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Preventing Toxic Exposures

Workplace Lessons In Safer Alternatives

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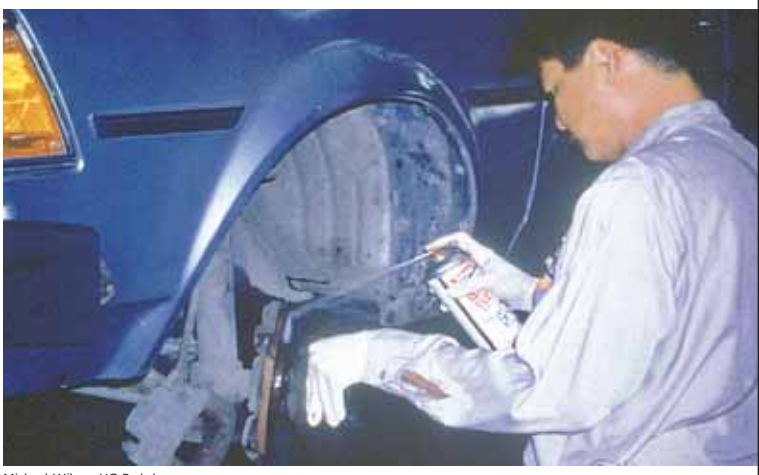
Luis, an auto mechanic in his 20s, gradually noticed that his hands and feet tingled and felt numb. His symptoms got worse over the following months, spreading up his arms and legs and into his torso. He was examined by a doctor of occupational medicine, who suspected that Luis had nerve damage caused by exposure to chemicals he used at work.

Every day for nearly two years, Luis had used up to nine spray cans of a brake cleaner. Further investigation showed that the product he used contained 50–60% n-hexane, a chemical known since 1964 to cause nerve damage.

Luis's doctor reported his case to the California Department of Public Health (CDPH). Occupational health specialists there investigated the possibility that other auto mechanics had suffered nerve damage. They studied a large auto dealership and surveyed California neurologists, and quickly found two similar cases.

CDPH developed diagnosis and treatment guidelines for physicians and issued a health hazard advisory to alert workers and employers in the vehicle repair industry about the hazards of n-hexane. CDPH staff also began working with the Institute for Research and Technical Assistance (IRTA) and businesses to develop and test safer, water-based aerosol brake cleaners.

Why was a chemical known to be hazardous put into a brake cleaner used by workers and consumers?



Michael Wilson, UC Berkeley

An auto shop worker using an aerosol brake cleaner similar to the one that caused Luis's illness.

N-hexane was used to replace methylene chloride and other toxic chlorinated solvents. New environmental regulations to protect the public had been promoted to reduce solvents in the air and wastewater. However, manufacturers did not consider the health hazards of n-hexane, the substitute chemical—especially its effect on workers, who use it in much larger quantities than the average consumer. The larger problem is the lack of regulations that prohibit the use of toxic products and mandate the use of safer alternatives.

Luis's story demonstrates what can happen when we fail to include worker health in our efforts to protect the community and the environment from toxic chemicals.

> ***The workplace is the mother lode of all environmental contaminants and exposures…. Most of what leaches into our drinking water, contaminates our food and pollutes our air comes from workplaces, where it first damages workers.***
>
> —*Lisa Cullen, A Job to Die For*

US Laws Offer Little Protection

Over 85,000 industrial chemicals are on the US market today and 2,000 new ones are introduced each year. Large numbers of chemicals used in high volumes have not been adequately tested for safety, and US regulations require government agencies to prove that chemicals cause harm before taking action to protect health.

In 2005, the European Union adopted a comprehensive chemicals management policy called REACH—Registration, Evaluation, and Authorization of Chemicals—which requires businesses to show that the chemicals in their products and processes can be used safely, and stimulates research and development to replace hazardous chemicals with safer ones.

Key Features of REACH

- Regulates chemicals currently in use as well as new substances.
- Requires registration of all chemical substances produced or imported in quantities of 1 ton or more per company per year.
- Requires companies to provide information on the health and environmental effects of their chemical substances at time of registration.
- Provides for transfer of hazard information up and down the supply chain.
- Requires preauthorization for substances of very high concern and a plan to replace them with safer alternatives.

