



Asthma-Related Chemicals in Massachusetts: an Analysis of Toxics Use Reduction Act Data

Toxics Use Reduction Institute's Sustainability
Research Fellows Program FY 08

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Outline

- Asthma prevention through toxics use reduction: policy context
- TURA analysis: methods, findings & recommendations



Asthma in MA & its Causes

- Massachusetts: among highest rates of asthma*
 - 10.3% children with current asthma
 - 40.5% are not well controlled (symptoms in the past 30 days)
 - 37.8% missed one or more days of school or daycare due to their asthma in the last year.
 - 9.9% MA adults with current asthma
 - 67.5% are not well controlled (symptoms in the past 30 days)
- Hundreds of environmental causes/triggers play a role
 - Complex etiology

*Source: Massachusetts Department of Public Health, Asthma Prevention and Control Program. Burden of Asthma in Massachusetts. April 2007



Asthma Impacts Employers

- 6.2% of current adults cases are work related; individuals:
 - 4.8 times as likely to report an asthma attack
 - 4.8 times as likely to visit the ER at least once
 - 2.5 times as likely to visit the doctor for worsening asthma at least once
- 4th leading cause of work absenteeism and 7th leading cause of presenteeism (lost work productivity due to illness)
 - Costs associated with asthma presenteeism significant: 72.5% of total asthma costs



Chemicals: Causes of initial onset & Exacerbation of Asthma

- Hundreds of chemicals found to initiate asthma in occupational settings
 - Some of these likely capable of initiating asthma in non-occupational settings
 - These same chemicals can also exacerbate existing asthma
 - Responses vary by individual
- Asthma prevention and control programs focus:
 - medications; some environmental trigger reduction
- Missed disease prevention opportunity:
 - promoting safer alternatives research & supporting technical assistance to industry



Primary Research Objective for TURA Data Analysis

- To understand trends associated with the use and release of asthma-related chemicals by industries reporting to TURA
 - *Using hazard surveillance to help target programmatic and policy activities*
 - *What this is not: an etiologic study*



Methods

- Stage 1: develop “master” list of asthma-related chemicals
 - Cross-reference list with TURA reportable chemicals
- Stage 2: examine trends in TURA data (use and release of asthma-related chemicals)
- Stage 3: consider MDPH’s work-related & pediatric asthma surveillance data in the context of TURA data



Stage 1: Master List Development

1. **Association of Occupational and Environmental Clinics (AOEC)** Occupational agents shown to cause asthma (de novo).
2. **Collaborative on Health and the Environment (CHE)** Comprehensive literature review to rank strength of evidence
 - Includes home, work and intrauterine environment
 - NOTE: chemicals ranked as “limited” excluded from our analysis
3. **Institute of Medicine (IOM)** Evidence associated with IAQ and asthma onset and exacerbation in non-occupational environments.
4. **Malo and Chan-Yeung** comprehensive literature review in Bernstein’s 2006 edition of *Asthma in the Workplace*



Stage 1 Results: “Master List” of Asthma-Related Chemicals

- 335* agents/non-specific categories
- ~150* chemicals that can cause and/or exacerbate asthma
 - 68 on TURA List
 - 41 on TURA List-reported
 - 15 on More Hazardous TURA Chemical List

**mix of individual chemicals & classes: difficult to get an exact #*



Asthma-Related Chemicals on TURA More Hazardous Chemicals List

- Benzene (*evidence limited*)
- Chlorine
- Chloroform (*evidence limited*)
- Chromic Acid
- Chromium Compounds
- Dibromochloropropane (*evidence limited*)
- Ethylene Oxide
- Formaldehyde
- Hydrazine
- Methylene diisocyanate
- Nickel compounds
- Phenols (NOS)
- Phosgene
- Sulfuric Acid (and sulfuric acid fuming)
- Toluene diisocyanate

Asthma was not a criteria the TURA SAB considered for recommending that a chemical from the "more hazardous" list be reviewed for a "higher hazard" designation.

This policy is evolving.



