



Determining the Cost of Toxics

A TUR Planning Fundamentals Webinar

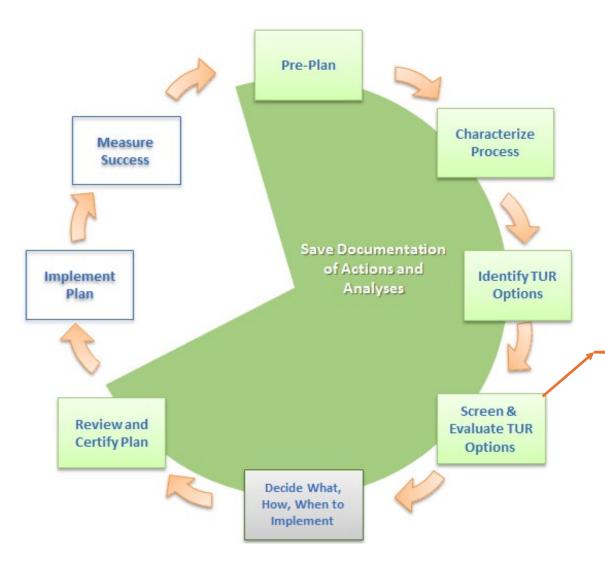
September 12, 2025 Noon – 1:30 PM







The steps of toxics use reduction planning



- Determine the scope of your plan
- Establish current/accurate process flows and chemical pathways
- Facilitate process for identifying possible TUR options
- Determine which options are technically feasible
- Determine the cost of using toxics
- Assess the economic feasibility of implementing
- Establish implementation schedule



Why bother assessing cost of toxics?



It's a required element for all TUR plans



Creates a **baseline** against which you can determine the economic feasibility of TUR options



Being **thorough** here strengthens the business case for implementing TUR



Requirement

A cost of toxics determination MUST be made for EACH covered toxic in EACH production unit in which it is used

Include *quantitative*calculations if
technically feasible
TUR options have
been identified

If NO technically feasible TUR options identified, the Plan must include a qualitative cost evaluation

Must consider relevant cost elements identified in the regulations

https://www.mass.gov/doc/toxics-use-reduction-planning-plan-update-guidance/download **TUR Plan Guidance** (Jan 31, 2024 rev) Section 3.2.1.5, pages 22-23



Steps for determining cost of toxics



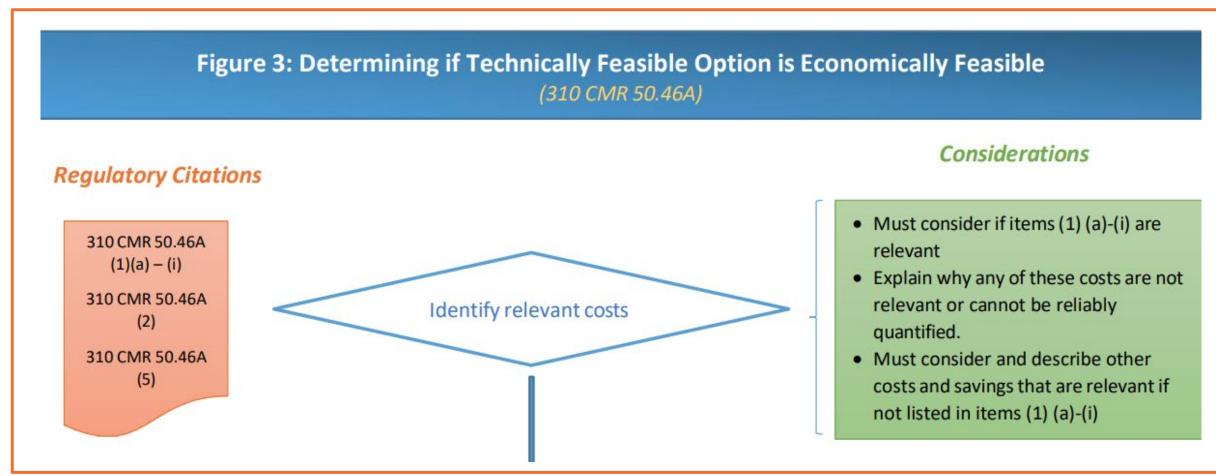
- 1. Identify relevant cost elements
- 2. Gather appropriate cost data
- 3. Determine cost of using toxics
- 4. Allocate those costs to production units

5. Evaluate the economic feasibility of your TUR options



If technically feasible options identified:

Step 1 - Identify Relevant Costs



Potentially relevant cost elements (310 CMR 50.46A(1))

- a) indirect and direct labor and materials costs (which shall be stated in the Plan);
- b) purchase or manufacturing cost of the toxic and its alternative chemical;
- c) capital and equipment costs;
- d) storage, accumulation, treatment, disposal, and handling costs associated with toxics and byproducts;
- e) costs associated with activities required to comply with local, state, or federal laws or regulations, including but not limited to, fees, taxes, and costs associated with treatment, disposal, reporting and labeling;
- f) worker health or safety costs associated with the toxic and its alternative chemical, including but not limited to, protective equipment, and lost employee time due to accidents or routine exposure to the toxic;
- g) insurance;
- h) potential liability costs that may arise from intentional, unintentional, or accidental activities or occurrences;
- i) loss of community goodwill and product sales lost to competing non-toxic products; and
- i) other cost items that are relevant.