In the US, there is a growing recognition that our system to minimize chemical risks is seriously inadequate. People are increasingly concerned about health effects from toxic chemicals and are urging policymakers to take action to protect them. In response, states have introduced their own policies to protect the public.

For example, the 1989 Massachusetts Toxics Use Reduction Act (TURA) requires businesses to report the amount of toxic chemicals they use and prepare toxics use reduction plans; state technical experts are available to help identify safer alternatives.

In California, two "green chemistry" laws enacted in 2008 require the California Environmental Protection Agency to prioritize chemicals of concern in consumer products, evaluate alternatives, issue regulations to protect the public and the environment, and create a clearinghouse of information about toxic substances.

Legislation requiring a US chemicals management policy similar to REACH was recently introduced in Congress, but we are far from achieving a comprehensive policy. In the meantime, successful state and local efforts that promote safer alternatives to high-priority toxic chemicals should be supported and expanded. As Luis's story illustrates, as we move forward we must integrate workplace, community, and environmental concerns to ensure that all are protected and we do not shift harm from one group to another.

Workplace and Community Health Are Linked

Workers and community members use many of the same toxic chemicals in cleaners, adhesives, paint strippers, pesticides and other products. In addition, community exposures and environmental contamination frequently occur when chemicals are released during their manufacture and use in the workplace. The health hazards of these chemicals are often unappreciated until workers become ill and occupational health specialists investigate and identify the causes of their illness. These investigations of worker chemical exposure have led to actions that also protect the public at large. (See table.)

Some examples of chemicals identified as health hazards after workers got sick

Chemical	Worker Population	Health Outcome	Action Taken
Asbestos	Ship builders, construction workers	Lung cancer, mesothelioma	Reduced use; stricter regulation in workplace and community
Lead	Battery manufacturers, construction workers, radiator repair workers	High blood pressure, stroke, kidney or nerve damage, infertility	Banned from paint and gasoline; stricter regulation in workplace and homes
Dibromochloro propane (DBCP)	Pesticide manufacturers, farm workers	Sterility in men	Banned from use in US
Diacetyl in butter flavoring	Flavoring manufacturers, microwave popcorn production workers	Irreversible lung damage	Regulation under development

Despite the obvious connections between workplace and community chemical hazards, we tend to treat them as separate concerns rather than different aspects of the same problem. As a result, we often fail to consider the special circumstances of workers' chemical use: limited freedom to choose the products they use and much higher exposure over a working lifetime. By developing separate solutions, we also risk increasing hazards for one group while protecting another (as with Luis). And, importantly, we waste the rich knowledge and experience that workers, community members, and labor and environmental advocates can contribute to more holistic solutions.

Courtesy of Communities for a Better Environment

Upstream Solutions

The most effective way to protect workers and communities is to prevent exposure to chemicals in the first place by using safer alternatives and work processes. This is often called "upstream" prevention because it addresses the source or hazard before it causes health problems "downstream."

Occupational health professionals are trained to start by eliminating the hazards if possible when addressing harmful exposures. As a result, they have considerable real-world experience and a long history of practicing this approach. They are also accustomed to working collaboratively with business, workers, and labor unions, which can result in workable solutions that are embraced throughout an industry. Equally important, they recognize that workers have firsthand knowledge of work materials and processes and often have creative ideas about how to do a job differently to reduce the use of hazardous substances.

Community and environmental health professionals and advocates have a long track record in preventing pollution. They have led the fight to reduce hazardous waste and the release of hazardous substances into the air and water. Environmental regulations have spurred research and innovation in the development of safer alternatives. However, to be most effective, pollution prevention requires an integrated approach that incorporates the health and safety of workers.

The requisite knowledge and technologies exist to develop alternatives to many … chemical agents known or believed to cause or promote cancer.

—President's Cancer Panel 2008–2009 Report, Reducing Environmental Cancer Risk

Learn from Experience

A number of state and local initiatives have already led to solutions with far-reaching effects on worker health, the community, and the environment. The stories on these pages illustrate elements of successful projects:

- Public health experts identify a chemical hazard that should be eliminated based on toxicity data or illness tracking and investigation.
- Researchers from public health agencies, universities, or nongovernmental organizations (NGOs) collaborate with workers and businesses. They develop and try out alternatives—aiming for solutions that address effectiveness and cost concerns and do not introduce new hazards. They also consider changes in work processes, as well as chemical substitution.
- Workers and business owners are trained to understand the hazards of the current chemicals, how to use alternative products and processes, and are empowered to make improvements.
- Occupational and environmental health proponents collaborate, leading to more comprehensive solutions that protect workers and communities.
- Once an effective solution is identified, a broader effort, such as technical and financial assistance or regulation, follows to implement it throughout an industry.

