their skills, and experience in a new job. Third, although the degree of novelty required for a trade secret is not so high as that needed for a patentable invention, the subject matter generally cannot be known or readily available. Fourth, the owner of the trade secret must take such steps to safeguard that secrecy as are required to demonstrate intent that the information not be accessible to an outside company.

But some industries, such as the pharmaceutical industry, don't have to worry about protecting trade secrets. "There really isn't any choice," says Stuart R. Suter of SmithKline-Beckman. The choice in the pharmaceutical industry always falls to patents. Drugs, pesticides, and herbicides do not lend themselves to trade secret protection because all must receive government approval prior to marketing. In obtaining that approval, the structure of the active component becomes known. Another problem is the fact that most pharmaceuticals can be reverse engineered easily and thus in the absence of patent protection others who wanted to market the product could do so without much trouble. But obtaining the necessary worldwide patent protection does not come cheap, Suter notes. Filing in 50 or 60 countries, he says, is not unusual and fees for keeping the patent in force over its lifetime can range from $1000 to $20,000 depending on the country.

Another industry that always opts for patents but does make some use of trade secret protection is biotechnology. Protecting proprietary rights in this area, says Walter Dreger of Genentech, requires a departure from the more traditional means of obtaining and retaining rights to intellectual property that has been followed in the more classical industrial setting. Primarily, this is because the industry's scientific talent is drawn mainly from a limited pool of academic researchers who come from a tradition of "publish or perish" and free sharing of research results.

What has resulted, Dreger says, is that "we've decided to bend in the direction of the scientists." Early leads in the development of a project are treated as short-term trade secrets. "We follow that procedure rigorously for the time it takes to develop the concepts of the project into a patentable entity." It works, he says, because "scientists are as competitive as lawyers. Their goal in life is to be first and when they have a lead that they think will give them a 'first' upon completion of a project, they can keep things as close to their vests as anyone can."

But once the patentable entity is achieved, the scientists have very little time to wait before publishing their results as compared to what they were used to in universities. The time between completion of a project and patenting can amount to only hours, Dreger says. The whole process takes at most months from beginning to end. "This is a very ra business and it requires a lot gence and perserverance both part of the scientists and the patent attorney involved."

This policy, he admits, may cause problems in the future once the industry's products finally enter the marketplace, and associated know-how such as purity improvements will need trade secret protection. □

Indexes aid chemicals' risk assessment

KC KANSAS CITY

A strange thing happens when a government agency such as the Food & Drug Administration or the Occupational Safety & Health Administration sets out to protect the public from a perceived risk (or in the case of the current Administration role, back a regulation that is seen as providing no benefit). It often appears that, as Edmund A. C. Crouch of Harvard University says more generally, "the discussion of risks ... proceeds in splendid isolation, usually with protagonists and antagonists ranged on two sides of an unbridgeable gulf, quoting contradictory and alarming risk estimates at each other."

At the Symposium on Assessing Health Risks from Chemicals, organized jointly for the Kansas City meeting by the divisions of Chemical Health & Safety and Chemical Information, Crouch noted that "the contradiction may be only apparent, the gulf bridgeable." In his own work, he is attempting to bridge that gulf by comparing the risks from nuclear power or chemicals with risks from everyday life, while at the same time providing an indication of which chemicals may need additional study.

Crouch uses a linear model to estimate a chemical's hazard index (number of cancers expected per year) based on the substance's potency in test animals, a factor that relates that potency to potency in humans, total industrial production, the fraction of that production that is absorbed by humans, and a factor to convert between units and to convert from lifetime risk to annual risk.

However, in calculating the hazard indexes presented at the meeting, Crouch considers only potency and production and assumes further that all of the material produced is inhaled, eaten, or drunk—the worst case one possibly could envision and one that produces very high numbers. The hazard indexes that Crouch has calculated for 47 chemical compounds range from 0.5 death per year due to 2,4,6-trichlorophenol, to less than 130,000 for allyl chloride, to 6 million for 1,2-dichloroethane.

Despite the crudeness of the approach, Crouch contends that the hazard index does provide a useful initial exercise in risk assessment. It also should draw attention to those chemicals needing further study—those that are capable of causing relatively large numbers of cancers. Many symposium attendees did not seem so sure, fearing, perhaps, that publication of such estimates could lead to a public perception that the risks are greater than they actually are.

And the public's perception of risks plays a key role in shaping the regulation of what are perceived to be hazardous technologies. Whereas an expert's perceptions of risk correlate well with annual mortality, Paul Slovic of Decision Research pointed out that the public's do not.

Once a perception is established, Slovic warns, disagreement about risks should not be expected to evaporate in the presence of evidence because definitive evidence, particularly about rare hazards, is difficult to obtain. And weaker evidence is likely to be interpreted in a way that reinforces existing beliefs. Although even well-informed lay people exhibit biased perception, Slovic does not believe that the public should be removed from the risk assessment process. Public perception, he says, sometimes may be sensitive to important factors overlooked by experts. And even if experts generally are much better judges of risks, public participation offers the best hope for creating the informed citizenry necessary for effective, long-term management of hazards. □