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Government Initiatives

Hands-on assistance improves already successful pollution prevention services of the toxics use reduction institute's laboratory

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ABSTRACT

In an attempt to improve the adoption rate of the work conducted at the Toxics Use Reduction Institute Lab, a more comprehensive on-site follow-up assistance program was implemented in 2006. The effort was piloted for trichloroethylene replacement in Rhode Island in conjunction with Environmental Protection Agency (EPA) Region 1.

Through hands-on workshops and on-site assistance efforts, the TURI Lab project was able to achieve an 82% reduction in TCE in a two year period. This new methodology for on-site assistance follow-up to the preexisting TURI Lab testing program has been incorporated into the work the Lab conducts for companies in Massachusetts. The Lab had an implementation rate of around 30% without on-site assistance. During the first year of the new process, the adoption rate has jumped to 80% of all companies working with the lab.

1. Introduction

The passage of the Toxics Use Reduction Act (TURA) in 1989 by the Massachusetts legislature marked the creation of the Toxics Use Reduction Institute (TURI) at the University of Massachusetts Lowell. Fully operational since late 1993, the TURI Laboratory (TURI Lab) is the research and testing facility of TURI. The objective of the laboratory is to assist in the development and promotion of safer alternatives to the traditional hazardous materials, primarily organic and chlorinated solvents used to clean metal surfaces without causing economic hardship or a loss in cleaning performance.

Technical assistance in pollution prevention (P2) activities has had marginal success over the years due to the relatively slow diffusion across most industry sectors (Lindsey, 1999). A study by Waste Management Resource Center in Illinois found that in one sector of pollution prevention (membrane filtration) more than 80% of the companies made no or little inroads into adopting the technology (Lindsey, 1999). The TURI Lab has had slightly higher success for companies serviced around the country with a major focus on Massachusetts companies, with about a third of companies adopting recommended changes in solvent substitution for cleaning applications (Kusz, 2002). Further research documents that implementation rates for the Worcester area, suggests that one in seven companies is successful in carrying out solvent substitution at the plant without additional assistance from the TURI Lab (LeBlanc, 2001).

From research conducted by the Waste Management Resource Center in Illinois, the traditional fact sheets, case studies and vendor databases have limited impact on a company's willingness to adopt a new pollution prevention technology (Lindsey, 1998). On the other end of the pollution prevention spectrum, when introducing hands-on piloting of the potential equipment, adoption rates range from 60–80% as compared to 0% adoption of the recipients of the traditional fact sheet/case study (Lindsey, 2000).

In an attempt to improve the adoption rate of the work conducted at the TURI Lab, a more comprehensive on-site follow-up assistance program was implemented in 2006. The effort was piloted for trichloroethylene replacement in Rhode Island in conjunction with Environmental Protection Agency (EPA) Region 1.

Trichloroethylene (TCE) has historically been used for various cleaning and degreasing applications. Because of the human and environmental health effects associated with exposure to TCE, it has been the target of many states' P2 programs over the past decade. Many P2 assistance providers consider this field to be "conquered" and have moved on to other niches to focus their efforts on the next battle. In many cases, particularly among larger companies, uses and emissions of TCE have been minimized through substitution and other engineering controls. Unfortunately