Printing Press Cleanup Chemicals

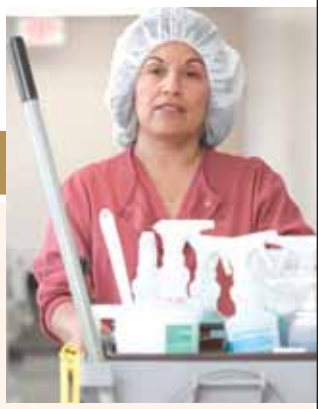
Lithographic printers use hazardous volatile organic compounds (VOCs) daily to hand-clean the ink on printing press cylinders. After IRTA developed and tested new low-VOC products that were less toxic to workers and better for the environment, California's South Coast Air Quality Management District passed regulations limiting VOCs in printing cleanup products. But elsewhere in California, printers continued to use toxic solvents because similar regulations were lacking.

A California Department of Public Health project involving workers, unions, printing shop owners, and local governments in the San Francisco Bay Area promoted awareness of less toxic alternatives that were effective, affordable, and acceptable to workers and printers.

CDPH found that printers were interested in using safer alternatives, but lacked the time or technical expertise to investigate and compare them. Occupational public health programs can provide this expertise to businesses and their workers so that use of safer alternatives spreads industrywide.

California Department of Public Health

Reducing Use of Hospital Disinfectants



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Hospital staff use substantial amounts of cleaning and disinfecting products. These products prevent infection, but are toxic and pollute water via the sewer system. The Sustainable Hospitals Program at the University of Massachusetts Lowell worked with a large hospital to test a change in cleaning process that uses smaller quantities of chemicals and water.

Researchers worked with hospital staff to compare new microfiber mops to the conventional cotton mops and obtained input from workers on their effectiveness. They also found ways to reduce the risk of wrist strain from using the new method. Staff preferred the microfiber mops because they were lighter. Researchers calculated that the cost of purchasing the microfiber mops would be offset by savings on water and chemicals.

This case illustrates the value of involving workers in evaluating alternative chemicals and technologies. It also shows the potential of including work process changes to minimize exposure to chemical hazards.

Much more work is needed. Yet efforts to develop safer alternatives are sporadic and grossly underfunded, and development of specialized expertise is lacking. The US Environmental Protection Agency (EPA) provides small grants to support pollution prevention, but the leading federal agency for workplace health—the National Institute for Occupational Safety and Health (NIOSH)—lacks funds to support practical research and collaboration on safer alternatives. Furthermore, there are few regulations or economic incentives that spur businesses to research alternatives.

Prescription for Change

Workers and communities need protection from harmful chemicals. Efforts have begun to promote essential changes to outdated and ineffective federal laws. To better integrate occupational and environmental health approaches and to foster increased use of safer alternatives at the state and local levels, we need to:

> ***Since TURA's passage in 1989, the Program has helped the state's largest toxics users reduce use by 40 percent, waste by 71 percent and on-site releases of toxic chemicals by 91 percent.***
>
> *—Philip Griffiths, Massachusetts Administrative Council on Toxics Use Reduction*

1. **Ensure that occupational health professionals have access to chemical use information in order to prioritize chemicals for the development of safer alternatives, pollution prevention efforts, and regulation.**

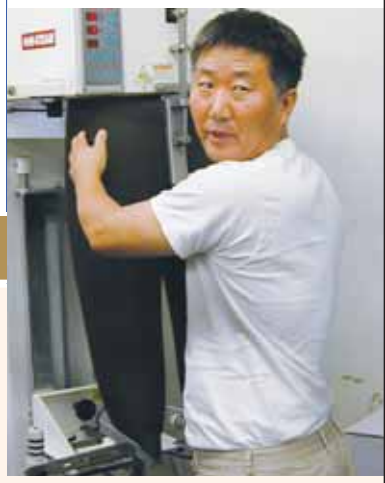
   Today it is not possible to determine how, where, by whom, and in what amounts toxic chemicals are being used. Without this information, government agencies and others cannot adequately prioritize chemicals of concern or provide early warning to workers, businesses, and communities when new hazards are identified.

