NEW SOLUTIONS, Vol. 21(3) 457-476, 2011

Scientific Solutions – Transforming Science

HIGHER HAZARD SUBSTANCES UNDER THE MASSACHUSETTS TOXICS USE REDUCTION ACT: LESSONS FROM THE FIRST FOUR YEARS

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ABSTRACT

The Massachusetts Toxics Use Reduction Act (TURA) has achieved significant reductions in toxic chemical use in Massachusetts, using a combination of regulatory and voluntary measures. Historically the program has regulated only users of relatively large quantities of toxic chemicals, with services provided to facilities of all sizes on a voluntary basis. Statutory amendments adopted in 2006 created an authority to designate Higher and Lower Hazard Substances (HHS and LHS). The HHS designation extends TURA program requirements to smaller quantity chemical users. This article reports on experiences from the first four years of implementing this new authority. A case study of trichloroethylene is provided as an example. The article also discusses steps taken to regulate *n*-propyl bromide, a drop-in substitute for TCE that is minimally regulated at the federal level. TURA program experiences may be of interest to other jurisdictions that are working to reach small-quantity chemical users, and to categorize and prioritize chemicals.

Keywords: chemicals, categorization, trichloroethylene, *n*-propyl bromide

doi: 10.2190/NS.21.3.k
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The Massachusetts Toxics Use Reduction Act (TURA), in force since 1990, has achieved significant reductions in toxic chemical use in Massachusetts, using a combination of regulatory and voluntary measures. Toxics use reduction is a form of pollution prevention. It focuses on finding ways to reduce or eliminate the use of toxic substances, avoiding the need for end-of-pipe pollution control or later remediation of contaminated sites.

Under TURA, regulated facilities must pay an annual fee, provide an annual report on toxic chemical use, and conduct toxics use reduction (TUR) planning every two years. A few key environmental policy principles are embodied in TURA. One is the focus on chemical use. Many statutes focus only on chemical emissions; in contrast, TURA requires reporting of all chemical uses, even if there are no emissions outside the facility, on the principle that any toxic chemical use presents a hazard. TURA embodies right-to-know principles by providing public access to information on chemical use at TURA-covered facilities. Another key principle is that TURA works to reduce risk by reducing the use of all inherently hazardous substances, rather than relying on quantitative risk assessment to identify areas for risk reduction. Finally, TURA is grounded in the principle that planning in itself is valuable. While the TUR planning process is mandatory, implementation of TUR options discovered through planning is voluntary.

TURA program activities are implemented by three agencies: the Massachusetts Department of Environmental Protection (MassDEP), the Office of Technical Assistance and Technology (OTA), and the Toxics Use Reduction Institute (TURI). These agencies work in conjunction with an Administrative Council, composed of government agency heads or their representatives; an Advisory Committee, composed of citizen stakeholders; and a Science Advisory Board (SAB) [1].

Historically the program has regulated only medium-sized facilities, although it has provided services to facilities of all sizes on a voluntary basis. This characteristic has been noted as a limitation of the program [2]. The original TURA legislation contained provisions to extend reporting and planning requirements to smaller users in some cases. However, these original provisions were cumbersome and were not implemented.

Statutory amendments adopted in 2006 created a new way for the TURA program to regulate facilities that use smaller amounts of highly toxic chemicals, by creating an authority to designate Higher and Lower Hazard Substances (HHS and LHS). Designating a substance as HHS lowers the threshold for application of TURA program requirements, bringing smaller-quantity chemical users into the program.

The designation of HHS and LHS, and resulting program activities, have yielded a number of important benefits. By bringing smaller-quantity chemical users into the program, the HHS designation has facilitated the program's work with these facilities, which previously could be reached only through

voluntary projects. The program agencies have used the HHS designations as an opportunity to focus and coordinate activities, conducting targeted outreach to stakeholders on these chemicals, analyzing alternatives, and offering a range of services to help facilities reduce the use of these chemicals. The program agencies have also taken the opportunity to assess potential unintended consequences. In particular, the program has undertaken an assessment of substances that could be used as alternatives for HHS, and has taken steps to regulate toxic chemicals that could be used as substitutes for HHS.

Data from the first year of reporting under the HHS designation for one chemical, trichloroethylene, indicate that a significant percentage of total use of HHS in Massachusetts is now occurring among facilities that individually are using smaller amounts of these chemicals. This finding confirms that extending program requirements to facilities using smaller amounts of chemicals is essential in order to achieve the broader goal of protecting health and the environment by reducing the use of toxic chemicals.