Step 2 – Gather Appropriate Cost Data

- Who should you speak with?
- Use accounting factors the company uses in other financial decisions
 - Payback or Net Present Value
 - Depreciation
 - Discount rate or Interest
 - Others?
- Remember that costs can change over time
- One of your strongest tools is to question assumptions

TUR Planners are expected to use standard accounting methods

Breakout discussion (10 min)



Which cost elements do you routinely consider?

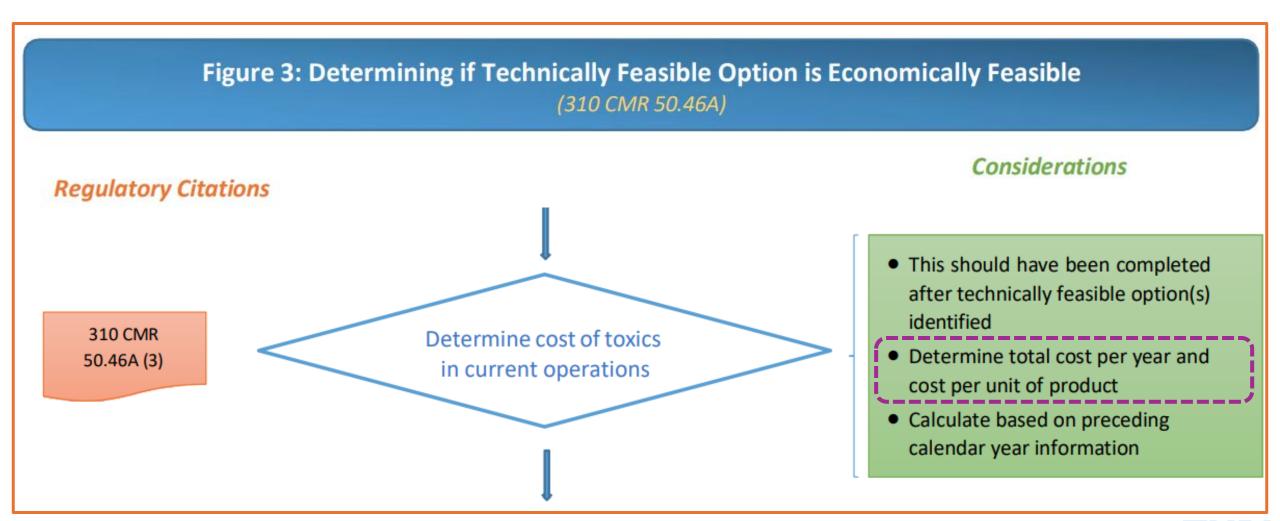
Which do you find challenging to quantify?

Who do you work with to find cost data?

Use your time together to share best practices from your experience.



Step 3 – Determine the Cost of Toxics



Suggested cost of toxics form

Exhibit 4 in the guidance suggests one way to document costs of toxics

- Indicates relevance and place to explain if not, or not quantifiable
- Provides space to estimate annual costs/savings if there is technically feasible TUR option implemented – annual and per unit of product
- Itemizes likely cost elements by
 - Manufacturing costs
 - Materials and waste management costs
 - Regulatory compliance costs
 - Worker health and safety costs
 - Insurance
 - Potential liability costs
 - Opportunity costs (community good will, effect of competition)

Optional form

	ate a separ	ate form for	each p	roduction unit fo	OF TOXICS EVALUATION or which there are no tech	nnicall	y feasible options		
Production Unit #		Loonomic	CVUIUU	evaluation of technically feasible options must Date Prepared/ Reviewed/ Updated		# of Products per Year			
Location of Supporting Documentation Covered Toxic Name(s) and CAS No.					Allocation of costs to Production Unit				
COST ELEMENT (from 310 CMR 50.46a (1) (a-g) and (2))	Element to the Pr	Cost Relevant oduction (Y/N)	lf	No, explain	If relevant, is it quantifiable? (Y/N) Exp	olain.	IF THERE IS A T Annual Cost/Sa (\$/yr)		ALLY FEASIBLE OPTION \$ / Unit of Product
Manufacturing Costs									1
(a) direct labor									
(a) indirect labor									
(a) materials									
(b) purchase of covered toxic or its precursors									
(c) equipment (including cost of capital if relevant)									
Materials and Waste Management Cos	ts								
Raw Material Storage Costs									
(a) direct labor									
(a) indirect labor									
(a) materials									
(c) equipment (including cost of capital if relevant)									
Product Accumulation and Storage Costs							I		I
(a) direct labor									
(a) indirect labor									
(a) materials									



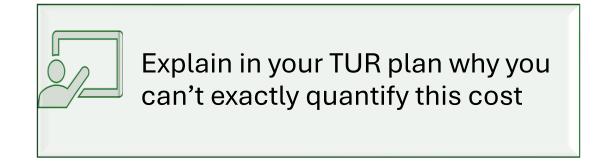
Dealing with hard to quantify costs

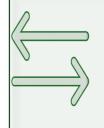
One way:

Tabulate, indicate relative weight

Relevant Cost Elements	Amount / year	Source
Chemical purchase	\$\$	Purchasing
Storage and handling	\$\$	Operations manager
Labor	\$\$	Process engineer, HR
Impact of use on equipment	?	Facilities manager
Cost to protect worker H&S	?	EH&S manager, HR
EH&S compliance costs	?	EH&S manager
Insurance premium	?	Insurance rep, HR
Opportunity loss	??	Marketing, sales, CEO