Synthetic Chemicals not on TURA List

- ~100 chemicals that can cause/or exacerbate asthma that are not reportable under TURA
- Examples:
 - Chloramine T
 - Quaternary Ammonium Compounds
 - Glutaraldehyde
 - Methyl 2-cyanoacrylate



Stage 2: Trend Analysis of Asthma-Related Chemicals Reported to TURA

- Total use and air releases, 1990-2005 by:
 - Specific chemical
 - Year
 - City/town
- Use: (potential worker/community exposures)
- Fugitive Air Releases (potential worker exposures)
- Point Air Releases (potential community exposures)



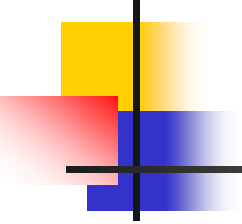
Asthma-Related Chemicals: TURA Program Trends 1990-2005

- **Total Use: 27% decline**
 - Excluding styrene: declined 18%
 - TDI on the rise in MA: use increased 62%
- **Fugitive Air Releases: 82% decline**
- **Point Source Air Releases: 71% decline
(1991-2005)**



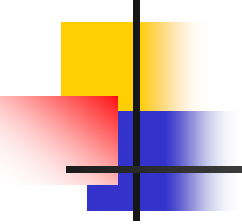
Top 10: Cumulative Use (lbs) 1990-2005

1. Styrene (5.3 billion)
2. Sulfuric Acid (769 million)
3. Zinc/zinc compounds (277 million)
4. Ammonia (244 million)
5. Diisocyanates (232 million)
6. Chromium/Chromium compounds (150 million)
7. Phthalic Anhydride (139 million)
8. Acetic Acid (120 million)
9. Formaldehyde (106 million)
10. Chlorine (85 Million)



Top 10: Cumulative Fugitive Air Releases (lbs) 1990-2005

1. Ammonia (1.8 million)
2. Sulfuric acid (664,000)
3. Acetic acid (565,000)
4. Styrene (327,000)
5. Nitrogen dioxide (103,000)
6. Formaldehyde (86,000)
7. Zinc/zinc compounds (52,000)
8. Chromium/chromium compounds (40,000)
9. Nickel/nickel compounds (31,000)
10. Diethylhexylphthalate (24,000)



Top 10: Cumulative Air Point Source Releases (lbs) 1990-2005

1. Sulfuric acid (17.8 million)
2. Ammonia (9 million)
3. Formaldehyde (1.4 million)
4. Acetic acid (1.1 million)
5. Styrene (567,000)
6. Nitrogen dioxide (527,000)
7. Zinc/zinc compounds (107,000)
8. Acetaldehyde (102,000)
9. Chlorine (88,000)
10. Diethylhexylphthalate (61,000)

Stage 3 Findings: Chemicals Reportable under TURA Have Been Associated with Cases of Work-Related Asthma

- MA physicians & other health care providers required to report confirmed and suspected cases of work-related asthma (WRA) to MDPH's Sentinel Event Notification System for Occupational Risk (SENSOR)
- WRA cases are occurring from chemicals reportable under TURA

Top 15 Agents/Chemicals
Indoor Air Pollutants
Cleaning Products
Minerals & Inorganic Dusts
Chemical, NOS
Molds
Solvents
Products of Combustion
Latex
Isocyanates
Paints & Lacquers
Acids & Bases
Metals
Formaldehyde
Polymers
Welding Fumes

Source: MDPH. SENSOR Occupational Lung Disease Bulletin, July 2007



Findings: Sectors with Majority of Work-Related Asthma in MA is within the Health Care Industry

- Service Industry: 52.8%
 - Health care: 28.6%
 - Educational services: 13.1%
 - All other: 11.1%
- Manufacturing: 23.7%

Need to share lessons learned with industries not directly involved with TUR planning



TURA and MDPH's Pediatric Asthma Surveillance Data

- Asthma prevalence data reported on children grades K-8 to MDPH by every public, charter or private school in MA
- Patterns between use or release of asthma related chemicals & school-based asthma prevalence in MA?
 - Our analysis insufficient to document or rule out an association.



Wrap-up: Report recommendations relevant to TUR planners

- Share TUR lessons-learned with industry sectors that do not report under TURA, especially health care
- Continue policy, research and technical assistance to promote safer alternatives to asthma-related chemicals



Toxic Use Reduction: A Crucial Disease Prevention Strategy

Hierarchy of Controls

1 Source	2 Path	3 Person
Substitution	Local exhaust ventilation	PPE
Engineering and Maintenance	Housekeeping	Administrative controls
Enclosure		