This article describes the history and goals of the creation of this new authority under the TURA program, summarizes activities the program has undertaken in the first four years, and evaluates results to date. The experience of the first few years of implementation supports the view that these designations, and associated program activities, are essential to continued progress in reducing toxic chemical use in Massachusetts.

SCOPE OF TURA PRIOR TO THE 2006 AMENDMENTS

The chemicals that are reportable under TURA are identified in a list of Toxic or Hazardous Substances. This list was originally created by combining two federal lists: the chemicals reportable under the Toxics Release Inventory (TRI) created by the Emergency Planning and Community Right-to-Know Act (EPCRA 313), and the chemicals listed under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). The TURA program has modified the list over time by adding and removing chemicals.

TURA requirements apply to facilities that are in specified sectors, have 10 or more full-time employee equivalents (FTEs), and use a listed chemical at or above a specified quantity. For most chemicals, the quantity threshold is 25,000 lbs/yr for facilities that manufacture or process a chemical, and 10,000 lbs/yr for facilities that "otherwise use" a chemical (i.e., use a chemical in a way that does not lead to its inclusion in the final product; for example, as a cleaning agent). The thresholds for chemicals defined within TRI as persistent, bioaccumulative, and toxic (TRI PBTs) are lower [3]. As shown in Table 1, the thresholds are either 10 lbs/year or 100 lbs/year for most TRI PBTs, depending on the chemical, and 0.1 grams per year for dioxin [4].

Table 1. Reporting Thresholds for TRI/PBTs

Chemicals	Reporting threshold
Polycyclic aromatic compounds (PACs); lead; lead compounds	100 lbs.
Benzo(g,h,i) perylene; mercury; mercury compounds; polychlorinated biphenyls (PCBs)	10 lbs.
Dioxin and dioxin-like compounds	0.1 grams

Prior to the 2006 amendments, for all non-PBT chemicals, facilities manufacturing or processing less than 25,000 pounds of a listed chemical per year, or "otherwise using" less than 10,000 pounds, were completely outside the scope of TURA requirements. This meant that the TURA program had no regulatory option to address a potentially significant portion of chemical use in the state.

Creation of the More and Less Hazardous Chemical Lists

In the late 1990s, a consensus emerged within the TURA program and the regulated community that it would be helpful to divide the TURA list into categories, distinguishing among chemicals by level of toxicity. There were at least two distinct motivations for this effort.

One motivation was the increasing recognition that certain chemicals were of particularly grave concern and required focused attention. A second motivation was that the SAB wanted to take a more nuanced approach to its consideration of de-listing petitions. Industry representatives had requested the de-listing of a number of chemicals from the TURA list. Advocates of de-listing argued that certain chemicals should be removed from the TURA list because they were clearly less toxic than others. Although there were differences of opinion on whether these chemicals should be de-listed, there was broad agreement that it would be helpful to distinguish them from chemicals of higher concern. Categorizing the list helped the SAB to differentiate between chemicals that warranted removal from the list and those that, in the SAB's opinion, should be retained despite being less hazardous than other chemicals on the list.

In this context, the TURA program decided to create an informational categorization of chemicals. In 1999, the SAB created three categories within TURA's larger list of Toxic or Hazardous Substances: "more hazardous

chemicals," "less hazardous chemicals," and all remaining chemicals (designated "uncategorized"). All the chemicals on the TURA list have now been reviewed and placed in one of these three groups. This initial categorization was created strictly as a guide to help industry in making decisions. It had no regulatory implications. It continues to be maintained as an informational resource for companies. There are currently 90 "more hazardous chemicals" and 23 "less hazardous chemicals," out of the larger list of 1,300 chemicals and chemical categories that are reportable under TURA [5].

STATUTORY AUTHORITY TO CATEGORIZE CHEMICALS: HIGHER AND LOWER HAZARD SUBSTANCE DESIGNATIONS

The 2006 amendments created a regulatory category of Higher Hazard Substances (HHS, corresponding to the informational category of "more hazardous chemicals") and Lower Hazard Substances (LHS, corresponding to the informational category of "less hazardous chemicals.")

Goals of the Amendments

In writing the statutory amendments that created the authority to designate higher- and lower-hazard substances, policymakers had two broad goals:

1. *Formalize the distinctions among toxic chemicals created by the informational lists, and introduce incentives for substitution.* Categorizing chemicals by hazard level helps to guide industry toward safer options, and can be used as the basis for developing both positive and negative incentives to motivate industry to shift from more toxic to less toxic chemicals.
2. *Extend TURA program reporting and planning requirements to smaller users.* Extending TURA program reporting requirements to smaller users makes it possible to determine where chemicals of high concern are being used. It also requires smaller users to conduct planning, which facilitates the identification of practical options to reduce their use of these chemicals, and motivates these users to make use of technical assistance, grants, and other services provided by the TURA program. As a result, the benefits of toxics use reduction planning and implementation, already documented among larger users, can be extended more effectively to these smaller users.