Under TURA you must:

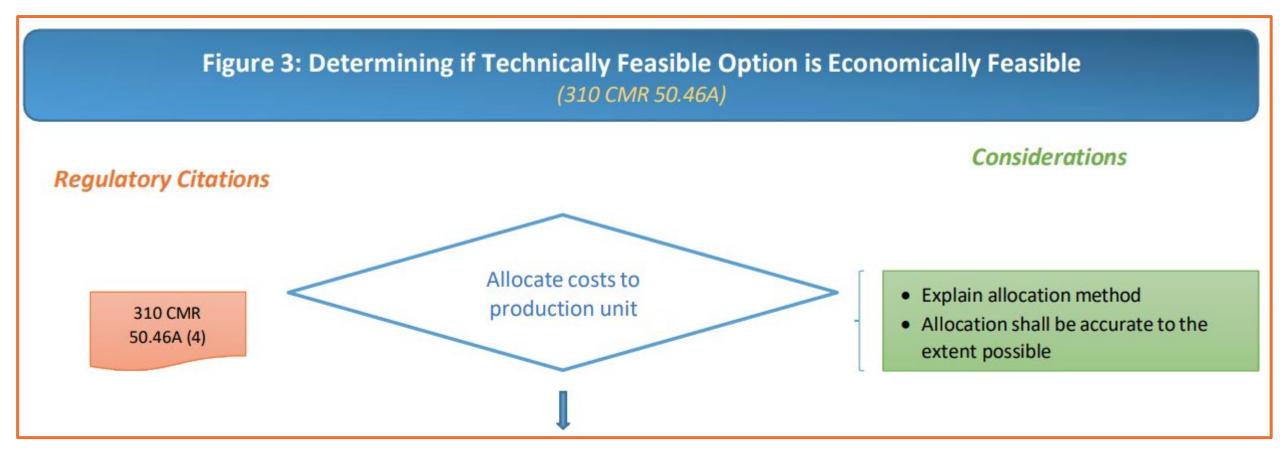




Describe its likely impact – positive or negative – on the costs and savings associated with implementing the TUR option



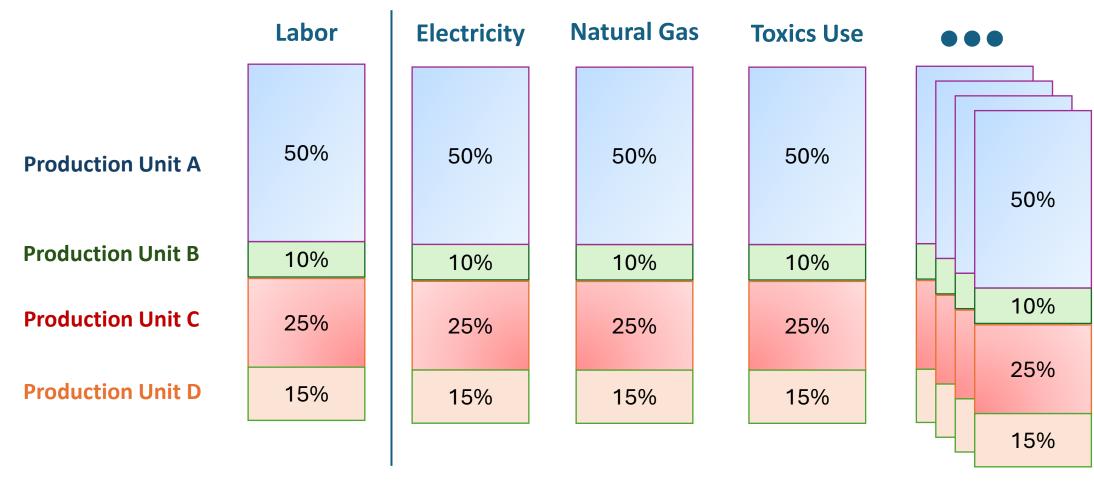
Step 4 – Allocate Costs to Production Units



Assumptions must be clearly articulated

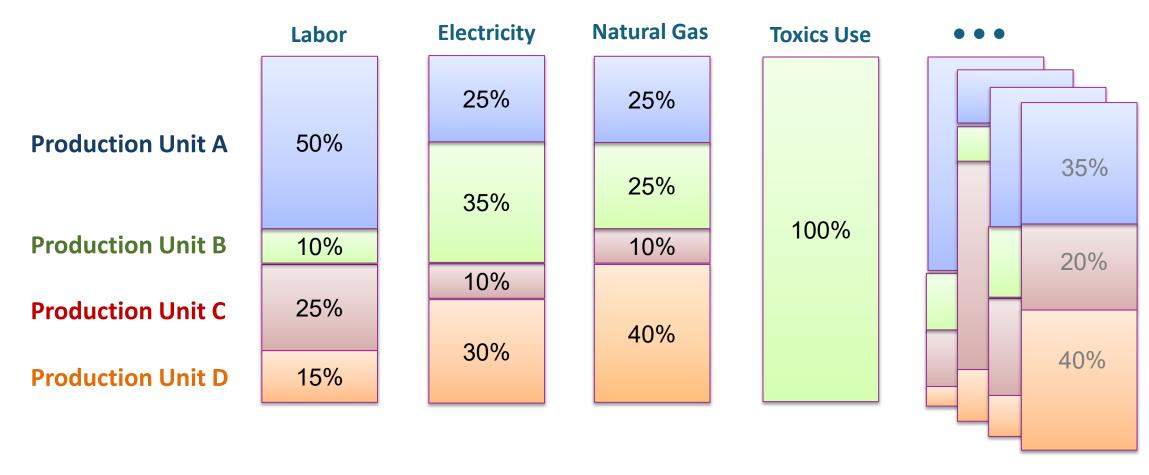


Conventional Accounting: Allocate costs in proportion to labor hours per production unit





