Resources for the Future, Dr. Barry Commoner argued that the best way to keep toxic chemicals out of the environment is to stop producing and using them. He cites as success stories the bans of DDT and PCBs in the 1970's and the phaseout of lead in gasoline in the 1980's. Commoner argues that these examples should serve as models of sustainable industrial development.

Toxic Versus Nontoxic?

In practice, TUR laws define "toxic chemicals" by legislative mandate. The Massachusetts TUR list started with 300 chemicals and now includes over 900 chemicals that are targets of use-reduction planning efforts.

From a scientific perspective, the phrase "toxic chemicals" is a misnomer. There is no such thing as a chemical which is free of harmful effects at any dose. Drinking 1.5 quarts of water per day is normal and healthy while drinking 15 quarts of water per day would be lethal. Similar types of statements can be made about sugar, salt, aspirin, alcohol and any other chemical compound.

Since all chemicals can be toxic under certain circumstances, it is reasonable to question the rationale for a chemical's inclusion on or exclusion from a list of "toxic chemicals." Indeed, without considering the likelihood and degree of human exposure and ecological risks resulting from specific applications of chemicals, there is no defensible method for determining which chemicals should be included on TUR lists. Scientists at the Harvard Center for Risk Analysis have examined the various lists proposed by TUR advocates and can find no sound and consistent technical basis for the lists that have been generated.

A key problem is that a particular chemical may cause significant risk or no risk depending upon how it is used in commerce. The phaseout of lead in gasoline was a success story because this particular use of lead posed serious and widespread risks to children, adults, and the environment. The use of lead-acid batteries in automobiles is currently being reduced, although EPA estimates that the health and environmental risks of this application are not particularly great. Other applications of lead, such as its use in chimney flashing, pose relatively little danger to the public.

Since the potential for human exposure and risk varies widely from one chemical use to another, the focus of TUR laws should be changed from lists of chemicals to lists of chemical applications that are known or suspected to pose significant risk to human health and the environment. This strategy is already widely used in other regulatory settings such as the registration of drugs for particular clinical indications or the registration of pesticides for use on particular crops.

Competing Risks of Substitutes

Chemical substitution is a primary means of achieving TUR. Just because a substitute chemical has escaped inclusion on a TUR list does not mean that its use is innocuous. If the use of one listed chemical is reduced, it is critical to assess what chemicals, processes, and associated risks will replace it. Unless such competing risks are evaluated, TUR may fail to achieve its risk-reduction goals and may actually exacerbate health and environmental risks in certain settings.

For example, chlorofluorcarbons and other chlorinated compounds, which have been regulated through international protocols, were adopted widely because they were less flammable and injurious to human health than the available alternatives. Now, some of the highly-touted alternatives to the ozone-depleting chlorofluorocarbons, such as the hydrochlorofluorocarbons, are proving to be more toxic than previously thought.

Chlorinated drinking water presents a useful example for reflection because the chemical byproducts of chlorinated drinking water may cause cancer. Nonetheless, the addition of chlorine to drinking water is highly effective in combatting microbial contamination and human disease. None of the alternative disinfection processes that have been proposed to date are equally effective or economical. If chlorine is banned in the near future, communities that cannot afford expensive alternatives to chlorine may be forced to expose their citizens to injurious microbial diseases. South America has recently experienced cholera epidemics as a result of inadequate disinfection of drinking water supplies.

All TUR legislation should be written to require that chemical users make risk-risk comparisons before engaging in TUR.

The Benefits of Toxic Chemicals

The success stories of TUR tend to involve the end use of chemicals, chiefly as solvents and cleaners. In some applications, the uses of these chemicals can be reduced considerably without incurring economic penalty or loss of benefits to commercial users and consumers. However, most TUR lists also include six of the eight organic chemical building blocks, from which many other chemicals and synthetic products are made. These are butadiene, benzene; ethylene, propylene, xylene, and toluene.

These six chemicals are used to make many beneficial products and cannot be readily replaced. For example, the manufacture of many recreational products such as camping and hiking equipment, golf balls, and compact discs depend on the use of these basic chemicals. Some of these same chemicals are important raw ingredients of many over-the-counter and presciption drugs.

Nor is it clear that we should always promote *less* use of "toxic" chemicals. Scientists in industry and universities are discovering new applications of toxic chemicals that promise potential benefits to the public. While dioxin is among the most feared chemicals because of its toxicity and presence in defoilants used in Vietnam, recent scientific evidence suggests that dioxins elicit antiestrogenic responses in rodents and in human breast cancer cell lines. Some of the less toxic congeners are currently being investigated as antitumor agents that may be useful in the treatment of breast cancer.

TUR legislation should be written to require consideration of the benefits of chemicals, along with less risky ways to use them.

Conclusion

Broad-scale application of TUR is inefficient unless most uses of a chemical are associated with significant risks and few benefits. Whether these conditions are satisfied for the the hundreds of chemicals included on TUR lists is unknown and should be analyzed. While some TUR advocates are frustrated by the need to do careful analysis, good public policy requires more than good intentions. We do know that some chemicals on TUR lists are combined with other chemicals to yield useful products that pose little or no threat to human health or the environment. All TUR legislation should include a significant-risk requirement designed to focus scarce public and private sector resources on specific industrial processes and applications that are known or suspected to cause significant risks. Our ultimate goal is the *optimal* use of toxic chemicals in society.

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Further Reading
Francine Laden and George M. Gray, "Toxics Use Reduction: Pro and Con," *Risk: Issues in Health and Safety*, in press.

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