The importance of substitution of hazardous substances: Governments role in strengthening substitution.

Dolores Romano Mozo
Chemical risks prevention consultant

Meeting for the review of the Industrial Chemicals Toolkit under the Rotterdam Convention
Barcelona, 25-26 February 2015

Technical support

SUBSTITUTION is

”... the replacement or reduction of hazardous substances in products and processes

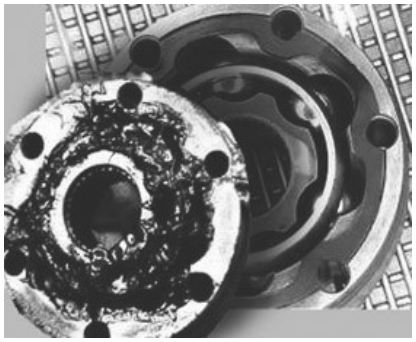
by less hazardous or non-hazardous substances, or

by achieving an equivalent functionality via technological or

organisational measures.”

Lohse/Lissner (2003)

Using less hazardous or non-hazardous substances:



Metal cleaning:
Replace hazardous solvents
(Eg. chlorinated, xilene, toluene, naftas, etc.)

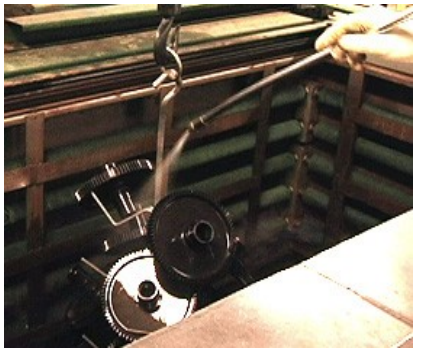
with safer substances:

Terpenes
Fatty acid esters
Aqueous cleaners
Semi-aqueous cleaners

Using alternative technological measures that achieve the same functionality:

Metal cleaning:

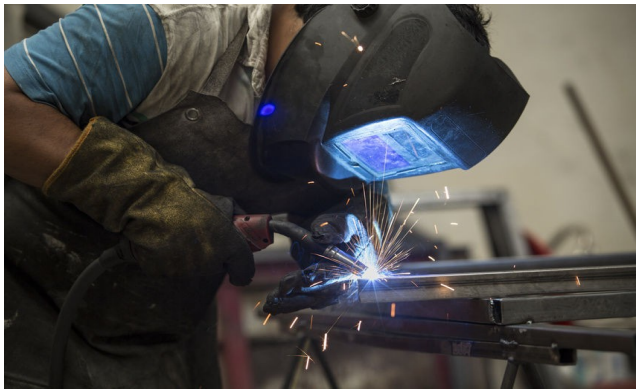
Ultrasonic cleaning
Spray cleaning
Blasting
Mechanical cleaning
Open spray cleaning
Vapour degreasing
CO2 dry ice blasting



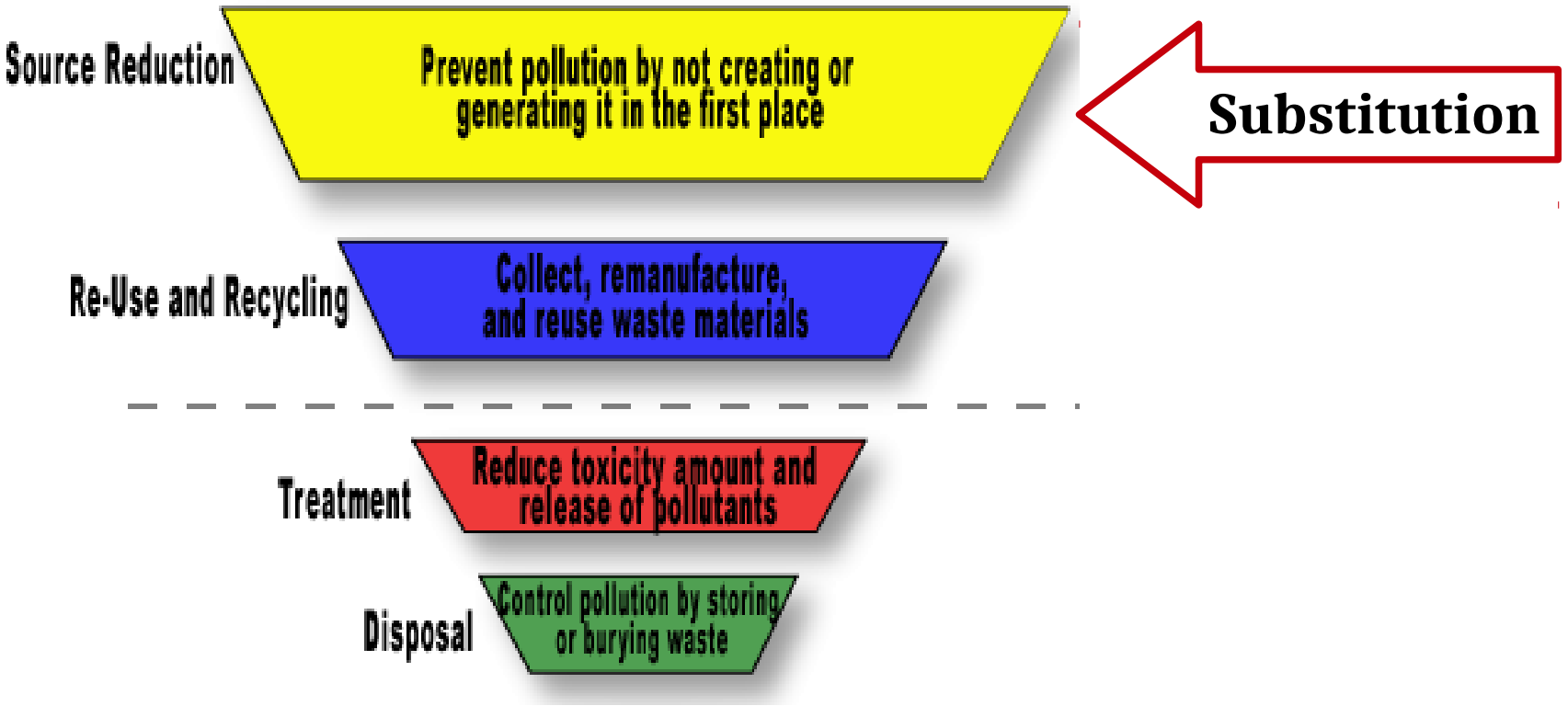
Alternative organizational measures that achieve the same functionality:

Metal cleaning:
Change work process to avoid the need to clean parts.