Activity-Based Accounting: Allocate costs based on use per production unit





Deficiencies noted in recent DEP TUR Plan reviews

Plans that completely skip this step

Calculations that are incorrect/inaccurate

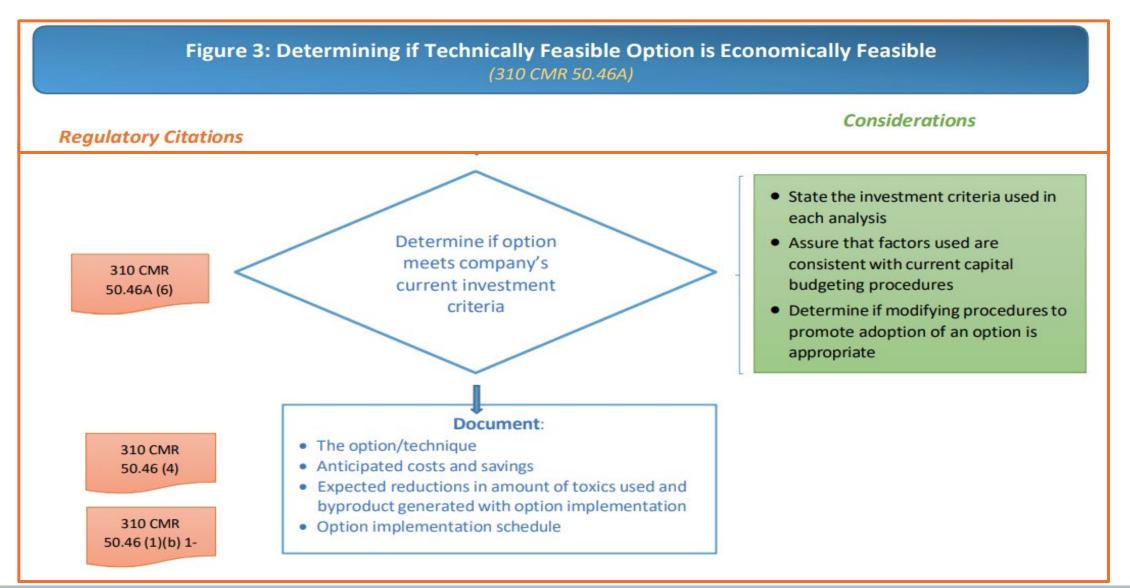
- Using numbers from previous years
- Using usage amounts that don't match current use or what is reported elsewhere in the Plan
- Incorrectly or inconsistently rounding numbers
- Spreadsheets: Not including the spreadsheet in the Plan or using incorrect formulas or data

Insufficient explanations about cost elements being calculated

Senior management doesn't know where the numbers came from



Next step - Economic Evaluation





Considerations

The economic analysis of **each** feasible TUR option must consider the following cost elements when calculating associated costs and savings:

- Indirect and direct labor and materials costs
- Purchase or manufacturing cost of the toxic and its alternative chemical
- Capital and equipment costs
- Storage, accumulation, treatment, disposal, and handling costs associated with toxics and byproducts

A relevant cost for the current toxic chemical used is not necessarily relevant for the TUR option

The guidance encourages facilities to determine if indirect or overhead costs that are not usually associated with the production unit are relevant

Cost estimating for option implementation

Use same protocol for identifying/allocating costs for each TUR option as done in cost of toxics analysis

Costs that were not relevant in the cost of toxics analysis MAY be relevant in calculating costs to implement a TUR option

Assess the quality/reliability of estimates before starting your financial analysis

Relevant Cost Elements	Amount	Source
Equipment	\$\$\$	Vendor Quote
Installation	\$\$	Contractor Quote
Engineering & Permitting	\$\$	Consultant Quote
Process Downtime/Lost Production for Install & Startup	?	Process engineer's estimate
Product Revalidation (FDA or MilSpec)	?	Quality control estimate
EH&S costs	?	EH&S manager estimate
Project Management costs	?	Process manager's estimate
Risk of Customer Loss	??	Sales estimate

Choosing options to implement

Planners advocate for implementation, but company management selects which projects are funded and the schedule for implementation

While an option *may* be declared economically feasible even if it does not meet the company's current investment criteria, it *MUST* be deemed economically feasible if it DOES meet these criteria

Economically feasible TUR options aren't required to be implemented

Other projects with even greater potential economic returns may be in the queue

The perceived risk may be too high



Additional tools to consider



Cost/benefit analysis

Calculates the ratio of favorable outcomes of implementation to the associated opportunity costs over a set period of time

Costs and benefits should be in terms of net present value



True cost accounting

Accounts for externalities (environmental, social, health and other economic factors outside the company's control)



Estimating costs of occupational injuries (OSHA)



 Thorough cost of toxics analyses support your facility's decision on whether and when to implement TUR

 Relevant costs are not simply capital equipment costs and contractor expenses

Costs change!