Provisions of the Amendments

For HHS, the threshold for the TURA requirements drops to 1,000 lbs/yr. In addition, the TURA program may raise the per-chemical fee charged to facilities that use these substances. For LHS, the amendments provide for a fee

reduction,[1] creating a small financial incentive for facilities to adopt LHS as substitutes for HHS or uncategorized chemicals.

The amendments create the authority to designate up to 10 HHS and 10 LHS each year. Chemicals proposed for these designations must be drawn first from the existing informational lists of "more hazardous chemicals" and "less hazardous chemicals," respectively.

Process Overview: How HHS and LHS are Designated

The process of designating HHS and LHS is defined in general terms by the statute, but has been refined by program staff in the course of implementation.

The SAB, using scientific information compiled by staff members at the Toxics Use Reduction Institute, proposes a subset of chemicals from its existing "more hazardous" and "less hazardous" lists for possible designation as HHS or LHS, respectively.

The implementing agencies then review the list of chemicals proposed by the SAB in order to select priorities. The agencies may take account of considerations such as the number of facilities expected to be affected by the designation and the program's ability to offer useful services to help facilities reduce use of the chemical.

The Institute, in consultation with OTA and MassDEP, prepares a detailed policy analysis for each selected substance. The policy analysis includes a discussion of the science considered by the SAB; trends in the use of the substance by TURA filers; how the chemical is regulated at the state, federal, and/or international levels; what opportunities exist for toxics use reduction; and what challenges are likely to be faced by facilities working to reduce or eliminate their use of the chemical. It also includes an estimate of the number of facilities likely to be brought into the program through the lower chemical quantity threshold, and potential unintended consequences that could result from the designation.

This policy analysis is presented to the TURA Advisory Committee, whose members provide additional information based on their expertise, and pose additional questions for research. Finally, the Institute, in consultation with MassDEP and OTA, brings a recommendation to the TURA Administrative Council, which decides through a vote whether to designate a HHS or LHS. If the Council votes in favor of a designation, a regulatory process follows (draft regulations, comment period, and final regulations). Figure 1 shows the TURA decision-making process in schematic form.

[1] All fees paid under TURA are calculated as the sum of a base fee plus an $1100 per-chemical fee, not to exceed a set maximum based on facility size. The LHS designation eliminates the per-chemical fee for the chemical in question. It does not affect the base fee.

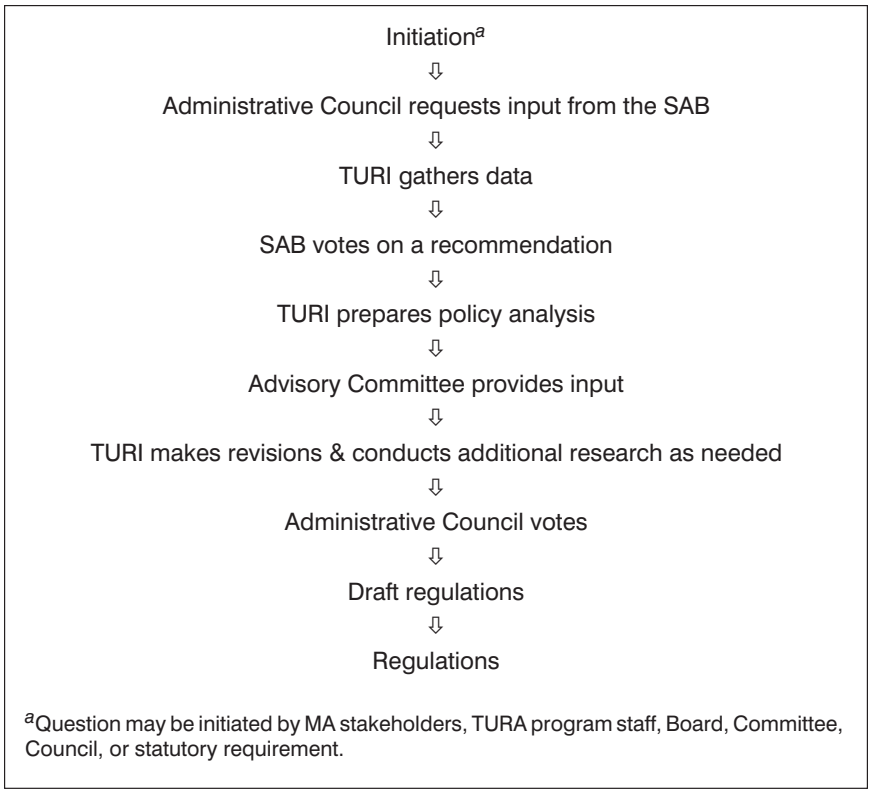

Figure 1. TURA decision-making process.
Source: Toxics Use Reduction Institute, *Decision Making Under TURA: Process Overview and Reference Guide* (Toxics Use Reduction Institute Methods and Policy Report #28, December 2010).