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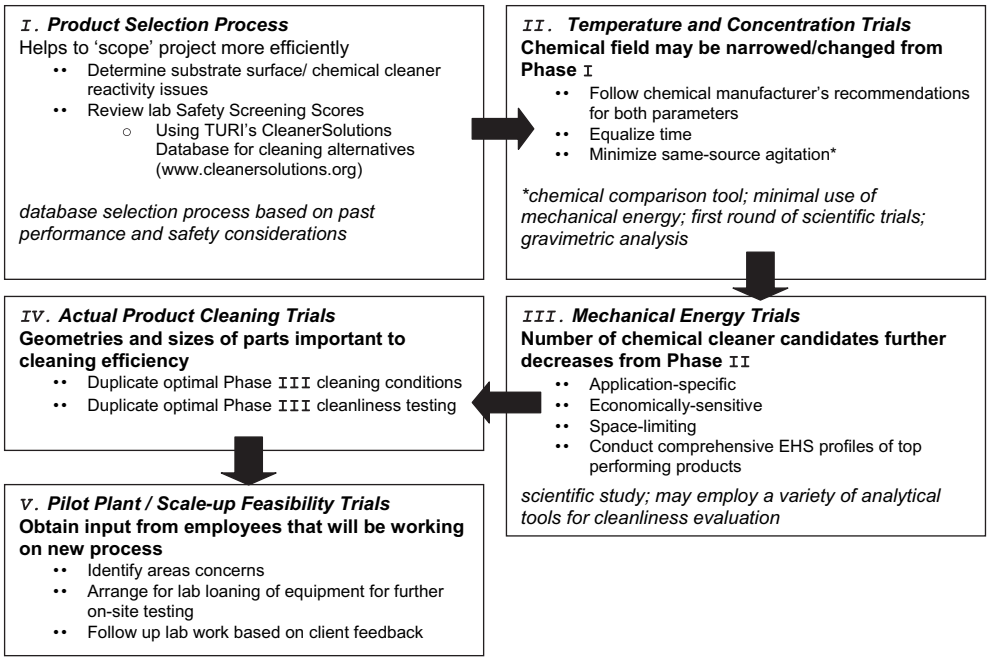

Fig. 1. TURI lab cleaning project steps.

the use of TCE has not been eliminated. Alarmingly, there are many small users of TCE that continue the same cleaning and degreasing practices they have used for decades, and have not reduced their use of TCE at all.

In the summer of 2006, EPA Region 1 found TCE at elevated levels as part of its routine air monitoring system evaluation in the Providence, Rhode Island (RI) area (specifically Olneyville). Therefore, EPA Region 1 made TCE the focus of intense scrutiny over the next year as part of its environmental justice efforts. A list of approximately 40 companies potentially using TCE was generated and subsequently visited by a member of EPA Region 1. Of these companies, 24 were still in operation in 2006. Many of the companies that were identified made materials for the Department of Defense (DoD). When the DoD learned of TCE being used by its suppliers it took a vested interest in the project, encouraging its suppliers to eliminate the use of this chemical.

With the list of companies in hand, the EPA and the RI Department of Environmental Management (DEM) needed to come up with a way to eliminate/reduce the usage of TCE in this community. Enforcement actions were considered but the regulatory partners agreed that a more effective method for improving air quality in the communities affected could be found. EPA Region 1 funded the TURI Lab to provide technical assistance and/or training to the identified companies with the goal of supporting the companies in voluntarily reducing or eliminating their uses of TCE.

The TURI Lab determined that the initial step in this project would be to convene a one-day hands-on-training workshop for these companies. Prior to the workshop, dirty parts and soils were collected from a sampling of the 40 identified companies by the EPA Region 1 staff and brought to the TURI Lab. Testing was then conducted to determine which alternatives would be appropriate for each company's exact needs. This end user specific testing was deemed necessary as solvent substitution in cleaning applications does not have a single drop-in. By providing testing services to companies, the TURI Lab was able to come to the Rhode Island based workshop with the specific products that were most likely to be effective for individual companies.

To keep the TCE substitution project moving forward, follow-up assistance on a one-to-one basis was made available to attendees of the workshops. TURI Lab and EPA Region 1 staff members brought laboratory proven products and bench scale equipment to the individual companies to conduct on-site piloting. The piloting was demonstrated by the TURI Lab first and then by the workers who were responsible for the cleaning process. This activity had the added benefit of opening up critical lines of communication relative to what actually goes on in the process.

2. Work performed

2.1. Workshop training

The initial workshop had twelve companies in attendance. During the workshop companies brought their dirty parts to be cleaned using the alternatives that the TURI Lab had previously identified and tested. The workshop allowed these companies to see first hand that alternatives do exist that are effective for their needs. In addition, the workshop gave these small companies the opportunity to talk with their peers to see what others have tried or experienced. This networking provided the companies with a sense of comfort knowing that they were not alone and emboldened them to begin the TCE replacement process.