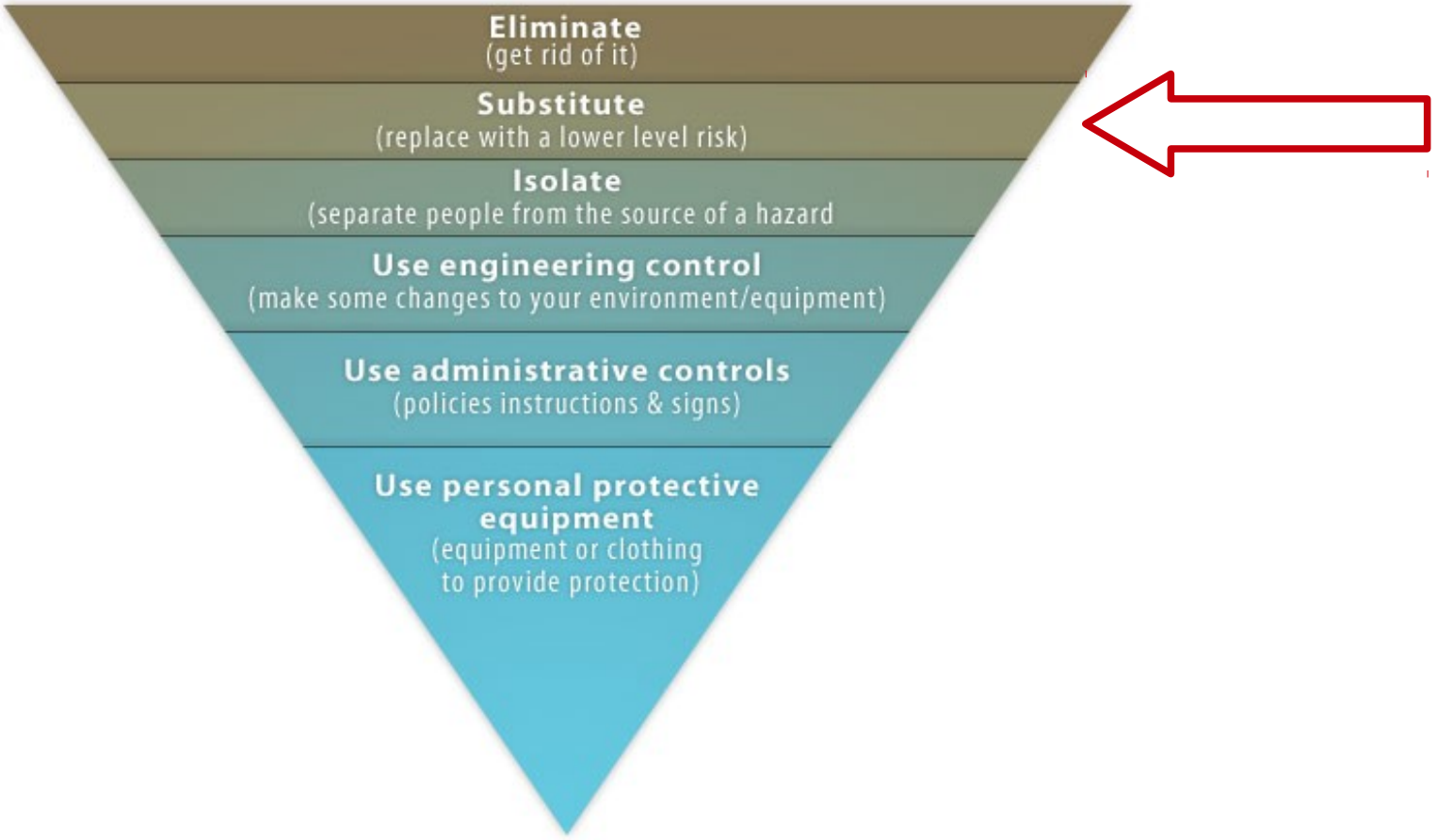
Folding metal sheets instead of soldering avoids need to clean soldering fumes.



Pollution prevention hierarchy



Occupational health and safety risk management measures hierarchy



Benefits of substitution:

- ✓ Avoid/reduce health and environmental risks
- ✓ Improve safety (and related costs).
- ✓ Reduction of need of risk management measures and related costs, including administrative burdens.
- ✓ Improve relations with workers, community, consumers
- ✓ Improve corporate image
- ✓ Comply with legal obligations