THE FIRST FOUR YEARS: DESIGNATION OF FOUR HHS AND TEN LHS

The amendments provided for automatic designation of the TRI PBTs as HHS. This designation was effective for the 2007 reporting year. It had no immediate practical implications for Massachusetts facilities, because these chemicals were already reportable at lower thresholds, and the program has not yet taken action to raise fees for HHS.

Going beyond these automatic designations, in 2007 the SAB recommended 11 potential HHS and 10 potential LHS. The HHS were selected on the basis of high concern and the SAB members' professional judgment that they were a high priority from a hazard perspective.

The implementing agencies, in consultation with the Advisory Committee and Administrative Council, then selected a smaller number of chemicals from within this list, and completed the designation process according to the decision-making steps outlined above. As shown in Table 2, in 2007 the program designated three HHS (trichloroethylene, cadmium, and cadmium compounds). In 2008, the program designated one HHS (perchloroethylene) and three LHS (iso-butyl, sec-butyl, and n-butyl, alcohol). In 2009, the program designated seven LHS and no HHS. In 2010, the program reviewed a possible HHS designation for formaldehyde, but deferred decision-making until 2011. In 2011, the TURA Administrative Council voted to separate hexavalent chromium compounds from the larger Chromium Compounds category, and to designate hexavalent chromium compounds as HHS. The Council also voted to designate formaldehyde as a HHS. Draft regulations incorporating these decisions are expected to be promulgated later in 2011.

Table 2. HHS and LHS Designations, 2007-2010[a]

Chemical	Year regulations adopted	Year requirements are effective
HHS		
TRI PBTs	2006 (Automatic)	No new requirements
Trichloroethylene	2007	Reporting[b]: 2008; planning: 2010
Cadmium	2007	Reporting: 2008; planning: 2010
Cadmium compounds	2007	Reporting: 2008; planning: 2010
Perchloroethylene	2008	Reporting: 2009; planning: 2012
LHS		
Isobuyl alcohol	2007	2008
See-butyl alcohol	2007	2008
n-butyl alcohol	2007	2008
Butyl acetate	2009	2010
Isobutyl acetate	2009	2010
Ferric chloride	2009	2010
Ferric sulfate	2009	2010
Ferrous chloride	2009	2010
Ferrous sulfate (heptahydrate)	2009	2010
Ferrous sulfate	2009	2010

[a]Reporting requirements are effective the year after regulations are adopted to designate a HHS. Planning requirements go into effect later. Designations shown in this table are current as of December 2010.

[b]Reports are submitted in July of the following year (e.g., July 2009 for reporting year 2008).

For chemicals designated as HHS, reporting requirements are effective the year after regulations are adopted, and planning requirements are effective later. (Because planning occurs on a two-year cycle, the timing is variable. If regulations are adopted in an even-numbered year, planning is required two years later. If regulations are adopted in an odd-numbered year, planning is not required until three years later.)

CASE STUDY: TRICHLOROETHYLENE (TCE)

Trichloroethylene (TCE) is a solvent used in a range of industries, including electroplating, metal products, machinery manufacturing and repair; paper, pulp, and rubber manufacture; semiconductor production; and auto maintenance; as well as in some consumer products and pesticides [6].

TCE poses significant and well-understood hazards to human health and the environment [6]. The TURA program, like many other pollution prevention programs in the United States and around the world, has worked steadily to help facilities reduce or eliminate their use of TCE in a wide range of applications. The TURA program selected it as one of the first chemicals considered for HHS designation in part because significant progress has been made in reducing TCE use among large companies, and there may be ample opportunity to prompt similar progress by smaller facilities. The TURA program did not know how many facilities might be using TCE below the existing use thresholds, but suspected that the number might be significant.

To make a decision about designating TCE as a HHS, the TURA program analyzed existing scientific, regulatory, and technical information about TCE; estimated the number of facilities likely to be using TCE above the 1,000-pound annual use threshold; and analyzed opportunities available for TCE users to reduce or eliminate TCE use.