Cleaning Products and Asthma

Asthma has increased at an alarming rate in the past decade. State public health department tracking systems have shown that work-related asthma associated with cleaning products is a significant problem; janitors and cleaners have nearly double the rate of asthma compared to the overall workforce. Finding safer cleaning products has become a priority for both worker and environmental health advocates, as anyone present may be affected by asthma-causing chemicals in indoor air.

State health department staff in Massachusetts and California participated in a nationwide process to revise the Green Seal™ GS-37 environmental standard for industrial and institutional cleaners. Occupational and environmental health advocates, as well as product manufacturers, were also involved. As a result, chemicals known to cause asthma are now prohibited from cleaning products certified under GS-37. When employers buy Green Seal products to protect their workers, all building occupants (such as students, teachers, nurses, and office employees) benefit. Efforts are now under way to encourage more institutions to change their policies to require the purchase of safer cleaning products.

Nontoxic Dry Cleaning



Dennis Shusterman, CDPH

The toxic solvent perchloroethylene (perc) is the most widely used dry cleaning agent. A demonstration project focusing on nontoxic alternatives being conducted by the Sustainable Technology & Policy Program at the University of California, Los Angeles has shown that professional "wet cleaning" (a water-based technology) is a viable, safer alternative to perc. Participating dry cleaners receive training in wet cleaning, technical assistance to select and install new equipment, and financial support to make the switch. The researchers found that professional wet cleaning cuts cleaners' operating costs and reduces energy use, while maintaining customer satisfaction.

This successful research was instrumental in decisions by the South Coast Air Quality Management District and the California Air Resources Board to phase out the use of perc in dry cleaning. It also prompted state legislation to provide a $10,000 incentive to dry cleaners to switch to nontoxic and smog-free technologies.

Access to this information could be provided in a variety of ways. Manufacturers could be required to provide government public health agencies a listing of purchasers of specific toxic chemicals or products on an as-needed basis. Alternatively, Massachusetts and the European Union require users of targeted toxic chemicals to register their use. States will need to explore the options and select the approach that works best for them.

We're a small company and don't have a lot of resources to do this work. Without a doubt, technical assistance to find safer chemicals and change some of our work processes has played a major role in keeping us in business.

—President, Massachusetts manufacturing company

2. Expand resources to support research into safer alternatives by health departments, NGOs, universities, and research institutes.

We need ongoing, dedicated funding for practical research to help industry shift to safer alternative chemicals and processes. Chemical user and polluter fees can be an effective source of funds to support these activities at the state level. Modest fees often provide significant revenues, and their use is well established and accepted when goals are clearly communicated.

In Massachusetts, companies that use chemicals pay a fee that funds the Toxics Use Reduction Institute. TURI provides training and technical assistance to help companies reduce their use of toxic chemicals and find safer alternatives. Federal funding through expanded grant programs run by the US EPA and NIOSH could support innovative and practical research by health departments, academic institutions, and others in collaboration with community, worker, and employer organizations. In addition to research funding, we need to develop economic and other incentives for businesses to participate in research.

3. Develop regulations that drive innovation and require the adoption of safer alternatives when available.

Regulation that restricts the use of a hazardous substance is one of the most effective drivers of safer alternatives development. Manufacturers who wish to maintain market share are motivated to reformulate their products to remove harmful chemicals. For example, California environmental regulations that lower VOCs have led to the development of alternatives that are safer for the environment and sometimes safer for human health.

Requiring the consideration of safer alternatives when setting a particular workplace chemical exposure limit may also lead to reformulation of products and adoption of safer alternatives. Current exposure limits are frequently a compromise between protecting worker health and feasibility of employer compliance. If alternatives exist, there is less pressure to set a compromise standard. Employers unable to meet low health-based exposure levels could switch to another safer chemical or product, thus creating a market for alternatives.

Once alternatives are developed, businesses should be required to use them or prove why their use is not feasible in a particular workplace or work process. Continued use of hazardous chemicals should not be accepted.

4. Ensure the integration of occupational health concerns into development of environmental chemical legislation and regulations.