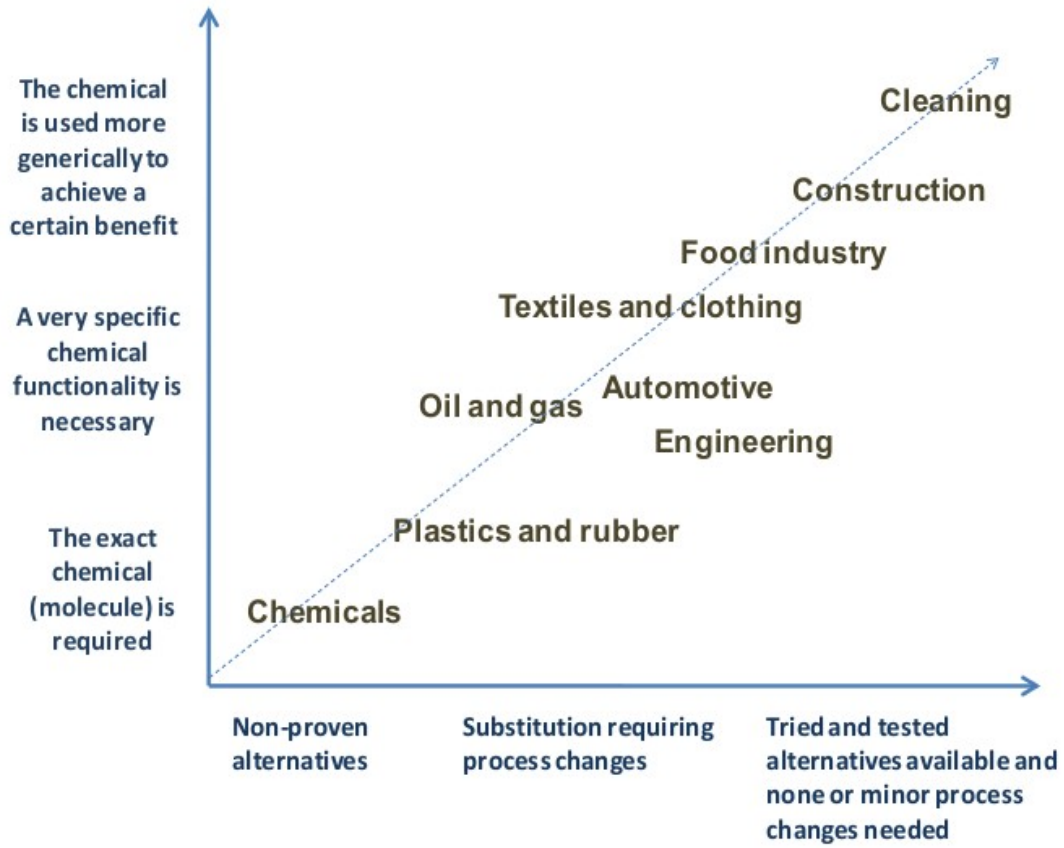


Figure 19: Substitution complexity as a function of alternatives and chemical requirements. Complexity decreases in the direction of the dotted arrow

DG Employment. Minimising chemical risk to workers' health and safety through substitution. Luxembourg: Publications Office of the European Union, 2012

Initiatives: intergovernmental and governmental

EUROPEAN UNION LEGISLATION

1. REACH Regulation
2. CLP Regulation
3. EU POP Regulation
4. Water Framework Directive
5. VOC Solvents Directive
6. Chemical Agents Directive
7. Carcinogens and Mutagens Directive
8. RoHS Directive
9. End-of Life Vehicles Directive
10. Biocides Directive
11. Batteries and Accumulators Directive
12. IPPC Directive
13. Directive on General Product Safety

INTERNATIONAL AGREEMENTS

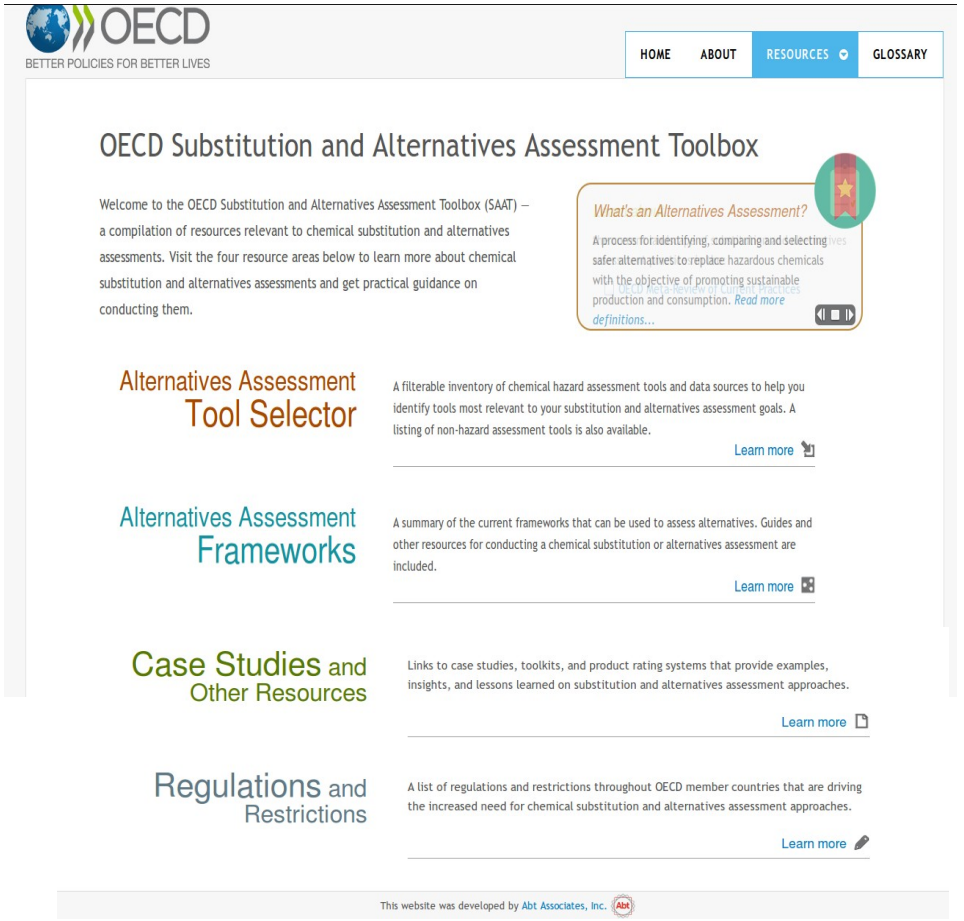
14. Stockholm Convention on Persistent Organic Pollutants (POPs)
15. OSPAR Convention
16. Convention on Long-range Transboundary Air Pollution, the Geneva Protocol on VOC
17. Montreal Protocol on Ozone Depleating Substances – ODS
18. Rotterdam Convention On the Prior Informed Consent Procedure
19. Agenda 21
20. Aarhus Protocol on heavy metals
21. Aarhus Protocol on Persistent Organic Polutants (POPs)

USA

22. U.S. Clean Air Act – Hazardous Air Pollutants
23. Massachusetts Toxic Use Reduction Act (TURA)
24. Michigan Executive Directive – Promotion of Green Chemistry
25. Illinois Toxic Chemical Safety Act
26. U.S. Battery Act

CHINA

27. Chinese Law on Promotion of Clean Production
28. Chinese RoHS



Initiatives: academia, technical institutes

International Symposium on Alternatives Assessment

Advancing Science & Practice

NATCHER CONFERENCE CENTER | BETHESDA, MD | MARCH 5–6, 2015

Organized by The Lowell Center for Sustainable Production at University of Massachusetts Lowell

HOME | ABOUT | PROGRAM | SPEAKERS | VENUE

About the Symposium

Symposium

The field of alternatives assessment has grown significantly over the last decade because of increasing regulatory, marketplace and consumer demands to substitute chemicals of concern in consumer products and manufacturing processes.