Following the workshop efforts, the TURI Lab continued to work with six of the companies that attended. TURI's Field Implementation Specialist went on-site with each company to assist in the adoption of the identified alternatives. The TURI Lab provided these companies with a small cleaning unit (i.e., immersion and/or ultrasonic tank) and concentrated samples of safer cleaning alternatives. Cleaning was conducted by both the Field Implementation Specialist and the worker(s) involved with cleaning at the company. During the field work, the cleaning process was adjusted to meet the needs of the company.

After determining the appropriate cleaning cycle, the cleaning unit and alterative cleaning products were left with the company to conduct piloting on their own. This loaning was a new service that the TURI Lab implemented in its effort to improve adoption rates. Typical piloting lasted from one to two weeks after which the equipment was returned to the TURI Lab. During the pilot phase, the companies were provided with a list of possible equipment

Table 1
Company project status and TCE reduction achieved.

Locations visited/type	Actions taken on-site	Notes	Date	TCE used gal/yr	Gallons eliminated	Pounds used/year	Pounds eliminated
IRA Green/Metal finishing – military insignia	Set up a test tank w/alternative in Ira Green's facility. Determined that alternative solution works as well as TCE. TURI provided free gallon of alternative solution	Initial switched to alternative in existing ultrasonic tanks for 30% of product line, using n-propyl bromide as a drop-in replacement while waiting to purchase additional ultrasonic equipment.	10/31/2006	1023	1023	12500	12500
3 As/Fine jewelry and statue figurines	Viewed new machine	Stopped using TCE, now using steam cleaning – won't be attending workshop but said it was okay for companies to contact them.	10/18/2007	55	55	672	672
Nulco/Brass light fixtures	Collected more parts, dropped of cleaned parts	Results looked promising for drop-in solvent vapor degreasing – signed up for workshop. Wanted information on n-propyl bromide regulation potential.	2/11/2008	330	0	4089	0
Mel-co-ed/Military insignia, brass and steel parts	Walk through, collection of parts – Had reduced 7000 lbs TCE to 3000 lbs and working toward being below 1000 lbs	Signed up for workshop, conducted lab testing, visited facility to arrange for parts cleaning. Waiting on samples to complete work.	2/11/2008	500	400	6196	4957
Teknicote/Metal shop, small springs	Walk through, review of new system – reduced TCE following last workshop – eliminated 7000 lbs	Switched to aqueous power washing, purchased drying equipment similar to what lab has in-house (just larger). Quality maintained but scheduling more challenging	2/11/2008	500	500	6196	6196
Herff Jones/Jewelry, class rings	Conducted work with lab from previous year of work. Wanted to attend workshop	Completed work. Switched from TCE to nPB and a 3M product and some aqueous. Want to do case study	4/1/2008	161	153	2000	1900
Mereco/Make resins and use large aluminum and stainless steel buckets	Replaced TCE with n-propyl bromide but are interested in replacing nPB.	Identified several options for resin cleaning applications with no loss of performance	6/23/2008			*6000*[a]	
Providence Metalizing/ Electroplating	Combination of ultrasonics and power washing. 500 lbs a month of TCE	Based on information provided on TCE alternatives, company began investigating alternative processes.	11/27/2008	484	444	6000	5500
Whittet Higgins/Industrial retaining devices		No data					
Chemart Co/Etch decorative brass ornaments		No data					
G Tanury Plating/ Electroplating jewelry, eyeware		No data					
Garlan Chain (MA)/Metal fence	Significantly cut down usage. (10,000) At this rate they believe the can be well under the 1000-lb/year	Following workshop, company set out to reduce their TCE usage below the new threshold of 1000 lbs	4/10/08	97	30	1200	370
Tech Etch (MA)/Photo etching, flexible circuits		No data					
			Totals	**3150**	**2605**	**39033**	**32095**
					% Reduction		**82**

[a] nPB replaced.

Table 2
Expected and actual pollution prevention results.

