

# LEADERSHIP IN SUSTAINABLE CHEMICALS POLICY: OPPORTUNITIES FOR OREGON



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June 2011

## EXECUTIVE SUMMARY

**Oregon is uniquely positioned to lead in the development of safer alternatives to toxic chemicals.**

Existing chemicals policy in the United States does not comprehensively protect human health or the environment from the potential impacts of chemical exposure. Very few of the 84,000 chemical substances produced, processed or imported for commercial purposes in the United States have been studied for health and environmental impacts.

The federal Environmental Protection Agency has access to only limited information about potential health or environmental hazards. Manufacturers have the right to withhold what they consider to be confidential business information. Because of this lack of information, in many instances it is impossible for the EPA to demonstrate that a chemical poses a risk. With this weak federal regulatory structure, industry has little incentive to develop safer alternatives.

Although legislation has been introduced in the U.S. House and Senate to strengthen the enforcement capacities of the 35-year-old Toxic Substances Control Act, progress in policy reform at the federal level is slow and thus far inadequate to protect human health and environmental quality. States

have a chance to lead the way to safer chemicals policy.

### GAPS IN OREGON'S POLICY

Oregon's regulation and monitoring of toxic chemicals are fragmented among seven agencies, with little coordination. The safety of consumer products is a particular concern, as state agencies lack essential information needed to scientifically assess potential hazard. State tracking of exposure to toxic chemicals in communities and the workplace is incomplete and largely unanalyzed, with little reliable data about health disparities.

### STEPS IN THE RIGHT DIRECTION

The Oregon Department of Environmental Quality is developing a toxics reduction strategy that includes a more coordinated approach to managing its air, water and land programs. It has established an agency-wide focus list of high-priority toxic chemicals. In many instances, however, toxics reduction requires the cooperation of other state agencies, which DEQ currently cannot compel.

### LEADERSHIP IN CHEMICALS POLICY

Despite these challenges, Oregon is positioned to become a leader in developing safer alternatives to toxic chemicals. The state is already a leader in the development and application of green chemistry strategies — the

design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. Two university-based research centers — the Oregon Nanotechnology and Microproducts Institute and the Oregon Built Environment and Sustainable Technologies Research Center — are working on “green” nanotechnology and clean energy and building practices, respectively. However, because Oregon lacks a framework to prioritize or align research and development toward areas where alternative products or approaches are most needed, the opportunities represented by these research initiatives are not being fully leveraged.

### RECOMMENDATIONS

The following actions would strengthen Oregon's policy framework while at the same time cultivate industry innovation:

1. Strengthen coordination and development of shared goals among agencies. Direct state agencies to develop a shared set of priorities and goals focused on moving upstream to prevent the use of chemicals of concern. A more integrated approach will provide cost savings through reduction of duplication and by leveraging agency resources toward shared outcomes.
2. Prioritize the most hazardous chemicals, the most vulnerable people, and the most sensitive and most toxic environments.

- Target biomonitoring programs on areas where there are known health disparities.
- Enhance monitoring programs focusing on water bodies that do not currently meet standards for particular uses or on areas where endangered or threatened species are believed to be at risk.
- Require more complete — and easily comprehensible — information on consumer products so producers of those products have an incentive to move toward safer alternatives.
- Build on and expand access to searchable databases with industry-specific information about safer alternatives.

3. Provide incentives for identifying and developing safer alternatives to the most highly toxic chemicals. Align the priorities and resources of the state’s university-based research centers with the needs of Oregon’s leading industry sectors to help leverage Oregon’s competitive advantages.

4. Promote education and workforce development to lay the foundation for long-term innovation. Expand interdisciplinary approaches to education, internships and workforce development.

## CONCLUSION

Oregon has the opportunity to emerge as a leader in chemicals policy reform by modeling a partnership approach that aligns with and supports the state’s economic base and that focuses on priorities shared across state agencies and other institutions. Such an approach will take focused effort on the part of state agencies and industry leaders, but offers long-term gains in terms of health outcomes, environmental quality and economic competitiveness.

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Funding for this research was provided by the Oregon Department of Environmental Quality, Oregon Department of Human Services, North American Hazardous Materials Management Association, Northwest Chapter of North American Hazardous Materials Management Association and Metro Regional Government.

**Thanks to those who reviewed or provided input on this document:**

**Jae P. Douglas**, M.S.W., Ph.D., Oregon Health Authority  
**David Farrer**, Ph.D., Oregon Health Authority  
**Jason D. Feldman**, M.P.H., Oregon Health Authority  
**Elizabeth Grossman**, B.A., independent journalist and writer  
**Renee Hackenmiller-Paradis**, Ph.D., M.P.H., Oregon Environmental Council  
**Lisa Heigh**, M.S., Metro Regional Government  
**Lauren Heine**, Ph.D., Principal, Lauren Heine Group LLC, Consulting Green Screen Director, Clean Production Action  
**David Livengood**, Oregon Department of Environmental Quality  
**Kevin Masterson**, Oregon Department of Environmental Quality  
**Colin Price**, M.U.R.P., Oregon Environmental Council  
**Joshua Proudfoot**, M.A. Ed., Good Company  
**Megan R. Schwarzman**, M.D., M.P.H., University of California Berkeley School of Public Health  
**Gail R. Shibley**, J.D., Oregon Health Authority  
**Joel A. Tickner**, Sc.D., University of Massachusetts Lowell Center for Sustainable Production  
**John Wargo**, Ph.D., Yale School of Forestry & Environmental Studies

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## INTRODUCTION

Existing chemicals policy in the United States does not comprehensively protect human health or the environment from the potential impacts of chemical exposure. This shortfall reflects a lack of knowledge about how chemicals are used and their hazardous properties, a fragmented policy framework with weak coordination among players and inadequate investment in the development of **safer alternatives**<sup>1</sup> (Wilson and Schwarzman 2009).

Current policies treat chemicals as if they exist in isolation from their environment, do not combine with each other and do not flow between media, and as if we can presume their potential human health and environmental impacts without examining them. These approaches ignore some basic realities: chemical substances accumulate in the food chain and in human tissue, combine in the environment in unpredictable ways, and flow downstream and downwind, across media and between classes of products. Current policies require government agencies to prove beyond a reasonable doubt that chemicals pose a certain level of risk without giving these agencies access to adequate data to prove such risk. This approach is biased against efforts to prevent harm to humans and the environment.