This two-day international symposium will provide a collegial forum for governmental agency staff, university researchers, industry sustainability professionals, advocates and others to:

- **Understand gaps in knowledge and methods** confronting the use of alternatives assessment.
- **Identify elements of a research agenda** for alternatives assessment and a process for moving it forward.
- **Advance and support** the growing community of practice for alternatives assessment.

Symposium Planning Committee

- **April Bennett**, National Institute of Environmental Health Sciences
- **Ann Blake**, Environmental and Public Health Consulting
- **Sally Edwards**, University of Massachusetts Lowell, Lowell Center for Sustainable Production
- **Pam Eliason**, Massachusetts Toxics Use Reduction Institute
- **Molly Jacobs**, University of Massachusetts Lowell, Lowell Center for Sustainable Production
- **Tim Malloy**, University of California Los Angeles, Sustainable Technology Policy Program, School of Law & School of Public Health
- **Ray Lizotte**, Schneider Electric
- **Mark Rossi**, Clean Production Action
- **Alex Stone**, Washington State Departmen
- **Joel Tickner**, University of Massachusetts
- **Christopher Weis**, National Institute of E
- **Meg Whittaker**, ToxServices
- **Martin Wolf**, Seventh Generation

Symposium Organizers

The University of Massachusetts Lowell, Lowell Center for Sustainable Production organized this conference with the help of our organizational financial sponsors and dedicated symposium planning committee:

Financial Sponsors

TOXSERVICES

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Toxics Use Reduction Institute

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skills and capacity of managers,
e mission of TURI's educational
ome Massachusetts-certified Toxics
continuing education. >>

Upcoming Events

February 24, 2015
Beyond the MSDS: A Workshop on Finding Information to Inform Decision Making About Chemical Hazards >>

February 27, 2015
WEBINAR: Identifying Safer Solvents Using Hansen Solubility Parameters >>

March 10, 2015
WEBINAR: Identifying Safer Solvents Using Hansen Solubility Parameters >>

March 26, 2015
Environmental Management Systems Training >>

April 09, 2015
TURA Continuing Education Conference >>

May 12, 2015
OSHA Update >>

View All Events >>

>> In the News

Premier Cleaner of Westford Demonstrates Professional Wet

TURI 25th Anniversary

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Home » Training Manual

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- Introduction
- Module 1: Definition and Benefits
- Module 2: Soil Fertility Management
- Module 4: Pest, Disease and Weed Management
- Module 5: Animal Husbandry
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- Module 7: Marketing and Trade
- Module 8: Conversion to Organic Farming
- Module 9: Crop Management
- Module 10: Animal Species
- Swahili Module 2: Usimamizi wa rutuba ya udongo
- Swahili Module 4: Wadudu,magonjwa na magugu
- Swahili Module 9: Kupanda

African Organic Agriculture Training Manual

The African Organic Agriculture Training Manual aims at delivering best farming practices to farmers, farmer groups, extension workers and trainers in Africa. The version presented on this website is an initial step towards a comprehensive collection of training materials to promote organic and other sustainable farming practices in Africa. The aim is to continually add new materials and further improve their content. It is also planned to gradually add translations in Swahili and French.

About the project

English Edition

Introduction
Module 1: Definition and Benefits
Module 2: Soil Fertility Management
Module 4: Pest, Disease and Weed Management
Module 5: Animal Husbandry
Module 6: Farm Management
Module 7: Marketing and Trade
Module 8: Conversion to Organic Farming
Module 9: Crop Management
Module 10: Animal Species

Swahili Translations

Module 2: Usimamizi wa rutuba ya udongo

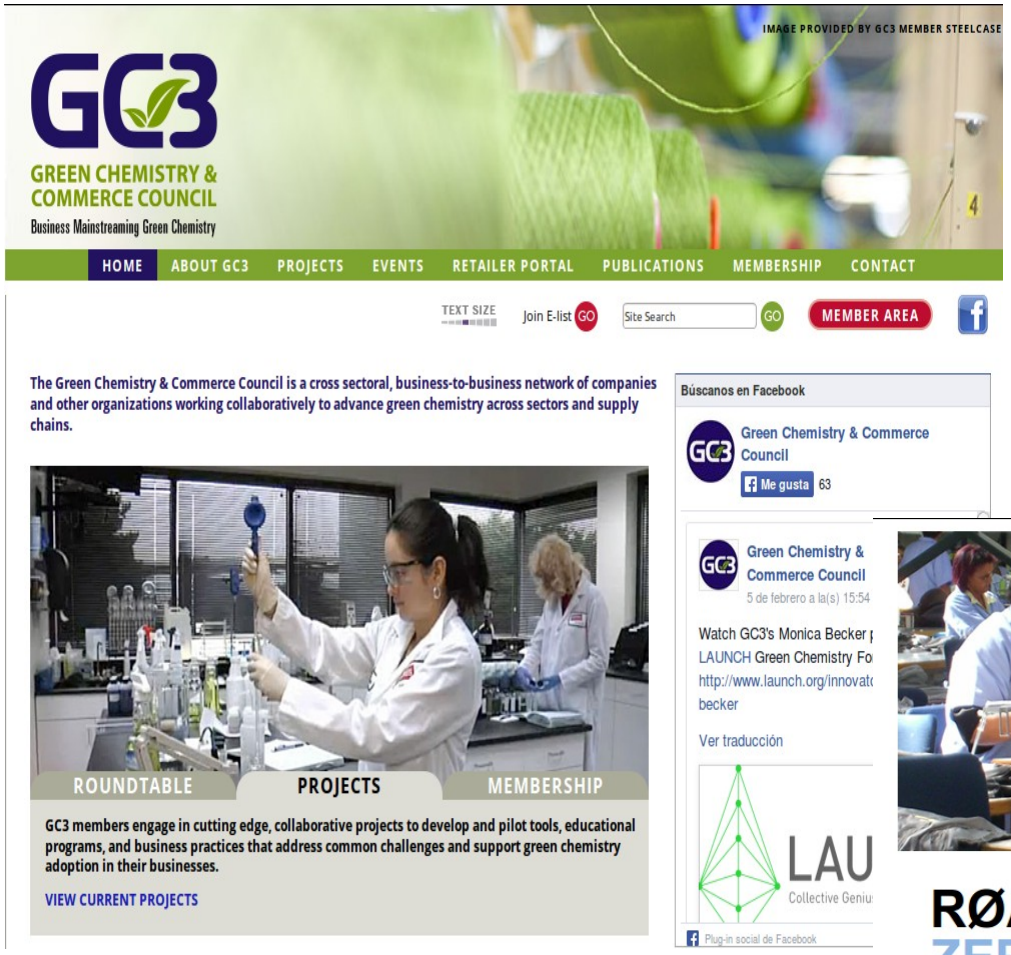
Contribute to the validation process!