Project Name: Cleaning Workshop		
Measures/Results for 2007–8	Results	
Activity Measures:	**Projected**	**Actual**
Number of conferences/workshops/training sessions held		
Hands-on-training workshops	1	1
Number of attendees	20	13
Number of clients/facilities that received assistance	12	8
Outcome Measures: From workshop only	**Projected**	**Actual**
Gallons of TCE reduced by participants per year (pounds/year)	100 (1240)	1037 (12850)
Project Name: Laboratory Evaluations		
Activity Measures:	**Projected**	**Actual**
Number of laboratory Tests	25	11
Number of clients that received on-site visits/assistance	8	5
Outcome Measures: From Lab evaluations only	**Projected**	**Actual**
Gallons of TCE reduced by participants per year (pounds/year)	350 (4340)	150 (1860)
Project Name: Field Testing and Implementation		
Activity Measures:	**Projected**	**Actual**
Number of site visits	18	8
Number of clients that received on-site visits/assistance	6	4
Number of unique documents developed	3	6
Outcome Measures: From field evaluations only	**Projected**	**Actual**
Gallons of TCE reduced by participants per year (pounds/year)	1000 (1240)	2093 (25760)

vendors that could assist in the purchase of equipment or in the modification of existing equipment.

From September of 2006 through April of 2007, half of the originally identified companies suspected of using TCE in the Providence area participated in the hands-on-training workshop. Six of the original attendees from the workshop participated in piloting projects. Most of these have or will be eliminating or reducing TCE in their facilities.

A second hands-on-training workshop was held in March 2008. The target audience was those companies that could not attend the previously offered workshop in September 2006. This new training was modified from the original workshop to incorporate the lessons learned by the TURI Lab from the original workshop. The materials provided included a tip sheet generated by the joint effort of EPA Region 1 and TURI, and short case studies of companies that had gone through the complete substitution process. While these companies could not speak at the workshop, they did allow TURI and EPA to mention them by name and to provide personal contact information to anyone who wanted to speak directly to them on the projects conducted at their facilities.

The original list of companies possibly using TCE (provided by EPA), about 30 companies (some of the original 40 were determined to not be in business), was contacted via a mailing from TURI about the workshop. In addition, the Narragansett Bay Commission (NBC) sent a copy of the flyer to more than 80 companies that the NBC thought would benefit from the workshop. A handful of Massachusetts companies located close to RI also were invited to the conference. In total, there were 8 companies that signed up for the workshop, 6 from RI and 2 from Massachusetts. In addition to TURI Lab staff and EPA Region 1 contacts, representatives from the RI DEM, NBC and RI Occupational Safety and Health Agency (OSHA) attended the workshop and were available for companies to discuss how each agency could assist companies to replace/reduce TCE.

At the end of the March 2008 workshop, on-site assistance was offered to the attendees. Follow-up email contact was attempted for six of the eight attending companies. One company did not provide contact information. The remaining company previously worked with the TURI Lab and was ready to complete the transition efforts to a new cleaning process. They wanted to make contact with the TURI Lab to offer their company as a possible case study.

In addition to the workshop, laboratory services were provided to other companies that participated in the first round of on-site and laboratory testing offered by TURI in 2006–7. On-site assistance was provided to these companies through the use of laboratory loaned equipment and cleaning products.

3. Results and discussions

The goal of the project was to increase the adoption rate of the TURI Lab testing program thereby reducing the amount of TCE used by small companies in Rhode Island. During the period after conducting the workshops for twenty companies, the TURI Lab had further contact with twelve companies. The amount of TCE that was being used by attendees and other contacted companies was calculated to be about 39,000 pounds/year. This number was based on the preliminary questionnaire and/or registration forms for new companies serviced and those that continued on during the second year of work by TURI. (For five of the companies, the lab was unable to determine the amount of TCE being used.)

Services provided to companies included preliminary site visits by TURI and EPA Region 1 staff, laboratory testing, follow-up site visits and onsite testing assistance. The visits allowed TURI to conduct a walk through of the facility and to collect sample materials for laboratory testing.

Laboratory testing conducted by TURI allowed for the identification and evaluation of alternative cleaning products that were specific to each company's needs. A dozen trials were conducted for 3 of the 8 companies that attended the workshop in March 2008. In addition a handful of testing was done for companies that attended the previous workshop in September 2006.

With safer alternatives to TCE identified and evaluated, the TURI Lab provided companies with the opportunity to have equipment loaned to them (free of charge) from the TURI Lab to evaluate the identified products on-site. Equipment and cleaning alternative supplies were left with a company for a period of 2–4 weeks. At the end of the lending period, the equipment was retrieved and the status of the alternative cleaning product was determined.