Consider the accuracy of your estimates

Question assumptions





Next up – Colin Hannahan TURI's Policy Analyst

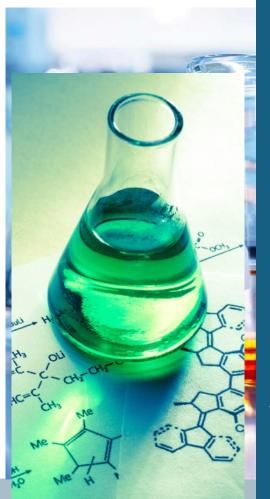
Costs/benefits of implementing TUR

 Case examples from TURI's soon to be published TURA Competitiveness Report





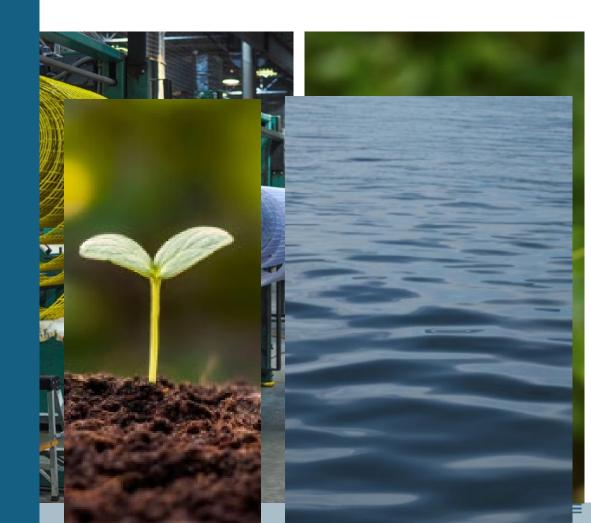




Enhancing Competitiveness Through Toxics Use Reduction

September 12th, 2025

Colin Hannahan, Policy Analyst Toxics Use Reduction Institute Cost of Toxics Webinar







Overview

- The Toxics Use Reduction Act
- Background on Competitiveness under TURA
- Toxics Use Reduction and Competitiveness: Themes and Outcomes





The Toxics Use Reduction Act (TURA) of Massachusetts

TURA requires companies to:



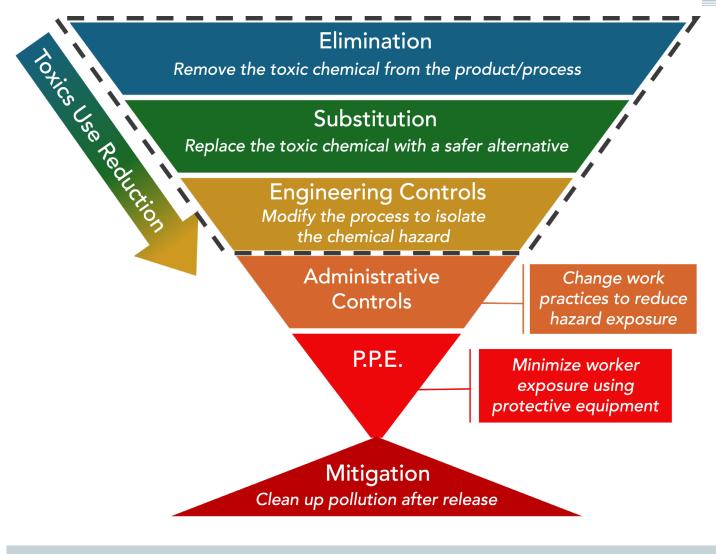
Report on their <u>use</u> of chemicals on the TURA list of toxic substances



Prepare evaluations to identify opportunities for toxics use reduction



Pay annual fees based on business size and chemical use

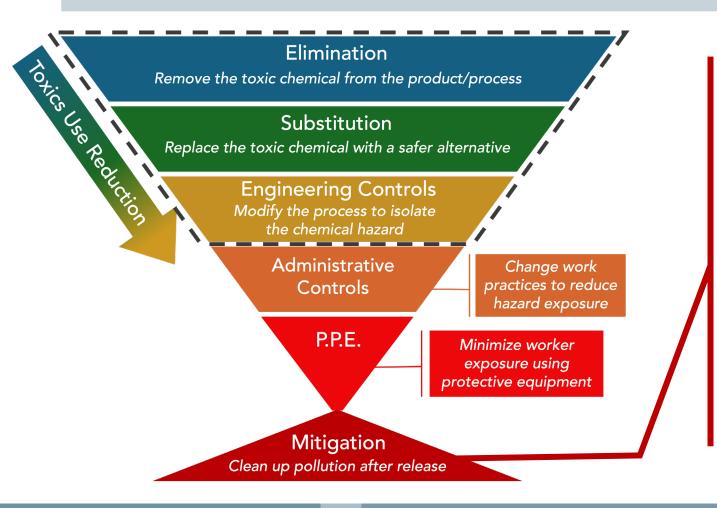


- The TURA list of toxic substances can be updated
- TURA does not ban or restrict any toxic substances



The Toxics Use Reduction Act (TURA): Cost Effectiveness

Toxics use reduction (TUR) has proven to be the most cost-effective method for protecting public and worker health from hazardous chemicals



- **\$21 billion** was spent by American taxpayers to pay for pollution clean up via the EPA superfund program between 1997 and 2017.¹
- Removing and destroying PFAS from municipal wastewater costs between \$2.7 million – \$18 million per pound².





Collaborative research to Eliminate PFAS An example from the MA Microelectronics Industry

TRANSENE COMPANY, INC.