Help improve the draft version of the training materials by testing them in your local context and giving us your feedback.
Further information

Organisations presently validating the training manual

> Agro Eco Louis Bolk Institute - Eastern Africa, Uganda
> Uganda Coffee Development Authority
> CARITAS Uganda
> Rural Community in Development (RUCID), Uganda
> Sustainable Agriculture Trainers network (SATNET), Uganda
> National Organic Agricultural Movement of Uganda (NOGAMU)
> National Union of Coffee Agribusinesses and Farm Enterprises (NUCAFE), Uganda
> International Centre of Insect Physiology

Initiatives: companies



RØADMAP TO ZERO DISCHARGE OF HAZARDOUS CHEMICALS

ZDHC Group Releases Key Milestone: Manufacturing Restricted Substances List (MRSL)

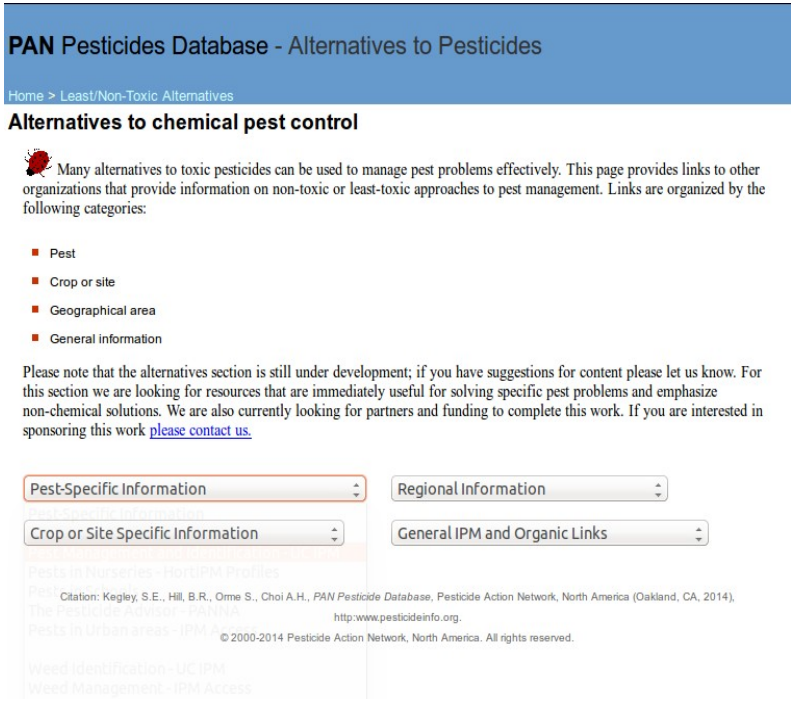
ZDHC Guidance Sheets Released forEleven MRSL-restricted Chemicals

ABOUT ZDHC

JOINT ROADMAP

NEWS BULLETIN

Initiatives: NGOs



Initiatives: www.subsport.eu

SUBS PORT
Substitution Support Portal

MOVING TOWARDS SAFER ALTERNATIVES

- Home
- News
- Newsletter
- About the Portal
- Substitution Steps
- Substitution in Legislation
- Identifying Substances of Concern
- Restricted and Priority Substances Database
- Case Story Database
- Substitution Tools
- Training
- Forum

Support for Substitution

Substitution of hazardous chemicals is a fundamental measure to reduce risks to environment, workers, consumers and public health.

Legislation encourages you to substitute, this site will show you how.

Read more

Latest News

Alternatives Identification and Assessment Training for BSI members

Events & Training | 12.01.2015

As a part of the SUBSPORT Textile project, Kooperationsstelle Hamburg and the Association of the German Sporting Goods Industry (BSI) carried out a training/seminar in Bonn in December 2014. The search for substitutes for hazardous substances and the assessment of alternative substances are key steps of a substitution process and were in the focus of this seminar.

Read more

Substitution Steps

Substitution may be fast and easy or a more complex process. Generally it includes the following steps:

1. Define the problem
2. Set substitution criteria
3. Search for alternatives
4. Assess and compare alternatives
5. Experiment on pilot
6. Implement and improve

Read more

Search SUBSPORT

- Website
- Restricted and priority substances database » link
- Case story database » link

Search » Overview

External substitution websites and databases

Search

Your contribution

Provide substitution examples
Provide feedback

Training

Governments role?