The Lowell Center for Sustainable Production,

based at the University of Massachusetts Lowell, advocates for a more comprehensive policy framework, one that offers an “integrated and prevention-oriented” approach that ensures “protection of workers, communities, and consumer health while stimulating the development and use of non-hazardous and sustainable chemicals in production systems, materials, and products” (Schifano et al. 2009; Lowell Center for Sustainable Production 2010). Such a policy framework would have several important elements:

- It would take a comprehensive and integrated approach to all chemicals, whether toxic or relatively benign.
- It would establish processes that allow rapid chemical assessment, prioritization and decision-making based on inherent **toxicity**, uses, functions and potential exposures through manufacturing, use and disposal.
- It would provide for adequate data collection to assess safety and health and to form an accessible information hub.
- It would consider **hazard** rather than **risk** in chemical assessment (see Box 1).
- It would establish processes to transition chemical use from high-hazard to low-hazard substances.
- It would promote research and innovation.

Although federal policy reform is needed to address the fundamental weaknesses

of the current system, opportunities exist for states to better ensure the health and safety of their residents and the environment. States that take a leadership role in addressing the growing demand for safer alternatives to **chemicals of concern** can also enjoy significant economic development opportunities.

Oregon currently falls short of the attributes of a comprehensive chemicals policy in a number of areas:

- The state lacks an integrated approach that encompasses all chemicals — instead, its efforts are fragmented and uncoordinated.
- There is no mechanism to rapidly assess, prioritize and act upon chemicals based on their toxicity, use or exposure — instead, most efforts focus on monitoring and cleanup.<sup>2</sup>
- Existing policies do not ensure adequate data collection regarding chemical attributes nor do they provide open access to this information.

### Box 1. Risk = Hazard x Exposure

Hazard is the potential to cause harm or the inherent toxicity of a chemical; risk is the quantified likelihood that people, in real life or worst-case situations, will be exposed to a hazardous chemical in quantities or ways that cause harm. Determining the hazards posed by a particular chemical (e.g., whether it is a **persistent, bioaccumulative or toxic substance**) can be relatively easier than assessing its risk, provided adequate resources and technology are available. This is because it is impossible to predict every way in which a chemical might be used in the future as new products and technologies are developed.

<sup>1</sup>Terms that are bolded are included in the glossary.

<sup>2</sup>Oregon has recently taken action to evaluate chemicals based on hazard attributes, uses and potential magnitude of exposure through the Department of Environmental Quality's Toxics Reduction Strategy.

- There are no institutional mechanisms for linking the prioritization of chemicals directly to the development of alternatives.

- Oregon's policies do not encourage shifts toward safer alternatives and away from chemicals of concern.

- Although Oregon has significant knowledge and expertise related to the development of safer alternatives, the state does not have a policy framework that provides incentives for investment in related research and development.

economic competitiveness while ensuring the health of Oregonians and the natural environment.

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Oregon has opportunities to strengthen its policy framework to better protect human health and the environment. Oregon is also well positioned to take advantage of potential economic development opportunities related to investments in **green chemistry** and other safer chemical research and development activities because of the state's intellectual leadership in these fields. Oregon's commitment to sustainability and its reputation for being a leader in this arena give the state the credibility to spearhead development of a more comprehensive chemicals policy framework.

What can Oregon do to move in this direction? This paper describes the context for chemicals policy in the United States and Oregon and explores opportunities for Oregon to develop a more comprehensive approach that enhances the state's

## THE FEDERAL CONTEXT

The federal government has the primary responsibility for managing chemicals in the United States, and the regulatory framework at the national level therefore provides the context for state-level action. The Environmental Protection Agency is responsible for implementing the Toxic Substances Control Act of 1976, the primary federal law regulating chemicals in the United States (Wilson and Schwarzman 2009). EPA's Office of Pollution Prevention and Toxics works to ensure that chemicals that are manufactured, imported, processed or distributed in commerce or that are used or disposed of in the United States do not pose any "unreasonable risks" to human health or the environment. EPA also regulates the use and sale of pesticides under the Federal Insecticide, Fungicide and Rodenticide Act.<sup>3</sup>

It is well documented that federal chemicals policy has not been effective in assessing chemical hazards or controlling chemicals of concern (U.S. GAO 2007, 2009; Wilson and Schwarzman 2009). Chemicals policies at all levels fall short in identifying chemicals of concern, managing their risks and facilitating a shift toward development and use of safer chemicals (Denison 2007; Lowell Center for Sustainable Production 2008; Rosenbaum 2010). The

fragmented structure of U.S. chemicals policy has created three interrelated "gaps": a data gap, a safety gap and a technology gap (Wilson and Schwarzman 2009).

### THE DATA GAP

Under current federal chemicals policy, manufacturers and businesses can sell a chemical or product without generating or disclosing sufficient information about its potential health or environmental hazards to enable agencies or consumers to adequately assess the environmental and health impacts of these chemicals (U.S. GAO 1994; Wilson and Schwarzman 2009). Without clear evidence of harm, companies have largely been free to produce and use chemicals as they see fit. Companies have little incentive to develop better information, because doing so voluntarily may increase the likelihood that they will uncover evidence of harm, thus triggering government action (Denison 2007).

### THE SAFETY GAP

The data gap leads directly into a safety gap. Current chemicals policy limits the ability of public agencies to efficiently gather hazard information from producers, proactively regulate known hazards or require producers to accept greater responsibility for the life-cycle impacts of their products (Wilson et al. 2008). Government agencies must prove "beyond

a reasonable doubt" that a chemical poses a risk before they can take any action to restrict its production or use, and they must do this with limited options for obtaining information from producers or users of the chemical or requiring that they assess the chemical. In essence, EPA must show that a chemical poses a relatively high level of risk without having access to the data needed to show that such risk may in fact exist. As a result, little is known about which chemicals may pose risks and what the magnitude of these risks may be. Limited data are available about which chemicals pose slight or no risk and might serve as safer substitutes, and there are few incentives to develop such information (Denison 2007).