Due to customer demands, wanted to eliminate the PFAS based surfactant from their microelectronics etching products.



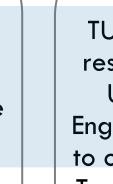
Transene
approached TURI
for assistance in
developing viable
and safer
alternatives to
PFAS



TURI awarded a research grant to Umass Lowell Engineering faculty to collaborate with Transene and TURI



- Adopted by ~ 90% of Transene's customers
- Cost-savings achieved for the PFAS-free surfactant







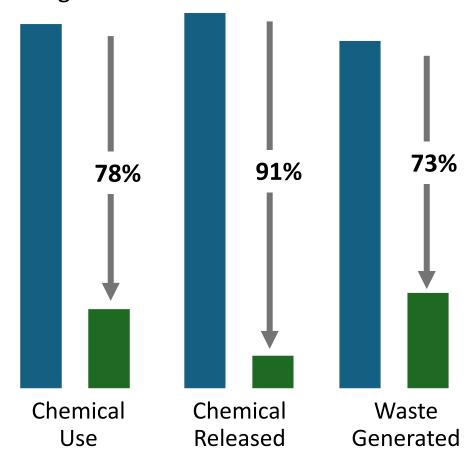
TURI Case Study - Transene

Transene Case Study - Youtube



Results under TURA

Progress under TURA from 2000 to 2023

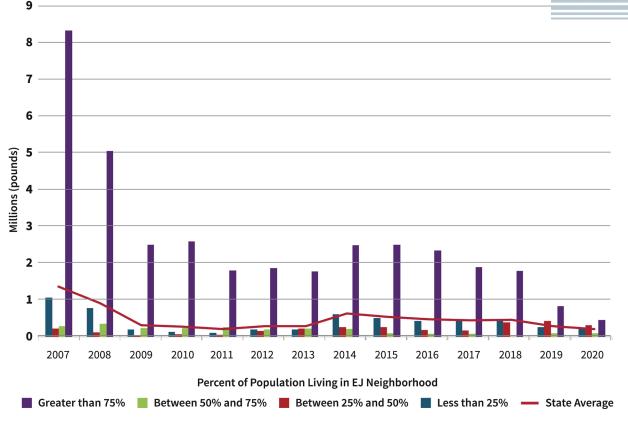


Massachusetts TURAData.org

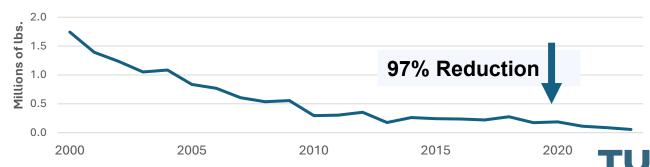
*Among 2000 TURA core group, more information can be found via TURA Information Releases

Average Release per Municipality, Asthmagens, 2007-2020





Trichloroethylene (IARC Group I Carcinogen) Use: 2000 to 2023



The Toxics Use Reduction Act (TURA) and Competitiveness

- \$2.3 billion savings achieved by businesses which received EPA pollution prevention (P2) grants between 2011 and 20223
- \$4.5 million savings per year achieved by businesses as a result of TURA implementation according to 2016 survey⁴
- 50% reduction in operating costs
 achieved by businesses in the years
 directly proceeding TURA's
 adoption⁵



2017 TURI Report - Toxics Use Reduction and Resource Conservation: Competitiveness Impacts for Massachusetts Businesses



Company Description	Key Project Outcomes		
Metal Plating Facility (Over 100 workers)	Eliminated use of carcinogenic Hexavalent Chromium. Tripled production capacity with annual savings over \$1 million		
Biomedical (Start Up)	Reduced chemical use by 70% achieving		
	savings of \$46,900/year		
Global Consortium of 25 businesses in the	Collaborated to advance lead-free		
electronics sector from start up to	electronics assembly. Ensured		
multinational corporations including 14	competitiveness in global markets and		
companies from MA	increased speed-to-market.		
Multinational semiconductor Manufacturer	Implemented numerous TUR projects including water pre-treatment which saved 2,200 lbs. of chemicals and 150,000 gallons of water annually		
Two family-owned auto repair businesses	Removed numerous hazardous chemicals from the workplace. Achieved annual savings between \$1,400 and \$3,400		

TURA Program Services to Improve Competitiveness





On-Site Assistance

Facility visits to identify TUR opportunities and implement safer solutions



Financial Assistance

TURI's industry and research grants for projects which advance safer chemical solutions



Laboratory Services

TURI's two on-site laboratories with expert staff



Toxics Use Reduction Demonstration

Collaboration and events which promote TUR adoption



Knowledge Generation

Tools and reports like the Cleaner Solutions Database and P2OASYS Boyd leverages TURA technical and financial support to improve safety and save money

After a 6-year collaboration with TURI, Boyd switched away from a carcinogenic solvent to a fully automated, water-based cleaning system.

- \$31,000 in annual savings on operating costs
- 66% reduction in cleaning time
- 95% decrease in labor input



Improving Competitiveness under TURA: The Case of Halogenated Solvents

Targeted assistance has helped MA businesses reduce their use of carcinogenic halogenated solvents, saving money and improving their position in the market.