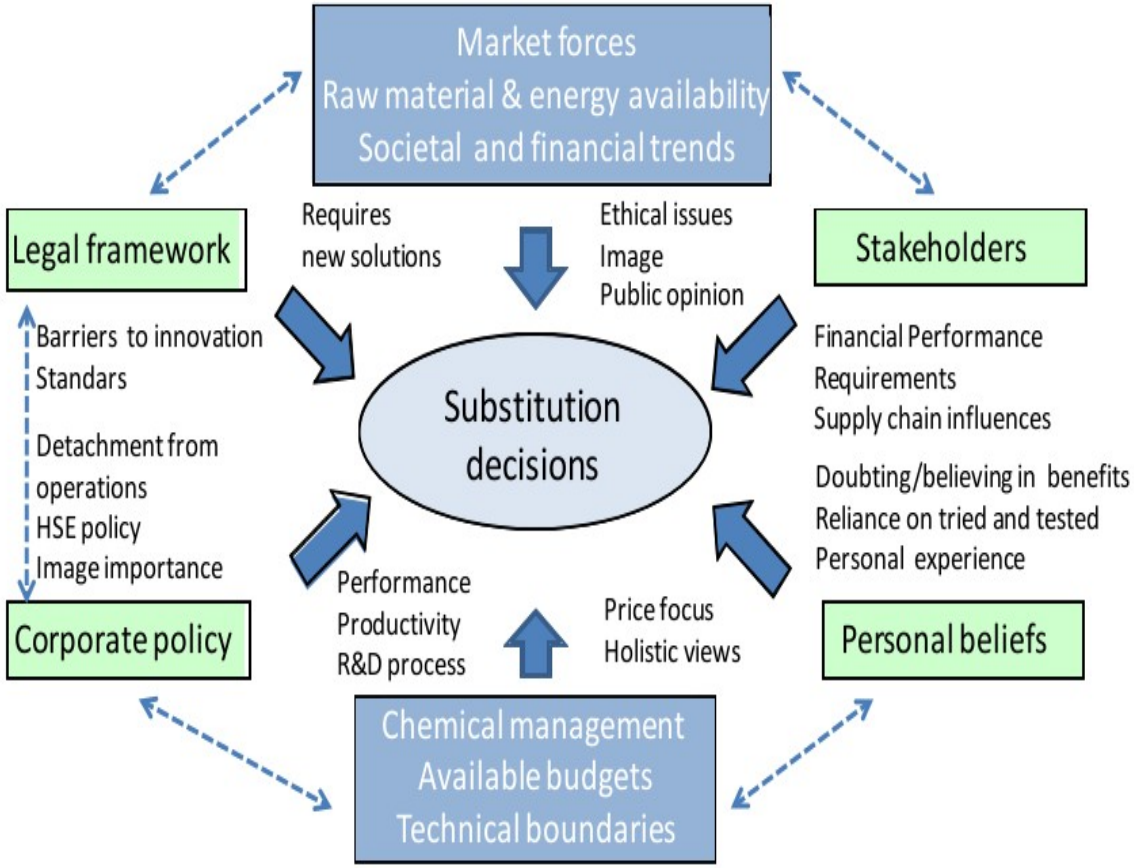


Figure 11: Drivers and barriers to substitution

DG Employment. Minimising chemical risk to workers' health and safety through substitution. Luxembourg: Publications Office of the European Union, 2012

Governments role?

6.1.2 The role of authorities

Authorities are seen as having a dual role in promoting chemical risk management. Firstly, they **create the boundaries of acceptable operations** through defining the legal requirements. At the same time, authorities interpret the legal text and define how enforcement and monitoring is taking place as well as execute enforcement. Secondly, authorities are viewed as a **significant source of knowledge** and are expected to provide guidance for how to best achieve risk reduction. Despite this, a common finding was that there is much to be done in enforcement of legislation and in information provision.

DG Employment. Minimising chemical risk to workers' health and safety through substitution. Luxembourg: Publications Office of the European Union, 2012

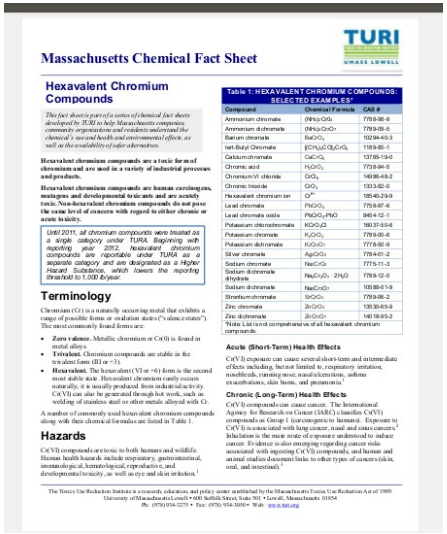
Governments role: INFORMATION

ON:

- ✓ Hazards and risks
- ✓ Alternatives
- ✓ Economic benefits
- ✓ Substitution process
- ✓ Methodologies ...

Through:

- ✓ Leaflets
- ✓ Workshops
- ✓ Pilot projects ...



Massachusetts Chemical Fact Sheet

TURI
UMASS LOWELL

Hexavalent Chromium Compounds

This fact sheet is part of a series of chemical fact sheets developed by TURI to help Massachusetts companies, community organizations and residents understand the chemical's use and health and environmental effects, as well as the availability of safer alternatives.

Hexavalent chromium compounds are a toxic form of chromium and are used in a variety of industrial processes and products.

Hexavalent chromium compounds are human carcinogens, mutagens and developmental toxicants and are acutely toxic. Non-hexavalent chromium compounds do not pose the same level of concern with regard to either chronic or acute toxicity.

Until 2011, all chromium compounds were treated as a single category under TURA. Beginning with reporting year 2012, hexavalent chromium compounds are reportable under TURA as a separate category and are designated as a Higher Hazard Substance, which lowers the reporting threshold to 1,000 lb/year.

Terminology

Chromium (Cr) is a naturally occurring metal that exhibits a range of possible forms or oxidation states ("valence states"). The most commonly found forms are:

- **Zero valence.** Metallic chromium or Cr(0) is found in metal alloys.
- **Trivalent.** Chromium compounds are stable in the trivalent form (III or +3).
- **Hexavalent.** The hexavalent (VI or +6) form is the second most stable state. Hexavalent chromium rarely occurs naturally; it is usually produced from industrial activity. Cr(VI) can also be generated through hot work, such as welding of stainless steel or other metals alloyed with Cr.