The Toxic Substances Control Act's Chemical Substance Inventory lists more than 84,000 chemical substances being produced, processed or imported for commercial purposes in the United States; of these, only 200 have been studied for health and environmental impacts (Owens 2010). Each year, 1,000 to 2,000 new chemicals are brought to the EPA for review before manufacture (Schierow 2008). These new chemicals enter into use faster than their impacts can be assessed, due to the limited resources allocated to testing and a continued focus on chemicals in isolation (see Box 2).

<sup>3</sup>Other federal agencies responsible for chemicals management in the United States are the Food and Drug Administration, the Consumer Product Safety Commission, and the Occupational Safety and Health Administration. However, while at least 84,000 chemical compounds fall under TSCA and close to 1,000 under the Federal Insecticide, Fungicide and Rodenticide Act, the other major U.S. statutes administered by these agencies regulate just over 1,000 substances combined (Schwarzman and Wilson 2009).

## THE TECHNOLOGY GAP

Data and safety gaps combine to exacerbate a technology gap — a disconnect between the need for safer chemical alternatives and investment in alternatives assessment and development of safer technologies, processes or products (see Box 3). Without information about the risks posed by particular substances to the environment or human health, industry has little incentive to prioritize development of safer alternatives. The lack of comprehensive information about chemicals' impacts on health and the environment also "skews" the market for chemicals by preventing product safety from being taken into account in purchasing decisions (Wilson et al. 2008). As Wilson and Schwarzman (2009) note, the current system values direct economic benefits of chemical use over human health.

Businesses require significant investments in research and development to take a safer chemical alternative from concept to commercial application (Denison 2007). Public and private investments in research and development are currently insufficient to overcome barriers to the development and application of safer chemical alternatives (Wilson and Schwarzman 2009). Underdevelopment of safer alternatives raises alarm in some business sectors about potential negative economic impacts of policies that restrict chemicals currently available

for use. These fears make it politically challenging to effectively address chemicals of concern.

The policy patchwork that resulted in these three gaps reflects the lack of understanding about the scale of chemical use and behaviors when the Toxic Substances Control Act was passed 35 years ago. Most major statutes in the United States have been revised as new information regarding key environmental challenges becomes available. For example, amendments to the Federal Insecticide, Fungicide and Rodenticide Act under the Food Quality Protection Act of 1996 specifically authorized EPA to strengthen the pesticide registration process by shifting the burden of proof to the chemical manufacturer, enforcing compliance against banned and unregistered products, and promulgating a regulatory framework to address gaps in the original law (EPA 2011a). The Toxic Substances Control Act, however, has not undergone such revisions, despite growing knowledge and understanding about chemicals and their impacts.

## FEDERAL POLICY REFORM INITIATIVES

Congress has debated legislation to reform the Toxic Substances Control Act over the past several years in an effort to address the issues identified above. As with earlier legislative proposals (e.g., the Kid-

Safe Chemical Act and the Toxic Chemicals Safety Act of 2010), the Safe Chemicals Act of 2011 (introduced in April 2011) would place more responsibility on chemical companies to prove their products safe before putting

### Box 2. Chemical Mixtures

One result of the data and safety gaps is that little is known about the environmental and human health impacts of mixtures of chemicals in the environment. Humans are rarely exposed to one chemical at a time. Individual chemicals in a mixture can influence one another's toxicity in ways that are:

- antagonistic — overall toxicity of the mixture is less than the summed toxicity of its individual components,
- additive — overall toxicity of the mixture is equal to the summed toxicity of its individual components, or
- synergistic — overall toxicity of the mixture is greater than the summed toxicity of its individual components.

Because there are currently no environmental benchmarks or standards for assessing the impacts of mixtures, it is challenging to assess whether exposure to a given chemical mixture may result in a more or less harmful effect than expected based on the toxicity of the mixture's individual components.

### Box 3. Alternatives Assessment

Alternative assessment is the process of identifying and evaluating alternatives to toxic chemicals that are healthier for humans and the environment. Safer alternatives can be achieved by redesigning or reformulating a product, improving a process to eliminate the need for the chemical, or substituting an inherently less toxic chemical (Rossi et al. 2006).

them on the market. The act would establish a process to categorize chemicals into high-, some- and low-concern classes and require expedited action to reduce exposure to chemicals of high concern (i.e., those that are persistent, bioaccumulative and toxic). The act also seeks to ensure that state governments have a right to take actions that are different from or in addition to those under the Toxic Substances Control Act, unless compliance with both federal and state standards is impossible.

In Europe, policy developments have already shifted the burden of proof away from government and onto industry to show that a chemical does not pose unacceptable risk to human health or the environment. The European Union's Registration, Evaluation, Authorization and Restriction of Chemicals regulatory framework requires registration of chemicals by producers and users of an estimated 30,000 chemicals in commerce in Europe<sup>4</sup>. For chemicals identified as substances of very high concern, these regulations allow their use only if explicitly authorized (Denison 2007). The EU's "Restriction of Hazardous Substances Directive" also restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment, with direct implications for the U.S. electronics industry. U.S. companies that do business internationally and use any

chemicals falling under the EU's frameworks are already considering how to move to alternative approaches. EPA has signed a Statement of Intent with the European Chemicals Agency, the agency charged with implementing the regulations, to promote enhanced technical cooperation on chemical management activities. The United States has taken some actions to provide support for the development of safer alternatives. The Green Chemistry Research and Development Acts of 2005 and 2007 established the Green Chemistry Research and Development Program to promote and coordinate federal research, development, demonstration, education and technology-transfer activities related to green chemistry (see Box 4). These bills authorized appropriations for the National Science Foundation, National Institute of Standards and Technology, Department of Energy and EPA to invest in research and development.

EPA's Design for the Environment program offers support in the development of safer alternatives by working in partnership with industry, environmental groups and academia to identify safer chemicals through alternatives assessment and to define best practices that advance the use of safer alternatives. The program also provides recognition for safer products through the use of its logo (<http://www.epa.gov/dfel>). The Federal Economy, Energy

and Environment program, a coordinated federal and local technical assistance initiative, has also been established to help manufacturers shift their processes toward more sustainable practices ([www.e3.gov](http://www.e3.gov)). Despite recent efforts, however, the policies and investments needed to ensure adequate information, enforcement capacity and incentives to move chemicals policy toward a more comprehensive structure in the United States remain inadequate.