Background on TCE

TCE is subject to multiple federal regulations, including reporting requirements under the Toxics Release Inventory; classification as a hazardous substance under the Clean Water Act; regulation as a Hazardous Air Pollutant under the Clean Air Act; and regulation as hazardous waste under the Resource Conservation and Recovery Act [6–9]. Some states have taken active steps to regulate TCE more stringently. California regulates TCE as a carcinogen under its Safe Drinking Water and Toxics Enforcement Act of 1986 (Proposition 65), and prohibits the sale and use of automotive repair products including TCE or certain other toxic chlorinated solvents [6, 10–11]. TCE is treated as a priority chemical internationally as well, and is banned for use professionally and in consumer products in Sweden [12].

There are many ways to reduce or eliminate the use of TCE. For cleaning applications, options include aqueous and semi-aqueous systems; nonchlorinated solvent systems; mechanical cleaning processes; and emerging technologies such as laser cleaning. In some cases, firms can eliminate the need for cleaning/degreasing entirely by redesigning the production process. For adhesive formulations, alternatives to TCE include terpenes, water-based adhesives, and solid adhesives. Many alternatives are available for use in paints as well [6].

Trends in TCE Use in Massachusetts

Responding both to regulations and to the availability of extensive technical assistance, facilities regulated under TURA have reduced their TCE use significantly over time. There was a 90 percent reduction in TCE use by the core group of industries that were in the TURA program over the period 1990–2005.[2] The TURA program also tracks a core group that has met TURA reporting requirements since 2000. This group reduced TCE use by 70 percent over the period 2000–2007. By 2007, just nine facilities were reporting TCE use under TURA. Trends in TCE use over time are shown in Table 3.

The First Year of HHS Reporting: Information about Smaller TCE Users

Based on experiences of TURA program staff, the TURA program had reason to believe that there was continuing TCE use below existing thresholds at a number of facilities, and that this TCE use was associated with significant occupational exposures. However, prior to the HHS designation, TURA lacked data on uses below 25,000 lbs/yr for manufacturing or processing, or 10,000 lbs/yr for otherwise using TCE. This information became available for the first time when facilities submitted their reports for 2008, the first year in which TCE was reportable as a HHS.

In 2008, 20 facilities entered the program under the new, lower reporting threshold of 1,000 lbs/yr. Two of these filers were completely new to the program. The rest either had been in the program at some point in the past, or were currently subject to filing requirements for other chemicals [4]. Table 4 provides information on these facilities by sector.

TURA filers reported using a total of 563,073 pounds of TCE in 2008. Of this amount, 117,380 pounds was reported by the facilities that entered the program due to the new reporting threshold. Thus, these facilities accounted for nearly 25 percent of the total amount of TCE reported in 2008. This finding confirms the TURA program's hypothesis that by 2008, a significant portion of TCE use in the state was occurring below the previously existing thresholds.

[2] This is an absolute reduction, not a production-adjusted reduction.

Table 3. Trends in TCE Use, 2000–2008

Reporting year	Trichloroethylene (lbs)
2000	1,742,305
2001	1,393,981
2002	1,234,011
2003	1,052,806
2004	1,085,571
2005	834,462
2006	770,538
2007	604,671
2008	536,073[a]

[a]117,380 pounds due to lower reporting threshold.

The majority of the facilities that reported TCE use were in the "otherwise use" category, indicating that they are likely to be using TCE in cleaning applications. Since the alternatives to TCE use in cleaning are well understood, this finding also indicates that there are significant opportunities to assist these facilities in shifting to safer alternatives.

AFTER HHS DESIGNATION: TURA PROGRAM SERVICES FOR HHS USERS

After designating a chemical as HHS, the TURA program uses a variety of industry and government databases, as well as outreach through industry and government communication channels, to identify facilities that need to be informed about the designation, and to provide services to help facilities reduce or eliminate their use of the HHS. Program services include on-site technical assistance; laboratory assistance; grants to Massachusetts facilities; demonstration sites showcasing toxics use reduction innovations at individual facilities; publications and information resources; sponsorship of university research; research conducted by TURA program staff members; and programs facilitating information flow up and down industry supply chains. Examples of some of these activities are shown in Table 5.