A number of commonly used hexavalent chromium compounds along with their chemical formula are listed in Table 1.

Hazards

Cr(VI) compounds are toxic to both humans and wildlife. Human health hazards include respiratory, gastrointestinal, immunological, hematological, reproductive, and developmental toxicity, as well as eye and skin irritation.[1]

Table 1: HEXAVALENT CHROMIUM COMPOUNDS: SELECTED EXAMPLES*

Compound	Chemical Formula	CAS #
Ammonium chromate	$(NH_4)_2CrO_4$	7788-98-9
Ammonium dichromate	$(NH_4)_2Cr_2O_7$	7789-09-5
Barium chromate	$BaCrO_4$	10294-40-3
tert-Butyl Chromate	$[(CH_3)_3C]_2O_2CrO_2$	1189-85-1
Calcium chromate	$CaCrO_4$	13765-19-0
Chromic acid	H_2CrO_4	7738-94-5
Chromium VI chloride	CrO_2Cl_2	14977-61-8
Chromic triazide	CrO_{12}	13343-82-7
Hexavalent chromium ion	Cr^{6+}	18540-29-9
Lead chromate	$PbCrO_4$	7758-97-6
Lead chromate oxide	$PbCrO_4 \cdot PbO$	846-4-12-1
Potassium chromochromate	$KCrO_3Cl$	16037-50-6
Potassium chromate	K_2CrO_4	7789-00-6
Potassium dichromate	$K_2Cr_2O_7$	7778-50-9
Silver chromate	Ag_2CrO_4	7784-01-2
Sodium chromate	Na_2CrO_4	7775-11-3
Sodium dichromate dihydrate	$Na_2Cr_2O_7 \cdot 2H_2O$	7789-12-0
Sodium dichromate	$Na_2Cr_2O_7$	10588-01-9
Strontium chromate	$SrCrO_4$	7789-06-2
Zinc chromate	$ZnCrO_4$	13530-65-9
Zinc dichromate	$ZnCr_2O_7$	14018-95-2

*Note: List is not comprehensive of all hexavalent chromium compounds.

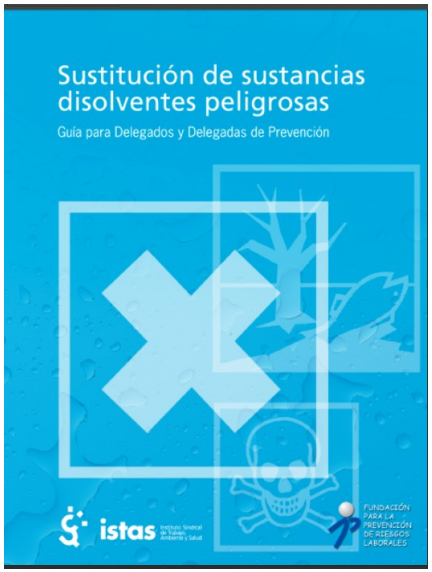
Acute (Short-Term) Health Effects

Cr(VI) exposure can cause several short-term and intermediate effects including, but not limited to, respiratory irritation, nosebleeds, running nose, nasal ulcerations, asthma exacerbations, skin burns, and pneumonia.[1]

Chronic (Long-Term) Health Effects

Cr(VI) compounds can cause cancer. The International Agency for Research on Cancer (IARC) classifies Cr(VI) compounds as Group 1 (carcinogenic to humans). Exposure to Cr(VI) is associated with lung cancer, nasal and sinus cancers.[2] Inhalation is the main route of exposure understood to induce cancer. Evidence is also emerging regarding cancer risks associated with ingesting Cr(VI) compounds, and human and animal studies document links to other types of cancers (skin, oral, and intestinal).[3]

The Toxics Use Reduction Institute is a research, education, and policy center established by the Massachusetts Toxics Use Reduction Act of 1989.
University of Massachusetts Lowell • 600 Suffolk Street, Suite 501 • Lowell, Massachusetts 01854
Ph. (978) 934-3275 • Fax: (978) 934-3050• Web: www.turi.org