### THE ROLE OF THE STATES: FRAMING OPPORTUNITIES FOR OREGON

Recognizing the backlog in assessment and regulatory action at the federal level, a number of states have taken action to address gaps in chemicals management. Of particular note are California's Green Chemistry Initiative, Washington's Children's Safe Product Act of 2008, and Massachusetts' Toxic Use Reduction Initiative.<sup>5</sup>

Another recent development in support of state-level activity is the Interstate Chemicals Clearinghouse, which promotes

#### Box 4. Green Chemistry

Also known as sustainable chemistry, this is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. Green chemistry approaches can be applied across the life cycle of a chemical product, including design, manufacture, use and end of life.

<sup>4</sup>Canada also recently developed a Domestic Substances List categorization that identifies more than 4,300 chemicals warranting further scrutiny of potential risks (Denison, 2007).

<sup>5</sup>For more information on these initiatives, see the following websites: <http://www.dtsc.ca.gov/PollutionPrevention/GreenChemistryInitiative/index.cfm> (California), <http://www.ecy.wa.gov/programs/swfa/rules/ruleChildren.html> (Washington) and [www.turi.org](http://www.turi.org) (Massachusetts).

collaboration to help states, local and regional governments, businesses and nongovernmental organizations advance their efforts toward safer chemicals and products. Activities under this initiative include developing an online portal for accessing hazard and toxicity data in collaboration with the California Toxics Information Clearinghouse, promoting regular intergovernmental collaboration on safer-alternatives assessments, developing a searchable repository for completed safer-alternatives assessments for use in implementing chemical policy programs, and promoting regular and effective communications and collaboration with the EPA (Geiser and Goldberg 2010). Oregon and 10 other states, as well as Metro, the Portland area's regional government, currently have representatives on the clearinghouse's board of directors and are actively involved in implementing that organization's activities.

Although the structure of federal policy places some constraints on the ability of states to achieve more comprehensive chemicals policies, Oregon could strengthen its approach to chemicals management in a number of ways. The following actions would strengthen Oregon's policy framework:

- Strengthen coordination and development of shared goals among agencies.
- Develop information in

priority areas to enhance understanding of chemicals uses and exposure.

- Align policies to provide incentives for identifying safer alternatives and create direct connections between areas where safer alternatives are most needed and where investment in the development of such alternatives is being made.
- Enhance education and workforce development to lay the foundation for long-term innovation.

These strategies would enhance Oregon's ability to protect its residents and natural environment and would enable the state to take advantage of opportunities for economic competitiveness through the development of safer alternatives.

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# CHEMICALS MANAGEMENT IN OREGON

In Oregon, multiple state agencies share responsibility for regulation and management of chemical substances. The Department of Environmental Quality, Oregon Health Authority, Occupational Safety & Health Administration, Department of Agriculture, Department of Forestry and Office of the State Fire Marshal all have significant responsibility for certain aspects of chemicals monitoring and management (see Figure 1). At local levels, county health departments, local environmental services agencies and water utilities all intersect with chemicals management in some way. In addition, a number of local and statewide nonprofits assist in assessing issues of concern and informing the public about the risk chemicals may pose.<sup>6</sup>

The current approach to chemicals policy in Oregon is fragmented, with weak coordination across agencies and levels of government. A lack of information regarding chemical uses and flows across the state weakens agencies' ability to prioritize chemicals of concern and limits the ability of consumers to incorporate considerations about chemical impacts into their decision-making. Oregon faces particular challenges in managing the impacts of consumer products, addressing **health disparities** in vulnerable

populations and prioritizing issues of regional concern.

## FRAGMENTATION

Responsibility for setting standards, tracking relationships between exposure to chemicals and resulting **health effects**, and reporting on chemical storage is spread between different agencies. There are few mechanisms to coordinate these programs. Even within agencies, separation of responsibilities along media-specific or individual chemical lines poses an obstacle to efforts to align and leverage resources.

## INADEQUATE INFORMATION

Oregon has no control over what chemicals are imported into the state and no system in place to track the transport, sale and application of chemicals used within its borders. As a result, agencies have limited information about exposure patterns and other factors that may put some populations at particular risk. Existing information about chemicals is collected from air and water monitoring programs, incident response efforts, hazardous substance inventories and hazardous waste management programs. Because Oregon's regulatory programs address only about 250 of the 84,000 chemicals in commerce or registered under the Toxic Substances Control Act, existing monitoring programs capture information on a small fraction of the chemicals in the environment.

FIGURE 1: AGENCY ROLES

	ODA	DEQ	OSFM	ODF	OHA	OSHA
<b>regulate chemicals in manufacturing</b>						
industrial		●	●			●
agricultural/forestry			●			●
consumer products			●			●
<b>regulate chemical storage and waste</b>						
industrial		●	●			●
agricultural/forestry	●	●	●			
consumer products			●			
<b>regulate chemical registration and use</b>						
industrial	●	●				●
agricultural/forestry	●			●		●
consumer products	●				●	
<b>monitor chemicals</b>						
air quality		●			●	
water quality	●	●			●	
soil quality		●		●		
human health					●	●
<b>emergency preparedness</b>						
risk assessment					●	
workplace safety		●	●		●	●
substance registry		●	●		●	

**DEQ** (Department of Environmental Quality)  
**ODA** (Oregon Department of Agriculture)  
**ODF** (Oregon Department of Forestry)  
**OHA** (Oregon Health Authority)  
**OSFM** (Oregon Office of the State Fire Marshal)  
**OSHA** (Oregon Occupational Safety & Health Administration)

<sup>6</sup>Appendix I describes responsibilities of specific agencies with respect to chemicals management in more detail.

## CONSUMER PRODUCTS

Although DEQ is required to protect air, water and land from the impacts of chemicals that may be in consumer products, the state has little information about and no control over what chemicals are used in these products. This may be due to a lack of scientific assessments of these substances or because the substances are considered to be proprietary and are categorized as “confidential business information” (see Box 5). The Oregon Health Authority has statutory authority to remove consumer products from commerce when they are demonstrated to threaten the public’s health, but has no funding or funding mechanism to implement this responsibility. Although the health authority works with DEQ to the extent possible, this lack of resources limits its effectiveness in this area.