\$212,436 in annual savings



\$1,197,240 investment into cleaner chemical innovation



1,375 workers no longer exposed to hazardous solvents



TURA agencies provide free services to offset the costs of switching away from halogenated solvents

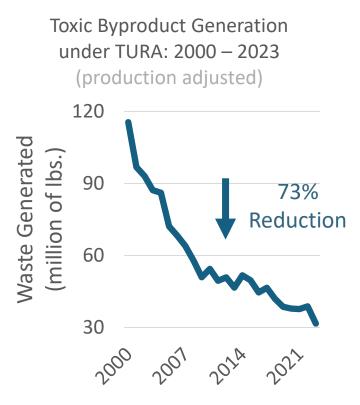
Costs of finding a safer chemical solution in industrial cleaning⁶

Activity	Employee Time (Hours)	Cost
Research cleaning options	60	\$7,500
Independent lab testing		\$4,000
Fine tune equipment and process design	40	\$8,000
Evaluation of testing	8	\$1,000

Enhancing Competitiveness with Toxics Use Reduction: Improved Productivity and Efficiency



"Hazard elimination and safer substitution result in large-payoffs by creating efficiencies throughout business operations" – The American Industrial Hygiene Association⁷



Under TURA Companies achieved

- A 51% increase in overall productivity despite large reductions in chemical use
- Greater reductions in waste generation than
 43 states

CD Aero achieves improved efficiency and productivity through TUR

Technical and financial support from TURI helped an electronics component manufacturer implement a clean chemical innovation

- \$46,000 in annual savings
- 1,920 ft² of reclaimed manufacturing space
- **68% increase** in throughput
- 33% reduction in maintenance labor





Enhancing Competitiveness with Toxics Use Reduction: Improved Compliance and Market Position

By focusing on safer solutions, TURA ensures MA companies are better prepared to comply and improve their position in the market

Public support for strong government regulation on toxic chemicals is increasing





Transene eliminates PFAS and improves supply chain position

Driven by customer demands for PFAS-free products, the microelectronics manufacturer Transene worked with TURI and Umass Lowell to develop a new product formulation. The safer alternative cost 70% less and achieved widespread adoption among clients

"This collaboration accelerated our ability to manufacture and sell safer etching products, which helps companies in the electronics supply chain meet new regulatory requirements and protect health and the environment." — Christopher Christuk, President of Transene Company

Enhancing Competitiveness with Toxics Use Reduction: Improved Compliance and Market Position

TURA Program agencies have supported many companies to stay ahead of federal bans and avoid workplace protection requirements. The TURA Higher Hazard Substance designation is not a ban and has preceded many restrictions – helping more companies switch to safer alternatives

TURA Higher Hazard	Reduction in users since		
Substance (HHS)	HHS designation		
Trichloroethylene	27 to 6		
Methylene Chloride	25 to 14		
Perchloroethylene	23 to 2		

EPA estimated costs of workplace protection compliance with TSCA risk management rule for Trichloroethylene (5 workers, open top vdg)¹⁰

Administrative Costs

Labor costs related to understanding the rule, keeping records of compliance, and notifying customers

\$593 Upfront

+ \$522 per year

Skin Protection

Costs for gloves and other dermal protection equipment, development of procedures and training

\$357 Upfront

+ \$1,008 per year

Respiratory Protection

Costs related to workplace air monitoring program and respirator equipment

\$9,225 Upfront

+ \$20,692 per year

Total Costs

Costs avoided by businesses which eliminated their use of TCE in vapor degreasing

\$10,175 Upfront

+ \$22,222 per year

Enhancing Competitiveness with Toxics Use Reduction: Improved Compliance and Market Position



TUR can eliminate or reduce a range of regulatory obligations

- 35.7 hours of labor or \$2,481/year – Estimated cost to report a single chemical under TRI¹¹
- \$44,428 Average cost of complying with TSCA Section 8 PFAS recordkeeping rule¹²

Steel Art Co. Finds Safer Alternative and Reduces Regulatory Obligations

The metal sign manufacturer collaborated with TURI to develop and implement a safer chemical solution for the cleaning of their metal sign letters. The new system reduced energy and chemical costs while lessening Steel Art's regulatory obligations, saving the company an estimated \$52,275 per year.

- \$6,725/year No longer required to plan or report under TURA
- \$1,425/year Savings on costs related to hazardous waste compliance
- \$28,125/year Reduced chemical costs by 97%
- \$10,500/year Increased energy efficiency by 62%



Enhancing Competitiveness with Toxics Use Reduction: Resource Efficiency and Operating Costs



Personal Protective Equipment costs represent the greatest opportunity for savings in the context of workplace safety according to AIHA



Energy Efficiency is often increased when implementing TUR solutions (e.g. lower operating pressure and temperature)



Chemical Savings opportunities can be identified during TUR planning

Company Description	Resources Savings Achieved	Estimated Cost Savings		
Metal Finishing	66% increase in solvent efficiency and 40%	\$3,456/year on electricity		
	reduction in energy use	\$1,000/year on solvent feedstock		
Semiconductor Parts	Eliminated use of toxic solvent	\$4,695/year on chemical costs		
Medical and Aerospace Materials	Replaced carcinogenic chemical with ultra-low cost, abundant	92% reduction in cost of chemical (\$5,605/year)		
	alternative	\$1,300 on hazardous waste disposal		
Electronics Components	Invested in safer chemical technology, which reduces costs of materials and electricity	\$21,574/year on chemicals and electricity		
		TUR		

Enhancing Competitiveness with Toxics Use Reduction: The Business Case for Environmental Justice







"Environmental justice is an increasingly material issue for companies, and therefore an important issue for investors to track" 13