We have a greater chance of developing solutions that do not shift risk from one group to another and are workable for business, labor, and workers if public health and environmental agencies jointly develop chemical legislation and regulations. Labor organizations must also be actively involved, as they give voice to workers' experiences and concerns. Funding is needed to support

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Trained workers can provide valuable input on safer job design.

meaningful collaboration by public health agencies and labor.

5. **Train workers and unions, and provide technical assistance to small and medium-size businesses about chemical hazards and safer alternatives.**

   Without training and technical assistance, business owners and workers will not be aware of the availability of safer alternatives for specific industrial operations. Effective training is needed to raise awareness of the hazards of current chemicals and the benefits of safer alternatives.

   Workers and unions also need training that empowers them to play a role in the development and implementation of safer alternatives and work processes. Most workers and many unions do not currently see themselves as playing this role. Without their active involvement we lose valuable experience and ideas for innovative solutions.

   Many organizations could develop curricula and provide training and technical assistance, including state and university occupational health programs and labor and business organizations. The National Institute of Environmental Health Sciences (NIEHS) Worker Education and Training Program funds labor unions and universities to develop green chemistry curricula for workers and train them about hazardous materials. Initiatives like this should be expanded.

6. **Train more occupational and environmental health professionals in pollution prevention, safer alternatives, and the integration of occupational and environmental health.**

   Expanded efforts to develop safer alternatives will create a demand for more occupational and environmental health professionals with expertise in this area. Degree programs for these professionals need to include more cross-disciplinary coursework in occupational and environmental health, engineering, and chemical processes. Training in collaborative and participatory research approaches is essential to success in this work as well.

   Professionals already in the field also need this training, which could be provided by academic institutions, occupational and environmental organizations, and state and local health departments. Education and training of professionals is essential for building the next generation with the skills to solve chemical exposure problems comprehensively.

Conclusion

A comprehensive federal chemicals management policy is needed to move us beyond our current regulatory framework—a reactive, chemical-by-chemical approach that permits chemicals to be used until there is sufficient evidence of harm. A proactive approach would identify toxic chemicals before they are used commercially and force the use of safer alternatives.

In the meantime, we should support and expand state and local efforts to implement safer alternatives and work processes. This will lead to better protection for workers, communities, and the environment in the immediate future and lay the groundwork for developing a comprehensive federal chemicals management policy.

By switching to safer products, it's better for the health of both my clients and workers. Our air quality has improved and I'm also saving money by using less solvent to wash the paint guns.

—Auto body shop owner

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To Learn More

Toxics Use Reduction Institute:
www.turi.org

Lowell Center for Sustainable Production, University of Massachusetts Lowell:
http://sustainableproduction.org

Lowell Center's database on US State Chemicals Policies:
www.chemicalspolicy.org/chemicalspolicy.us.state.database.php

UCLA Labor Occupational Safety and Health Program:
www.losh.ucla.edu

California Department of Public Health, Occupational Health Branch, Safer Alternatives:
www.cdph.ca.gov/programs/ohb/pages/SaferAlts.aspx

UC Berkeley Program in Green Chemistry and Chemicals Policy:
http://coeh.berkeley.edu/greenchemistry

UCLA Sustainable Technology & Policy Program:
www.stpp.ucla.edu

Institute for Research and Technical Assistance:
www.irta.us

References for this article are available on pp. 9–10 of the online version posted at:
http://healthresearchforaction.org/perspectives/preventing-toxic-exposures.pdf

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Health Research for Action is located in the UC Berkeley School of Public Health. Our mission is to conduct research and translate findings from that research into policies, resources, and programs that reduce health disparities and create healthier, more empowered communities. All of our work is conducted in partnership with the people living in these communities.

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References

California, Air Resources Board. Non-Toxic Dry Cleaning Incentive Program (AB998). Accessed at www.arb.ca.gov/toxics/dryclean/ab998.htm.

California, Department of Health Services (now the Department of Public Health) and Department of Industrial Relations, Hazard Evaluation System and Information Service (HESIS) (2001). *Health Hazard Advisory: n-Hexane Use in Vehicle Repair*. Richmond, Calif. June. Accessed at www.cdph.ca.gov/programs/hesis/Documents/nhexane.pdf.

California, Department of Toxic Substances Control. Website, Emerging Chemicals of Concern. Accessed at www.dtsc.ca.gov/AssessingRisk/EmergingContaminants.cfm.