## HEALTH DISPARITIES

The current framework for chemicals management in Oregon does not address health disparities related to chemical exposure among populations that may be more vulnerable, more susceptible or differentially exposed to chemicals of concern. Such populations include the following:

- Gas station attendants, who may face disproportionate exposure to benzene, fuel additives, diesel and exhaust-related compounds and mixtures as a result of Oregon’s law prohibiting self-

service stations.

- Urban dwellers, who may be exposed to higher concentrations of **pollutants** due to their proximity to industrial sites, **brownfields** and interstate highways (Oregon Environmental Council 2000).
- Agricultural workers, who may be disproportionately exposed to pesticides (Rothlein et al. 2006).<sup>7</sup>
- Rural families, often of lower income, who drink from wells potentially contaminated by fertilizers and septic tanks.
- Native Americans, who may be affected by unsafe transportation of hazardous materials on reservations (Oregon Environmental Council 2000) or who consume proportionally much greater quantities of fish contaminated by persistent, bioaccumulative chemicals than other populations in the state.

Children represent a population of particular concern because their behavior patterns and early growth and development make them more biologically sensitive than adults to chemical impacts (Karr 2010). In addition, injury to developing organ systems can cause lifelong disability (Landrigan et al. 2002). Environmental conditions may contribute to the most serious diseases confronting children, including asthma, childhood cancer, neurodevelopmental and behavioral disorders, and certain congenital defects (Landrigan et al. 2002).

### Box 5. Confidential Business Information

Businesses can request that information provided under the Toxic Substances Control Act requirements be categorized as “confidential business information”, restricting access to this information by the public. More than 16,000 of chemicals registered under the act are currently classified as confidential (Owens 2010); according to one assessment, 90 percent of the confidential business information claims in a given year hid the identity of the chemical used in the product (Wilson and Schwarzman 2009).

Recently, a number of these claims have been declassified either as a result of EPA’s review of health and safety studies or because businesses voluntarily sought declassification. These actions have increased information available to the public (EPA 2011b). individual components

### Box 6. Environmental Justice Task Force

Oregon Senate Bill 420 established the Environmental Justice task force in 2007, requiring that 11 of the state’s natural resources agencies assist the task force with information and seek to better integrate environmental justice considerations into their own programs. The departments of Agriculture, Environmental Quality, Fish & Wildlife, Forestry, Geology & Mineral Industries, Human Services, Land Conservation & Development, State Lands, Transportation and Water Resources, and the State Fire Marshal’s Office are required to report annually on steps they are taking to ensure their programs address the concerns and interests of all Oregon communities. Occupational Safety & Health and the Department of Energy also voluntarily participate.

<sup>7</sup>Lack of information regarding potential workplace risks, limited legal protections regarding occupation safety standards, and potential threats of deportation and harassment that may accompany whistle-blowing or organized response to working conditions further exacerbates the vulnerability of agricultural workers.

In 2007, Oregon established the Environmental Justice Task Force to work with state agencies on addressing some of the concerns noted above (see Box 6). Despite efforts of this task force, data tracking health disparities among particular populations remain fragmented and incomplete. There has been no comprehensive statewide assessment to identify which populations are at increased risk, and there is no process to systematically collect and analyze data that could help identify and prioritize these communities.

### ISSUES OF REGIONAL CONCERN

Certain impacts may be of specific concern to Oregonians due to the region's topographic, climatic and geological characteristics; occupational and residential patterns; and economic activities. For example, Washington and California recently adopted legislation that will phase out copper in brake pads because of the impact of copper particles from the pads on salmon and other regional aquatic life.<sup>8</sup> Air toxics represent another locally significant issue, with the Portland metro area exceeding health-based benchmarks for multiple air toxics including benzene. Although the Portland Air Toxics Solutions Advisory Committee convened by DEQ in 2009 is in the process of developing recommendations to address this situation, it is likely that there are other local

and regional issues requiring focused attention.

### EFFORTS TO ADDRESS CHEMICALS POLICY GAPS

In addition to its establishment of the Environmental Justice Task Force, Oregon has made other efforts to address the shortcomings described above. Senate Bill 737, passed in 2007, seeks to prioritize chemicals of concern for water by requiring DEQ to develop a list of priority persistent pollutants. An advisory group composed of scientists from various disciplines advised DEQ on the development of this list, taking into consideration the toxicity, persistence and bioaccumulation of more than 2,000 chemicals (Oregon DEQ 2009).

DEQ is also developing a toxics reduction strategy that includes the department's air, water and land programs to ensure a more comprehensive approach to chemicals management. As of April 2011, DEQ had established an agencywide toxics "focus list" of high-priority chemicals; collected data on the focus list's chemicals, sources and **pathways**; conducted a review of existing programs to identify gaps; identified factors for evaluating reduction options; and begun the process of evaluating and prioritizing a list of toxics reduction recommendations (<http://www.deq.state.or.us/toxics/>). Although DEQ's toxics reduction strategy seeks to create better integration among the department's

toxics-related programs and may identify opportunities for other state agencies, it cannot compel other state agencies to implement toxics reduction actions. This constraint limits its potential impact on the broader issue of agency alignment. (Oregon House Bill 3257, introduced during the 2011 session, would establish an interagency toxic chemicals reduction task force to support greater coordination across state agencies.)

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<sup>8</sup>The Oregon Legislature is considering this and other bills adopted by neighboring states during the 2011 session.

## OREGON'S OPPORTUNITY FOR LEADERSHIP IN DEVELOPING SAFER ALTERNATIVES

The significant expertise and technical resources available in Oregon can be applied to the development of substances, processes and technologies that provide alternatives to chemicals of concern. The state is already a leader in the development and application of green chemistry strategies — the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. Paul Anastas, assistant administrator for EPA's Office of Research and Development and EPA's science advisor, has noted that Oregon is recognized as one of the "world leaders in green chemistry research" and education:

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Since the early days of green chemistry, researchers at the University of Oregon as well as many of the other research institutes in the state have been recognized for their pioneering advances and basic green chemistry research, specifically in its application to green nanotechnology. ...

[T]he green chemistry community in Oregon also stands out for how it has coupled innovative research and fundamental science with an emphasis on education (Williams 2010).