Table 4. Facilities Reporting TCE Due to the 1,000-Pound Threshold in 2008

SIC code – industrial sector	Number of facilities reporting due to 1,000 lb threshold in 2008	Use category
2899 Chemicals and chemical preparations	1	Processed
3086 Plastics foam products	1	Processed
5169 Chemicals and allied products – wholesale	1	Processed
3471 Plating, polishing & 3479 metal coating	7	Otherwise used
3823 Process control instruments	2	Otherwise used
34xx Fabricated metal	2	Otherwise used
2834 Pharmaceutical preparations	1	Otherwise used
3089 Plastic products NEC	1	Otherwise used
3264 Porcelain electrical supplies	1	Otherwise used
3624 Carbon and graphite products	1	Otherwise used
3931 Musical instruments	1	Otherwise used
3993 Signs and advertising specialties	1	Otherwise used

ADDITIONAL POLICY IMPLICATIONS OF HHS DESIGNATIONS: REGULATING *N*-PROPYL BROMIDE AND OTHER ALTERNATIVES TO HHS

In regulating toxic chemicals, it is important to avoid a situation in which facilities unknowingly shift to less regulated alternatives that pose equally serious hazards. A number of efforts to regulate toxic chemicals of high concern have produced unintended consequences in which businesses shifted to chemicals with equally significant adverse effects [13–15].

Table 5. TURA Program Services for HHS Users

Services	Examples
On-site technical assistance	On-site technical assistance provided to facilities using trichloroethylene[a]
Laboratory assistance	TURI's Surface Solutions Cleaning Laboratory provides services to TCE users on an on-going basis, helping to identify and test application-specific alternatives.
Grants	Grants provided to dry cleaning facilities to demonstrate successful elimination of perchloroethylene (one per year, 2008-2011).
	Grants offered to facilities switching from vapor degreasing with TCE to an aqueous cleaning system.
Demonstration sites	Each grant recipient also serves as a demonstration site, providing training for other facilities in the sector.
Publications, research, and information resources	TURI published an updated fact sheet on trichloroethylene in 2008.
	TURI will produce a fact sheet on nPB (a drop-in substitute for TCE and PCE) in early 2011.
	TURI's Surface Solutions Cleaning Laboratory maintains an online Cleaner Solutions database that facilities can search for process-specific chemical substitutes.
Research	Prior to the HHS designation, OTA published a report on barriers to TCE reductions, identifying obstacles to switching away from TCE.
Supply chain coordination	The TURA program plans to initiate work in 2011 to help facilities communicate with customers, including the U.S. military, whose specifications require continued use of TCE.

[a]Since TCE was made a HHS, OTA has visited and developed recommendations for 18 facilities using TCE.

The chemicals that have been the focus of the TURA program's first efforts at designating higher-hazard substances are no exception. In particular, there is growing concern nationwide that many facilities are replacing chlorinated solvents, such as TCE and perchloroethylene (PCE), with *n*-propyl bromide (nPB, also known as 1-bromopropane). TCE and PCE are both regulated as hazardous air pollutants under the Clean Air Act, among many other regulations at the national level; nPB, in contrast, is not regulated at the federal level, although it is regulated by some states.[3] nPB does, however, pose significant health concerns, including reproductive toxicity, neurotoxicity, and potentially carcinogenicity [16–19].

As part of the analysis surrounding the designation of TCE and PCE as higher-hazard substances, the TURA program identified nPB as a significant concern. From field work and site visits, TURA program staff members were aware that many facilities were already shifting from these chlorinated solvents to nPB. nPB was a drop-in replacement, requiring no change in technology, and was largely unregulated. Facilities were unlikely to know, based on government regulation, that nPB was a significant concern. Furthermore, even if they were aware of these concerns from their own research, there was still an incentive to shift to nPB because it was minimally regulated.

In order to discourage substitutions of this kind, the TURA program added nPB to its list of Toxic or Hazardous Substances in 2009. Starting in reporting year 2010, facilities in TURA-covered sectors processing or manufacturing nPB in quantities of 25,000 pounds or more, or otherwise using nPB in quantities of 10,000 pounds or more, are subject to TURA reporting, planning, and fee requirements. Based on the available data, the TURA Science Advisory Board did not categorize nPB as "more hazardous"; however, its categorization could be changed in the future if warranted by emerging data.

In addition to adding nPB to the TURA list, TURA staff members are reaching out actively to facilities that are using or may be considering use of nPB, and the TURA program has developed additional educational materials on nPB.

Moving beyond the example of nPB, the Institute has undertaken to establish a process to promote the adoption of safer alternatives to HHS more generally, by conducting a detailed analysis of the environmental health and safety profiles of other chemicals that could potentially serve as substitutes for HHS. There are many possible alternatives for TCE, and the SAB is currently in the process of reviewing the science on several classes of chemicals to determine whether any additional substances warrant addition to the TURA list.

[3] nPB is on California's Proposition 65 list, and on Pennsylvania's Hazardous Substances List.