Governments role: TECHNICAL ASSISTANCE

Clean Production centers

Technical institutes:
TURI(US), KEMI (Sweden),

Academia

Business associations/ industrial sectors

NGOs

Governments role: LEGISLATION

Substitution obligations: EU CMR, EU REACH,

TUR planning obligations: TURA, OSH legislation

Substance restrictions: WEE, toys, cosmetics …

Emission restrictions: water, air, waste …

Green chemistry incentives

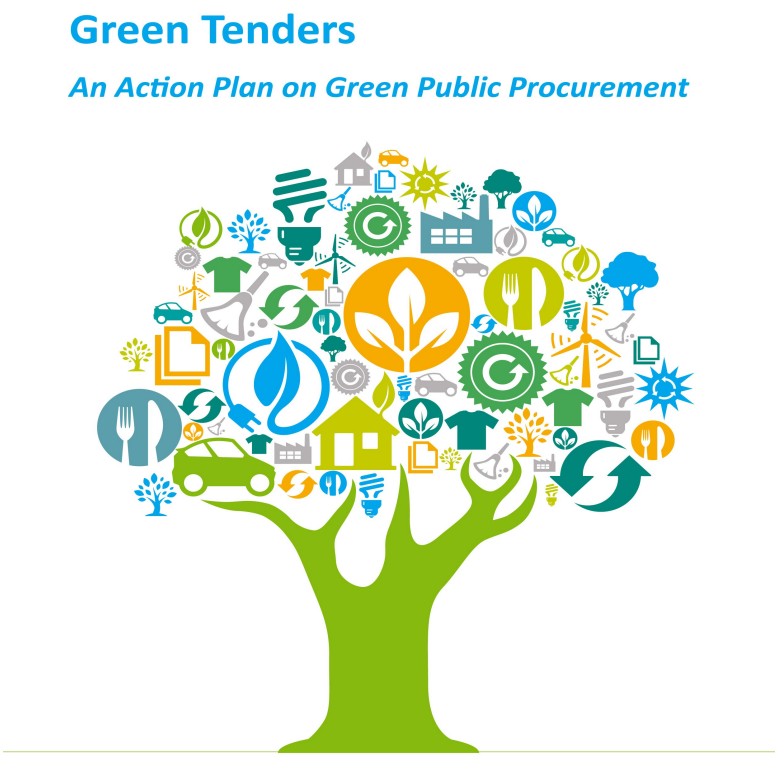
Governments role: ECONOMIC INCENTIVES

Fees: TURA Massachusetts

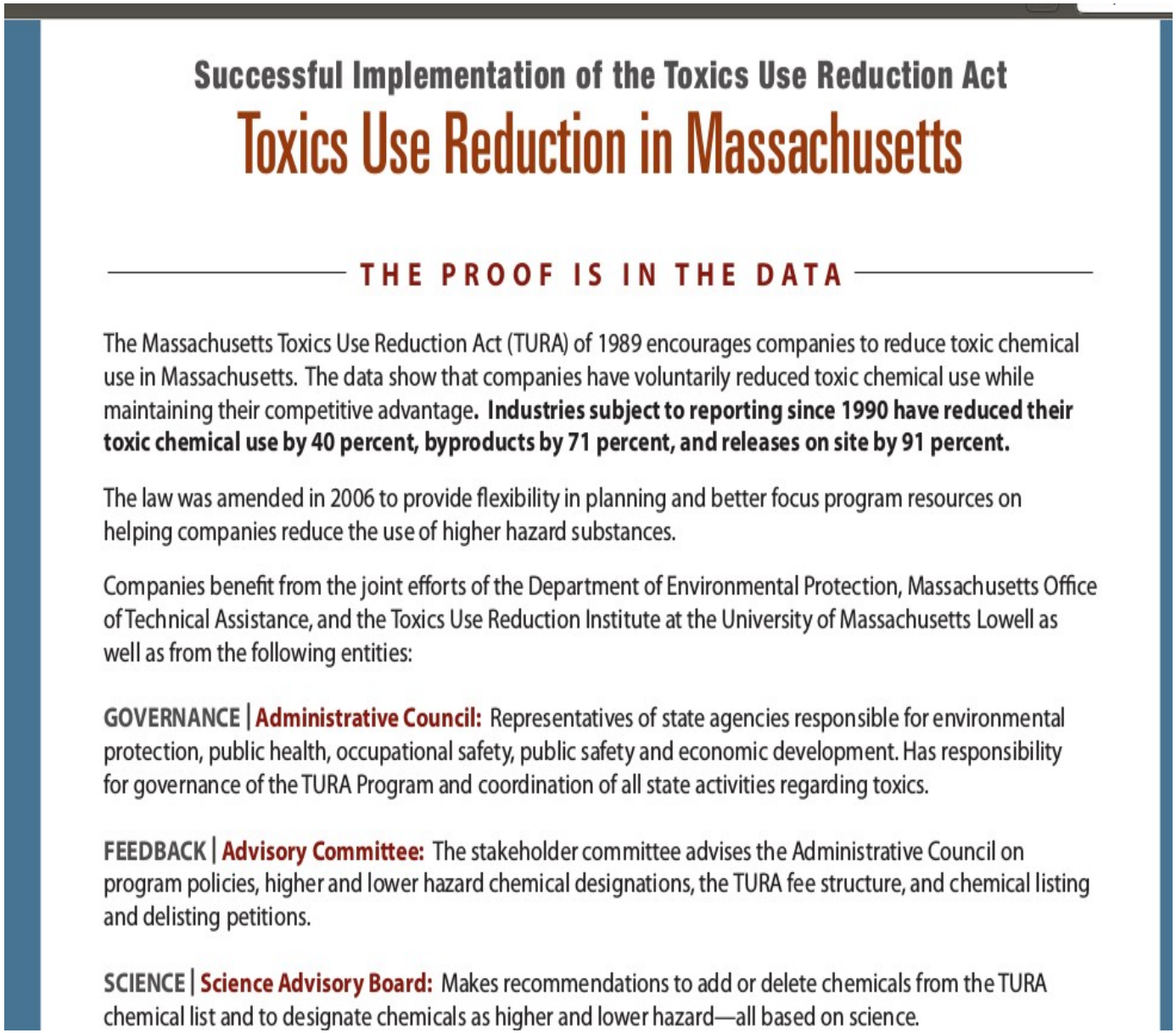
Financial support

Grants/ Subsidies

Public procurement



Substitution pays off!



Successful Implementation of the Toxics Use Reduction Act

Toxics Use Reduction in Massachusetts

THE PROOF IS IN THE DATA

The Massachusetts Toxics Use Reduction Act (TURA) of 1989 encourages companies to reduce toxic chemical use in Massachusetts. The data show that companies have voluntarily reduced toxic chemical use while maintaining their competitive advantage. **Industries subject to reporting since 1990 have reduced their toxic chemical use by 40 percent, byproducts by 71 percent, and releases on site by 91 percent.**

The law was amended in 2006 to provide flexibility in planning and better focus program resources on helping companies reduce the use of higher hazard substances.

Companies benefit from the joint efforts of the Department of Environmental Protection, Massachusetts Office of Technical Assistance, and the Toxics Use Reduction Institute at the University of Massachusetts Lowell as well as from the following entities:

GOVERNANCE | **Administrative Council:** Representatives of state agencies responsible for environmental protection, public health, occupational safety, public safety and economic development. Has responsibility for governance of the TURA Program and coordination of all state activities regarding toxics.

FEEDBACK | **Advisory Committee:** The stakeholder committee advises the Administrative Council on program policies, higher and lower hazard chemical designations, the TURA fee structure, and chemical listing and delisting petitions.

SCIENCE | **Science Advisory Board:** Makes recommendations to add or delete chemicals from the TURA chemical list and to designate chemicals as higher and lower hazard—all based on science.

Basel Convention

Rotterdam Convention

Stockholm Convention

Regional Activity Centre for Sustainable Consumption and Production

Thank you!

Dolores Romano Mozo

Chemical risk prevention

dromanot@gmail.com

istas CCOO

Technical support