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The Green Chemistry Program at the University of Oregon has recently launched a collaborative Green Product Design Network to provide support for the invention of greener products, materials and chemicals; the exploration of business models and practices to deliver these innovations to society; and the creation of educational programs (<http://uo-gpdn.ning.com>).

Oregon State University and Portland State University are partners with UO in the Oregon Nanotechnology and Microproducts Institute, a signature research center that provides expertise relevant to the development of safer alternatives. ONAMI's Safer Nanomaterials and Nanomanufacturing Initiative explores the potential environmental and health impacts of **nanotechnology** and seeks to develop

nanomaterials and nanomanufacturing approaches that offer a high level of performance but pose minimal harm to human health or the environment, addressing an area that is currently not well reflected under federal regulatory frameworks ([www.greennano.org](http://www.greennano.org)).

The Oregon Built Environment and Sustainable Technologies Research Center ([www.oregonbest.org](http://www.oregonbest.org)) is another signature

research center that offers expertise relevant to the development of safer alternatives. A partnership of PSU, OSU, UO and Oregon Institute of Technology, Oregon BEST focuses on research and development, commercialization and overall coordination of efforts around clean energy and the built environment. The Oregon Manufacturing Extension Partnership is another valuable resource that provides expertise, training and implementation assistance in "Lean Enterprise" — defined as the "systematic elimination of waste in all forms to improve quality, cost and delivery" (<http://www.epa.gov/lean/chemicalstoolkit/ch6.htm>). This nonprofit team of manufacturing professionals is increasingly providing assistance to small and medium-size manufacturers to improve energy efficiency and is forming strategic partnerships to provide more comprehensive assistance in sustainable manufacturing. Developing stronger relationships between the manufacturing extension partnership and the signature research centers would provide companies with additional opportunities to explore greener alternatives.

These initiatives and resources offer a platform to support Oregon businesses in advancing their competitive advantage through the application of green chemistry and other tools to develop safer chemical alternatives (see Box 7). However, Oregon is not

currently able to fully leverage the opportunities represented by these initiatives. The state lacks a framework to prioritize or align research and development toward areas where alternative products or approaches are most needed because of the risk posed by chemicals currently in use, high-volume uses or chemicals used in situations where particular populations are at heightened risk. The absence of adequate decision support tools and technical assistance to help businesses identify or develop effective substitutes for chemicals of concern makes it difficult for businesses to explore safer alternatives unless they have a relatively high level of technical assessment capacity in-house. As a result, some businesses are concerned about the potential negative economic impact if chemicals are restricted or banned without effective alternatives in place.

## INTEGRATION AND PARTNERSHIP AS GUIDING PRINCIPLES

Oregon can best leverage its limited resources, address priority areas of concern and advance the state's economic competitiveness by taking an integrated approach that engages government agencies, industry, nonprofits and individuals around a set of shared goals. Such an approach will require coordination that enables entities to share information about chemical use, hazard and exposure. It would also

require clear mandates, authorities and resources to enable state agencies to implement key strategies and actions.

Most important, Oregon has the opportunity to harness innovation and improve its economic competitiveness by engaging in cooperation and partnerships. Public-private partnerships in Oregon are already fostering the development of key innovation "inputs" that can advance the state's leadership in the development of safer alternatives (see Box 8). The Oregon Innovation Council, which championed the establishment of Oregon BEST, offers one example of a public-private partnership that seeks to foster innovation by identifying priorities and advocating for investment in key infrastructure as well as research and development.<sup>9</sup>

### Box 7. Business Opportunities in Green Chemistry

- Coastwide Laboratories has partnered with Purdue University to create the Sustainable Earth Green Chemistry Standard to inform product design.
- Blount Inc.'s investments in green chemistry reduced hazardous waste generation and increased production capacity, resulting in significant cost savings as a result of process efficiencies.
- Columbia Forest Products' development of formaldehyde-free adhesives in partnership with Oregon State University positioned the company for competitive advantage as products come under increased regulatory scrutiny.
- Nike's investments in green chemistry have allowed the company to create materials and products that are in compliance with the strictest global chemical legislation, avoiding potential regulatory issues in different countries or regions, and to reduce waste — and related costs — associated with their global supply chain (Oregon Environmental Council 2010).

### Box 8. Fostering Innovation

#### Inputs to innovation

- Robust fundamental science research base in universities.
- Strong intellectual property rights regime that rewards good ideas.
- Vibrant and working market with ample demand that can draw new technologies out of labs and onto assembly lines quickly and decisively.
- Access to angel, seed, venture and other forms of early-stage capital.
- Strong, transparent and science-based regulatory system.

#### Outputs of innovation

- New technologies
- New firms
- New industries
- New jobs
- Economic growth
- Prosperity
- International competitiveness

<sup>9</sup>For more information on the Oregon Innovation Council, see <http://www.oregon4biz.com/Innovation-in-Oregon/Oregon-Innovation-Council/>.

## FOUR KEY ACTION AREAS

To take the lead in developing a sustainable chemicals policy, Oregon should take the following steps:

1. Direct state agencies to develop a shared set of priorities and goals focused on moving upstream to prevent the use of chemicals of concern.
2. Develop and disseminate information about priority chemicals of concern.
3. Create a mechanism to align resources between priority areas and the development of safer alternatives.
4. Expand interdisciplinary education and workforce development programs.

These strategies address “supply-side” and “demand-side” aspects of chemicals management, both of which are needed to achieve a comprehensive chemicals policy. Supply-side strategies seek to improve the supply of science, technology and commercial applications of green chemistry and other tools for developing safer alternatives through expanded education, research and development efforts. Demand-side strategies generate the market need for new science and technology by driving data generation and disclosure as well as enhanced control of chemicals known to be hazardous. These strategies reinforce each other, with demand-side strategies

stimulating the investments needed to advance innovation in the development of alternatives (Wilson and Schwarzman 2009).

### ACTION 1: DEVELOP SHARED PRIORITIES AND FOCUS

A comprehensive chemicals policy must engage a broad set of constituents to be successful. Therefore, an inclusive effort to develop shared goals and priorities related to the health of Oregonians and the environment is an important first step. Dialogue about state-level goals should engage state agencies, universities, nongovernmental organizations, industries and the public. Engaging agency commissions and boards will be essential, given the central policy-making role they play.