Policy and Regulation

- Demands from the greater public to address equity in government
- Integration of environmental justice into State law

Litigation Risk

- New technology and targeted funding to collect data
- Growing litigation risk throughout the lifecycle of hazardous chemicals
- Increasing probability of accidents due to extreme weather

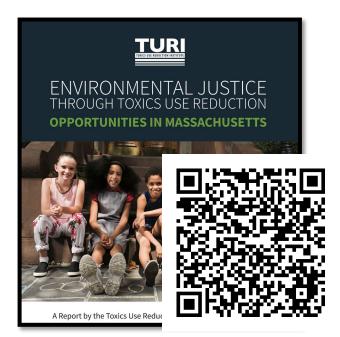
Community Reputation

- Community reputation can influence ability to operate
- Brand damage can threaten shareholder value



TURI Environmental Justice Analysis

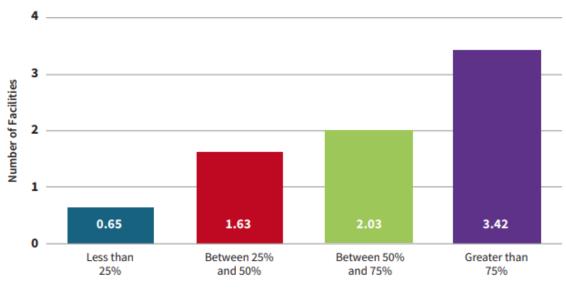
"Analyzes the use and release of Toxics in Massachusetts through an environmental justice lens"





Average Number of TURA Facilities per Municipality, 2020





Percent of Population Living in an EJ Neighborhood

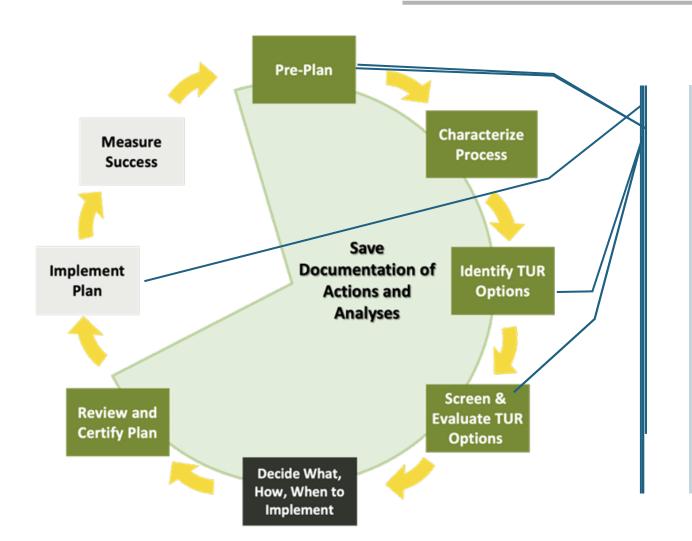
Top Three Facilities for Toxics Release, 2020





CS TOXICS

Advancing Environmental Justice during Toxics Use Reduction Planning



Implementation Plan

- Include community outreach element of implementation plan
- Measure impact on environmental justice





Discussion Questions

- Additional examples of cost savings or achievements to highlight or discuss?
- Challenges when calculating savings and benefits of TUR?
 Which resources do you use?
- How can TURI and the TURA program help to measure costs and benefits? What type of resources could we provide?





References

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- 13. https://www.iccr.org/reports/the-business-case-for-addressing-environmental-justice/



Upcoming Webinars



8 Oct., 9:00 AM - 10:30 AM

Evaluating chemicals of concern



9 Dec., 10:00 AM - 11:30 AM

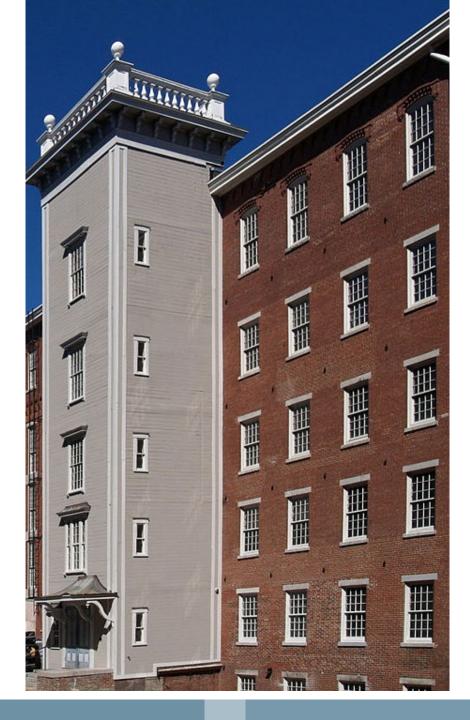
Using machine learning to support TUR

Implementing TUR: Company examples



19 Nov., 12:00 PM – 1:30 PM







Thank you!

Colin Hannahan Colin_Hannahan@uml.edu

www.turi.org

Toxics Use Reduction Institute
University of Massachusetts Lowell



Reminder

- To receive CEUs for attending today's webinar you must:
 - Attend the full webinar
 - Complete the survey, which will be distributed in the next few days
- Please never hesitate to reach out to TURI's training team if you have questions:
 - training@turi.org
 - Pam Eliason, Training Director: Pamela_Eliason@uml.edu
 - Agnes Cheng, Training Associate: <u>Agnes_Cheng@uml.edu</u>