3.1. Implementation adoption – TCE reduction

Through the combined efforts of the workshop training, laboratory testing and on-site assistance, the TURI Lab assisted nine of the companies in eliminating 82% of the reported total TCE usage of 12 companies. Solvent usage dropped from the 39,000 pounds/year to less then 7000 pounds/year. Additional solvent reduction of n-propyl bromide (nPB) was achieved for one of these eight companies; their initial usage of nPB was 6000 pounds a year.

Some of the companies that received testing from the TURI Lab did not adopt the suggested alternative cleaning products that were identified. However, the proof from peer companies that the alternatives to TCE could work prompted these companies to investigate other possible substitutes. Once such example was a small plating job shop. Several commercial products were identified by TURI for removing buffing compounds from the various brass pieces being manufactured at this facility. Upon further investigation by this company, a steam cleaning system was piloted and eventually adopted, eliminating more than 670 pounds/year of TCE.

For other companies, the use of drop-in organic solvents for cleaning was considered to be necessary for the continued success

of these companies due to economic considerations. The TURI Lab made attempts to identify suitable drop-in solvents for these companies. In addition, work was conducted to determine when and where these drop-in solvents were needed. Whenever possible the solvents were replaced by aqueous based alternatives. A large jewelry manufacturer was one such company that opted to diversify their cleaning process, using the more expensive drop-in solvents in only the most challenging situations. By following this method, nearly 2000 pounds/year of TCE was eliminated.

Table 1 lists the companies that received some kind of service during the grant period, the status of the project and the TCE usage/reduction values obtained.

To collect data for the companies in and around Providence, RI, TURI used checklists for on-site visits at facilities and pre-post testing for workshop attendees. In addition, follow-up phone interviews and additional site visits were made to identify P2 results. Table 2 outlines the expected and actual measurements for each pollution prevention project.

Through the collection of data for the grant, two of the three areas exceeded projected results. The most dramatic result was the amount of TCE reduced by those only attending the workshop. Based on previous outcomes, TURI assumed that 100 gallons per year (1240 pounds/year) of TCE would be replaced as a result of the information presented on during the workshop training. According to responses from attendees, the actual TCE replaced following the workshop was determined to be more than 1000 gallons (12,400 pounds/year).

An assumption that 1000 gallons (12,400 pounds/year) of TCE would be replaced after the TURI Lab conducted on-site assistance for companies considering the adoption of the alternative cleaning products/processes. At the conclusion of the grant period, the actual TCE replacement was higher, resulting in 2093 gallons (25,600 pounds/year) eliminated.

For the companies that received laboratory evaluations without on-site assistance, it was anticipated that 350 gallons (4340 pounds/year) would be replaced. Unfortunately the companies realized less than half this reduction, replacing only 150 gallons (1860 pounds/year). At the end of the grant time frame there were a few companies that had received successful lab testing of alternatives, but had not been able to move toward adoption due to financial restrictions.

The new TURI Lab assistance process has expanded beyond the traditional lab work to include on-site assistance. Fig. 1 shows the five step process that has helped to improve the pollution prevention adoption rate.

4. Conclusions

The lack of adoption by companies receiving lab testing only confirms the importance of providing the on-site assistance aspect of the TURI Lab. By conducting the on-site work, questions or concerns can be met in real time, facilitating a successful adoption of safer cleaning practices.

The lessons learned and the connections made with TCE users in Rhode Island can easily be applied to other areas with concentrated industry regions. Connecticut may be one such region with localized job shops and metal working facilities. According to EPA sources, Bridgeport, Danbury and New Haven may be ideal locations to provide future hands-on workshops and on-site cleaning assistance by the TURI Lab or an operation similar to the TURI Lab. The methodology for on-site assistance follow-up to the preexisting TURI Lab testing program has been incorporated into the work the TURI Lab conducts for companies in Massachusetts. As previously mentioned, the Lab had an implementation rate of around 30% without on-site assistance. During the first year of the new process, the adoption rate has jumped to 80% of all companies working with the lab.

Acknowledgements

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