This multi-stakeholder dialogue will help build the foundation for an outcomes-oriented policy framework. When desired outcomes are clearly defined in terms of the health of Oregonians, the quality of Oregon’s environment, and the state’s economic competitiveness, state agencies will be better able to evaluate what policy instruments and strategies will be most effective and where priority investments should be made. A more integrated approach will provide cost savings through reduction of duplication and by leveraging agency resources toward shared goals. From a regulatory standpoint, greater coordination will result

in more efficient delivery of services to the public, including regulated industries.

In addition to shared goals, state agencies will need a clear mandate, adequate authority and sufficient resources to be able to translate shared goals into action on the ground. Michigan’s Green Chemistry Initiative and Roundtable offers both a model for this effort and some important caveats. The roundtable seeks to engage regulatory agencies and the private sector in a collaborative effort aimed at advancing the development of safer alternatives. This effort has been criticized for the absence of a mechanism to ensure that action is taken on priority issues of concern. Any goal-setting effort in Oregon must have enough regulatory authority and adequate resources to ensure that meaningful action will take place. For example, to implement a comprehensive policy framework, state agencies will need enhanced capacity for “rapid chemical assessment, prioritization, and decision-making based on inherent toxicity (hazards), uses, functions, and potential exposures through manufacturing, use, and disposal” (Lowell Center for Sustainable Production 2010). Without this capacity, state agencies will not be able to take meaningful action toward better outcomes for Oregonians and their environment.

While the multi-stakeholder process of setting outcomes

may be a good candidate for an Oregon Solutions project<sup>10</sup>, an executive order may be needed to direct state agencies to develop and adopt a shared set of goals and policies around chemicals management. Directing state agencies to include consideration of chemicals of concern in their procurement policies offers one example of a policy change that could significantly enhance the demand for safer alternatives. Existing authorities may also be adapted to provide more incentives toward the adoption of alternatives; for example, fee structures such as those under the Office of the State Fire Marshal could be shifted to reward the use of safer alternatives.

## ACTION 2: DEVELOP AND DISSEMINATE INFORMATION

Oregon should target resources toward the development and dissemination of information about priority chemicals of concern for the state. Specific actions include the following:

- Focus on chemical priorities based on the state-level goals and desired outcomes.
- Target human **biomonitoring** and environmental monitoring toward areas where human and ecological risks are the greatest.
- Require labeling of consumer products and information disclosure of ingredients of concern that may be categorized as confidential business information.

- Engage with voluntary eco-certification programs to align their requirements with Oregon's priority chemicals of concern.
- Develop a coordinated information system.
- Expand public awareness of chemicals of concern.

**Establishing priorities** for information development and dissemination should ideally be guided by the goal-setting exercise described under Action 1 above. In the absence of such a goal-setting effort, priorities should focus on known hazards such as persistent, **bioaccumulative** and toxic chemicals; chemicals that directly contribute to health disparities and that threaten vulnerable populations in the state; chemicals that are used in high volumes in the state; and consumer products. Information provided through the Interstate Chemicals Clearinghouse can be used to help set priorities, and Oregon can build on efforts of other states, such as Washington and Maine, which have prioritized the development of safer products for children.

To date, state agencies have had neither the mandate nor the resources to establish a biomonitoring program to help address gaps in information about chemical exposures. A targeted biomonitoring program focused on areas where there are known health disparities would help advance efforts to protect the most vulnerable Oregonians from chemical

exposure. Resources to support such a program could be leveraged by engaging chemical users, members of at-risk populations and the general public in gathering information about both chemical use and exposure. Such "citizen science" can expand knowledge about chemical flows and impacts while educating the public about the need for safer alternatives. For example, cell phone scanners that allow consumers to obtain information about products could also be used to collect aggregate data on consumption patterns, expanding knowledge of consumption-related exposure. In 2007, the Oregon Environmental Council worked with a small group of volunteers to test chemical loads in their bodies; although limited in scope, this project offers another example of how citizens might be engaged in monitoring efforts (Oregon Environmental Council 2007).

Environmental **monitoring** should also be targeted toward areas where the human and ecological risks are the greatest. For example, enhanced monitoring programs focused on water bodies that do not currently meet standards for particular uses or on areas where endangered or threatened species are believed to be at risk would expand knowledge about conditions in these priority areas. Once again, engaging "citizen scientists" in information gathering where appropriate can leverage

<sup>10</sup>Based at Portland State University, Oregon Solutions develops sustainable solutions to community-based problems that support economic, environmental and community objectives. These solutions are built through the collaborative efforts of businesses, government and nonprofit organizations.

resources and increase public awareness of these issues.

Requiring **labeling** can help strengthen the demand side of chemicals policy. Requiring more complete — and easily comprehensible — information on consumer products sold in the state would create incentives for the producers of those products to explore ways to move toward safer alternatives and to engage their supply chains in providing information about chemicals used in products. Improved labeling will help consumers become better informed and increase market demand for safer products.

Voluntary **certification** programs can help with the development and dissemination of credible information about product ingredients and can thereby help build market demand for safer alternatives. A collaborative effort of state agencies, local wastewater and water utilities, and environmental public interest groups is seeking a voluntary agreement with prominent product-ranking tools to incorporate the Oregon Priority Persistent Pollutant inventory into product-ranking or screening tools. Funded by DEQ, the Oregon Association of Clean Water Agencies and local wastewater treatment utilities, this effort would enhance Oregonians' ability to choose to purchase and use products that do not contain the Oregon Priority Persistent Pollutant chemicals. There may also be opportunities to

engage in a similar manner with the Food Alliance, a national nonprofit based in Oregon that has developed a certification system for sustainable agriculture ([www.foodalliance.org](http://www.foodalliance.org)).

Generation of additional information will only be effective in improving chemicals management if this information can be managed in an integrative way that provides access to all interested parties. Developing a more integrated and accessible **information system** is therefore one of the top priorities in this arena. For the business community, Oregon can also build on and expand access to searchable databases with industry-specific information about safer alternatives, such as that developed by the Toxics Use Reduction Institute at University of Massachusetts Lowell.

Expanding **public awareness** will also foster demand for safer alternatives. Given the complexity of the existing chemicals policy frameworks, a focused effort to communicate issues of priority concern will be needed to fully engage the public in supporting efforts to develop a more comprehensive policy framework. Labeling consumer products and engaging citizens in monitoring of chemicals uses and exposures will also help raise public awareness of these issues.