PRIORITY USER SEGMENTS: A REGULATORY TOOL FOR REACHING THE SMALLEST FACILITIES

In addition to creating the HHS and LHS designation authority, the 2006 amendments updated a provision of TURA that had not previously been used: the authority to designate Priority User Segments (PrUS).[4] A PrUS is a production process that uses a higher-hazard substance and that the program believes deserves special attention. Designation of a PrUS has several important results. Among them, the 10-FTE threshold is eliminated, so that facilities with any number of employees can be covered by TURA requirements if they use regulated chemicals in above-threshold quantities. In addition, facilities can be required to submit supplemental data; and MassDEP "may set performance standards for priority user segments."

Under the amendments, a Priority User Segment can be designated only for a chemical that has been designated as a HHS. The statute allows the state a maximum of four years within which to complete the Priority User Segment designation.

The program has not yet designated a Priority User Segment. In 2010, the Office of Technical Assistance, which has primary responsibility for providing recommendations to the Administrative Council on implementation of the Priority User Segment provisions, evaluated the TRI PBTs to determine whether any should be considered for this designation. OTA found that due to statutory limitations, TURA could not reach the uses of greatest concern, even with the PrUS designation. For example, TURA covers only certain industrial codes (leaving out municipalities, schools, hospitals, and many commercial operations such as shooting ranges). For this reason, OTA recommended against designation of PrUS for these substances, and recommended instead that other policy options be considered to address the PBT uses of concern [20].

The program will consider trichloroethylene, cadmium, and cadmium compounds next for possible Priority User Segment designation. Since they were designated as HHS in calendar year 2007 and the designation went into effect for reporting year 2008, the Priority User Segment designation would have to be completed in calendar year 2011, taking effect in 2012.

NUMBER OF DESIGNATIONS PER YEAR: A STRATEGIC DECISION

One of the strategic decisions the program needed to make in embarking on implementation of the HHS and LHS substance designations was the pace at

[4] Prior to 2006, the statute provided for designating PrUS but not for designating HHS. The amendments introduced the authority to designate HHS, and linked the HHS designation with the PrUS designation. Under the 2006 amendments, a PrUS can be designated only for a process that involves use of a HHS.

which to pursue the designations. The program has statutory authority to designate up to 10 in each category per year.

However, there were several reasons to move more slowly. First, the program decided to conduct a detailed analysis of each chemical before proposing it for designation as a HHS. This research was a rate-limiting factor because each designation required significant staff time. Second, the program made a judgment that given limited total program resources, it would make sense to focus on a smaller number of higher-hazard substances and provide as much intensive assistance to facilities as possible for that substance. Third, there is a limit of four years within which to designate a priority user segment after designating a HHS. Thus, it could have been counterproductive to designate a large number of HHS at once because it might then have been impossible to conduct the necessary analysis within the required time frame for possible designation of priority user segments.

CHEMICAL CATEGORIZATION AND PRIORITIZATION: THE MASSACHUSETTS EFFORT IN CONTEXT

The adoption of the 2006 amendments to TURA, and the first years of implementation of the new authorities created by these amendments, have been contemporaneous with efforts to categorize and prioritize chemicals in a number of jurisdictions. Canada conducted a multi-year effort to categorize and prioritize all chemicals on the market in Canada, culminating with the identification of approximately 4,000 high-priority chemicals for which additional regulatory action would be considered. REACH, the European Union's comprehensive regulatory structure for chemicals, adopted in 2007, creates a process for designating substances that are subject to authorization requirements. In the years since REACH was adopted, the EU has been developing a list of candidate substances that may become subject to authorization requirements. At the federal level in the United States, proposed legislation to reform the Toxic Substances Control Act includes provisions related to categorization and prioritization of chemicals. At the state level, Maine, Washington, and California have adopted laws providing for the categorization and prioritization of chemicals used in consumer products.

Each jurisdiction has undertaken the categorization and prioritization effort in the context of specific goals, and the processes have varied considerably. The Canadian process systematically reviewed every chemical on the market. The Maine and Washington processes drew upon the results of other jurisdictions' efforts to build lists of high-priority chemicals, with a focus on those that might be found in children's products.

The Massachusetts process of categorizing chemicals (originally into the informational "more hazardous chemicals" and "less hazardous chemicals" lists, later into the regulatory Higher Hazard Substance and Lower Hazard Substance lists) is not exhaustive. The Massachusetts process began with the

existing list of Toxic or Hazardous Substances and developed hazard subcategories within it. In contrast, the Canadian process, for example, included a review of all chemicals on the market regardless of existing information about their toxicity. The informational lists developed as a result of this work may be useful to other states seeking to create similar lists, and can be used in combination with the results of categorization efforts in other jurisdictions. In addition, the modified Delphi process used by the TURA program's Science Advisory Board in its categorization work may be a useful model for other states undertaking similar efforts.