Centers for Disease Control and Prevention. N-Hexane-related neuropathy among automotive technicians—California, 1999-2000. *MMWR Weekly*, November 16, 2001, 50(45): 1011-3. Accessed at www.cdc.gov/mmwr/preview/mmwrhtml/mm5045a3.htm.

Cullen, Lisa (2002). A Job To Die For: *Why So Many Americans Are Killed, Injured or Made Ill at Work and What to Do About It*. Monroe, Maine: Common Courage Press.

Green Seal™ Standard for Industrial and Institutional Cleaners – GS-37. Accessed at www.greenseal.org/certification/gs37_iicleaners.cfm.

Massachusetts, Administrative Council on Toxics Use Reduction (2008). Toxics Use Reduction in Massachusetts: A Progress Report to the Governor from the Administrative Council on Toxics Use Reduction. Boston: November 25. Accessed at http://170.63.97.68/Eoeea/docs/eea/ota/tur_prog/2008_tura_program_to_governor.pdf.

Morris M, Wolf K (2006). Assessment, Development and Demonstration of Low-VOC Materials for Cleaning of Lithographic Printing Ink Application Equipment. Prepared for South Coast Air Quality Management District. Glendale, Calif.: Institute for Research and Technical Assistance. May. Accessed at www.irta.us/Litho06.pdf.

Quinn MM et al. (2006). Pollution prevention—occupational safety and health in hospitals: Alternatives and interventions. *Journal of Occupational and Environmental Hygiene* 3(4): 182–193 (April). DOI: 10.1080/15459620600584295.

Rosenman KD et al. (2003). Cleaning products and work-related asthma. *Journal of Occupational and Environmental Medicine* 45(5): 556–558 (May). Accessed at www.cdph.ca.gov/programs/ohsep/Documents/cleaningproducts.pdf.

Sinsheimer P et al. (2007). The viability of professional wet cleaning as a pollution prevention alternative to perchloroethylene dry cleaning. *Journal of the Air & Waste Management Association* 57(2): 172–178 (February).

South Coast Air Quality Management District. Financial Incentive Grant Program To Assist Dry Cleaners To Purchase Non-Perc Alternative Technologies. Accessed at www.aqmd.gov/business/drycleaninggrantsNEW.htm.

Sutton P, Wolf K, Quint J (2009). Implementing safer alternatives to lithographic cleanup solvents to protect the health of workers and the environment. *Journal of Occupational and Environmental Hygiene* 6(3): 174–187. DOI: 10.1080/15459620802705524.

Tickner J (2008). *Options for State Chemicals Policy Reform: A Resource Guide*. Lowell: University of Massachusetts Lowell, Lowell Center for Sustainable Production. Accessed at http://sustainableproduction.org/downloads/OptionsforStateChemicalsPolicyReform.pdf.

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US Department of Health and Human Services, National Cancer Insitute (2010). Reducing Environmental Cancer Risk: What We Can Do Now. Washington, DC: President's Cancer Panel 2008–2009 Annual Report. April. Accessed at http://deainfo.nci.nih.gov/advisory/pcp/pcp08-09rpt/PCP_Report_08-09_508.pdf.

US Department of Health and Human Services, NIOSH (2008). Council of State and Territorial Epidemiologists. *Guidelines for Minimum and Comprehensive State-Based Public Health Activities in Occupational Safety and Health*. DHHS (NIOSH) Publication 2008-148 (September). Accessed at www.cdc.gov/niosh/docs/2008-148/pdfs/2008-148.pdf.

US General Accountability Office (2007). Chemical Regulation: Comparison of U.S. and Recently Enacted European Union Approaches to Protect against the Risks of Toxic Chemicals. Washington, DC: August, GAO-07-825. Accessed at www.gao.gov/new.items/d07825.pdf.

Wilson MP, Schwarzman MR (2009). Toward a new U.S. chemicals policy: Rebuilding the foundation to advance new science, green chemistry, and environmental health. *Environmental Health Perspectives* 117(8): 1202–1209. DOI:10.1289/ehp.0800404.

Zavadil J, Wolf K, Morris M (2004). Safer Alternatives to Solvent Aerosol Automotive Cleaning Products. Glendale, Calif.: Institute for Research and Technical Assistance. December. Accessed at www.irta.us/Alternatives%20to%20Solvent%20Aerosol%20Automotive%20Cleaning.pdf.