A tale of two sciences

An innovative approach to reducing toxic-chemical use scrambles to stay alive as big science prospers, says **Daniel Sarewitz**.

WORLD VIEW

The main laboratory of the Toxics Use Reduction Institute (TURI) at the University of Massachusetts Lowell looks more like a 1940s factory machine shop than a state-of-the-art research facility. Yet despite its low-tech feel, TURI could revolutionize the way the United States deals with chemicals in the environment.

Regulation of toxic chemicals is supposed to be based on science, mainly using epidemiological and animal-model approaches to assessing risk. Although Europe recently enacted a comprehensive regulatory framework for chemicals (called REACH, for Registration, Evaluation, Authorisation and Restriction of Chemical substances), the United States remains gridlocked in an adversarial system that pits those with an interest in using a particular chemical — industry and its allies, for the most part — against those who want to get rid of it — environmental groups and their allies, for the most part. Technical experts line up on either side, and the often fuzzy demarcation between science and politics seems to vanish. The result is a morass of litigation, politics, science and uncertainty, in which debates over how to regulate some chemicals drag on for decades while the backlog of unevaluated substances grows unabated.

TURI offers a different path. The idea is this: because chemicals are valued for their functionality, the sensible procedure is not to ban or restrict toxic compounds, but to replace them with safer ones. At the core of this approach is a different role for science: not to reduce uncertainties about risk or to explain causal mechanisms, but to offer solutions by showing that a function served by a toxic chemical can be equally well served by a less toxic one.

For example, the US Environmental Protection Agency regulates the solvent trichloroethylene, but its health effects remain disputed and it is still widely used. The standard scientific approach would be to do more research on how trichloroethylene behaves in groundwater and in humans to reduce risk uncertainties before tightening the regulatory noose.

Instead, TURI found alternatives to the compound, such as non-chlorinated solvents with no known health risks, and water-based, ultrasonic cleaning processes. TURI researchers tested the substitutes for effectiveness and developed cost–benefit estimates. They worked with small firms to understand barriers to adoption, and cooperated with state agencies and professional organizations to demonstrate the replacements. The result: a 90% reduction in trichloroethylene use over two years.

TURI thus turns adversarial regulation on its head by making firms that use toxic chemicals into constituents for safer chemicals. It evades endless debates over uncertainty by focusing on finding solutions rather than diagnosing problems. This type of research does not generate many high-prestige publications or huge federal grants, but between 1990 and 2005 TURI helped Massachusetts firms to reduce toxic chemical use by 40%, and chemical waste by 71%.

The heart of TURI is clever science policy. In 1989, efforts in Massachusetts to pass legislation regulating toxic chemicals stalled because of industry opposition to chemical bans. The impasse was broken when Ken Geiser (then a professor at Tufts University, but soon to move to Lowell as TURI's first director) proposed that, rather than imposing bans, the law should require firms to develop plans for reducing their use of toxic chemicals. Geiser attributes this insight to his education in architecture: "Architects understand the role of a plan in diffusing information and focusing on solutions."

Geiser's approach was adopted in the 1989 Massachusetts Toxic Use Reductions Act, which requires firms to report their use of toxic chemicals and to develop plans for reducing this use. TURI was set up to provide technical and organizational support. Being university-based, the institute was able to maintain political independence, technical legitimacy and organizational flexibility. Its funding came from a levy on the 500 or so firms in the state that use toxic chemicals. TURI was therefore insulated from political whims and economic pressures; the state legislature merely allocated to it the money paid by the firms to the state.

Until this year. As the Massachusetts legislature confronted the state's budget crisis, lawmakers grabbed at every straw they could find. On 30 June, the final day for completing the fiscal 2010 budget, legislators swept TURI's modest $1.5-million allocation into the state coffers. In July, university leadership gave the institute four months to find alternative support or close down.

Meanwhile, it was the best of times for big science, as the US government pumped more than $20 billion in stimulus funds into federal research agencies. In early August — at about the same time that lay-off notices went out to TURI employees — presidential science adviser John Holdren and Office of Management and Budget director Peter Orszag sent a memo to federal agency heads emphasizing the need to "develop outcome-oriented goals for their science and technology activities … and target investments toward high-performing programs".

Yet shoving billions into existing institutions will produce more of what society already has, regardless of whether that's what it actually needs. So, on 28 October, the National Institutes of Health announced a $30-million stimulus grant to study the health effects of bisphenol A, a chemical used in plastics production. No doubt many peer-reviewed publications will result — but substitutes for plastics containing bisphenol A are widely available, and children's products containing it are already being phased out.

TURI, by the way, was saved — at least for a year. As imperial science lapped up its windfall billions, university officials worked to secure stimulus dollars for TURI from a US Department of Education programme aimed at preserving jobs in state educational institutions. On 16 September, two weeks before the plug was to be pulled, TURI announced that it would receive $1.3 million for fiscal 2010, enough to keep most of its operation alive. Geiser is now organizing firms that pay money into the programme to put pressure on legislators to restore funding in future years. The fact that these companies support a programme to reduce toxic-chemical use shows how radical TURI is, and how far beyond mainstream science institutions it has ventured.

US science policy is based on the idea that more money is the best route to more social benefit. TURI teaches us otherwise. ■

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