The process of adding chemicals to the regulatory Higher Hazard and Lower Hazard Substance lists has been slow, reflecting the TURA program's decision to conduct significant analysis for each substance prior to designation. As a result, the current Higher Hazard Substances list is not comprehensive, but rather includes a small number of chemicals that have been selected for early attention based on implementation opportunities as well as scientific considerations.

It is also important to note that the Massachusetts process has simultaneously pursued two goals, which are only loosely connected with one another. One goal is to categorize and prioritize chemicals. The other goal is to lower the reporting threshold for selected chemicals, in order to extend the reach of the TURA program. In this way, the Massachusetts effort differs from efforts that are focused purely on categorization and prioritization, such as the Canadian effort.

The Massachusetts effort differs from the categorization and prioritization efforts in Maine and Washington because TURA program regulations apply only to industrial facilities. The Maine and Washington categorization and prioritiza\tion efforts, in contrast, are focused primarily on regulation of consumer products.

The HHS list itself has also been useful beyond Massachusetts. For example, amendments adopted in 2010 to Maine's Toxics Use and Hazardous Waste Reduction law require Maine to develop a list of priority toxic chemicals by July 1, 2011. Starting in July 2013, users of more than 1,000 lbs/yr will be required to file reports and conduct pollution prevention planning. The amendments require that Maine consider the Massachusetts list of higher hazard substances, among other sources, in developing its own list of priority toxic chemicals [21].

Categorization and prioritization efforts are also relevant for the TURA program's work in the area of alternatives assessment. Many TURA program services are focused on helping companies not only to reduce or eliminate their use of hazardous chemicals, but also to make well-informed choices about what chemicals or processes to adopt instead. The theme of identifying alternatives that are both viable and safer runs through many TURA program activities. These range from one-on-one laboratory assistance helping facilities to identify safer cleaning solutions, to publication of formal alternatives assessment studies that provide a systematic review of a wide range of alternatives to a specific toxic chemical for a specific application.

At least in principle, chemical categorization has the potential to play a key role in helping companies to make wise decisions about chemical use. A categorization that identifies chemicals that are safer has the potential to help companies choose those chemicals in production decisions up front, avoiding difficulties later. Within the Massachusetts list, chemicals categorized as LHS are considered a better choice than those designated as HHS or those that are uncategorized, although all the chemicals on the list are toxic or hazardous. Massachusetts has not, however, taken the additional step of identifying safer chemicals that are not on the list of Toxic or Hazardous Substances.

CONCLUSIONS

Over the period 2007–2010, Massachusetts has worked to implement the new authorities created by the amendments to TURA adopted in 2006, including the authority to designate HHS and LHS. It is too early to assess the program's success in encouraging smaller users of HHS to reduce or eliminate their use of these toxic chemicals. As of December 2010, just two years of reporting data are available for smaller users of TCE and cadmium, and only one year of data is available for smaller users of PCE. However, the designation process has already produced important results.

As shown in the case study of TCE, chemical use reporting under the HHS for TCE has shown that, in fact, at least a quarter of total TCE use is occurring in quantities that were previously under the radar of the TURA program. Preliminary results for perchloroethylene indicate that an even larger portion of PCE use is occurring at small facilities. Similar findings are likely for other HHS going forward.

The HHS designation has drawn additional attention to chemicals of high concern and brought additional facilities into the regulatory sphere of the TURA program. As smaller HHS users become subject to TURA program requirements, there are greater opportunities for the program to learn how the HHS are being used and to provide targeted program services to encourage toxics use reduction. The HHS designation process has also led to other important policy activities, in particular the focus on safer alternatives and further analysis of other chemicals that could be used as alternatives to substances designated as HHS.

There are many open questions about how program activities will unfold in the years ahead. It remains to be seen whether the TURA program will continue to designate one or two HHS per year, or whether the pace will accelerate or slow. It also remains to be seen whether fees will be raised for HHS, and whether the program will take the step of designating one or more priority user segments. However, within the first years of implementation, it is already clear that the authority to designate HHS, and the accompanying program services, are key to continued progress in reducing the use of toxic chemicals in Massachusetts.

ACKNOWLEDGMENTS

Rick Reibstein and Rich Bizzozero of the Massachusetts Office of Technical Assistance, and Glenn Keith and Lynn Cain of the Massachusetts Department of Environmental Protection, contributed to the analysis of toxics use data and other information presented in this article, and Rick Reibstein, Glenn Keith, and Ken Geiser provided detailed comments on a draft of the article.

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