### **ACTION 3: DEVELOP SAFER ALTERNATIVES IN PRIORITY AREAS**

Investing in safer alternatives to chemicals used by Oregon's leading industries will leverage opportunities for economic competitiveness due to reduced costs of regulation and ability to access markets that favor safer alternatives. Stronger alignment between existing technical assistance programs, university-based research efforts and priority areas where alternatives are needed will help foster innovation in the development and use of safer alternatives. Oregon can also join with other states in targeting resources toward the development of safer consumer products, which has emerged as a national priority in order to better protect human health and the environment.

The following actions will help to align resources between priority areas and the development of safer alternatives:

- Focus resources on developing safer alternatives for Oregon's leading industries.
- Create a mechanism to coordinate demand and supply of safer alternatives.
- Invest in green chemistry research and development.
- Support small businesses.
- Mobilize capital resources.
- Collaborate with other states on the development of safer alternatives for consumer products.

### *Focusing on key industries*

Oregon can align its leading industries with the competitive opportunities related to both green chemistry and design for the environment. Oregon's four "key industries" reflect the state's competitiveness in the areas of advanced manufacturing (metals manufacturing and food processing), clean tech (solar, wind and wave energy, energy efficiency and green building), forestry and wood products, and outdoor gear and apparel. Oregon's agricultural sector is also highly competitive, with significant local, domestic and international markets. Appendix II highlights selected examples where alignment of state resources toward specific industry sectors can enhance their competitiveness and innovative edge. For example, both green building and solar energy are represented in Oregon's key industries, and Oregon BEST offers an important opportunity to link university resources to these business sectors so they can develop and implement safer chemical alternatives (see Box 9).

In cases where Oregon has the opportunity to join with California and Washington in advancing certain policy approaches, the regional impact may be significant and will position Oregon businesses competitively as concern over the use of hazardous chemicals increases. Oregon could join Washington and California in the phase-out of copper brake pads, or could bring together regional industries

such as wood products or high tech with state and federal agencies and academic institutions to develop an agreement to phase out use of high-priority chemicals. Such an effort could be made contingent on an aggressive, coordinated plan to identify and test alternatives and provide incentives to advance this work. In addition to government-led assessments of safer alternatives to substances used in these sectors, technical assistance can be provided to industries to conduct their own assessments.

### *Coordinating supply and demand*

Aligning the priorities and resources of the state's signature research centers ONAMI and Oregon BEST with the needs and opportunities of Oregon's leading industry sectors can help leverage Oregon's competitive advantages. Developing a "hub" to provide this connection is one strategy recommended by the Oregon Environmental Council (2010). Such a hub could bring together the resources represented by ONAMI, Oregon BEST, the Green Product Design Network and the Oregon Manufacturing Extension Partnership to develop a shared strategy for investment in research and development around priority concerns.<sup>11</sup> Other programs such as OSU's Wood Innovation Center, the Portland Center for Design and Innovation, and OSU's Integrated Plant Protection Center offer partnership opportunities that

can further innovation in these areas.

Development of decision support tools that provide assistance to identify and/or develop effective substitutes for chemicals of concern should be a primary area of focus (see Box 10). The development of such tools may help to address concerns among some businesses regarding the costs of shifting to safer alternatives, as well as providing these businesses with a competitive edge as public awareness about toxics exposures increases.

#### **Box 9. Enhancing Leadership in Green Building**

- Oregon BEST recently launched the Sustainable Built Environment Research Consortium, a regional group of member firms, organizations and researchers collaborating on applied research, development and commercialization of sustainable technologies and services for the sustainable built environment. The consortium uses the Living Building Challenge's "Red List" of materials that should be avoided in a Living Building to inform its research agenda. The consortium is funded by industry, indicating that the private sector places significant value on this effort.
- The City of Portland's pilot Alternative Technology Advisory Committee supports testing of new green building innovations to help them reach the marketplace. Although the downturn in building as a result of the Great Recession has limited the level of activity in this program, such efforts can provide an important mechanism to move innovations into practice.

<sup>11</sup>A related initiative to develop a hub that would provide support to key industries in green chemistry was proposed to the Oregon Innovation Council during a recent session but was not moved forward.

Participation in voluntary certification programs that are aligned with Oregon's priority chemicals of concern can also provide businesses with guidance in shifting to safer alternatives and help them access emerging market opportunities.

### *Investing in green chemistry*

Oregon should prioritize investments in research, education, technical assistance and market development related to green chemistry. Oregon's leadership in this area has already been noted, and the opportunities for economic advantage related to green chemistry applications are becoming increasingly apparent. Other countries are moving quickly to take advantage of opportunities in this arena, and Oregon would be wise to move promptly to take advantage of its early leadership in this area. Countries that have stepped up their investment in the development of green chemistry and safer chemical alternatives include the United Kingdom, China, France and Brazil (Clean Production Action 2009; Extance 2010).

The University of Oregon's Jim Hutchison (Hutchison 2010) sums up the need for expanding the opportunities for Oregon around green chemistry investments:

“While Columbia Forest Products and Nike have invested in green chemistry, the reality is that many companies simply don't have the workforce, the financial resources, or the time to develop their own green solutions. As a result, we need to make strategic investments that will help our business community succeed amid the ever-increasing global competition.

Oregon is lucky to have the foundation of key building blocks in place to develop green chemistry. Specifically, we have the leadership, talent, and commitment to sustainability within our business community and one of the largest teams in the world of renowned green chemistry researchers and educators within Oregon's universities.

But if we are going to excel at green innovation, we need to make an investment in green chemistry now because other nations, such as China, and states, including California, Massachusetts, and Michigan, are doing just that, placing big bets that green chemistry will help their companies meet these goals.”

The Green Chemistry and Commerce Council, the Lowell Center for Sustainable Production and the National Pollution Prevention Roundtable have developed a comprehensive resource guide identifying how green chemistry and design for the environment can be used to eliminate or reduce the use or generation of hazardous chemicals and promote the development of a “green economy” (Green Chemistry and Commerce Council et al. 2009). This report can help identify specific strategies to advance these opportunities in Oregon.

### *Supporting small businesses*

Providing support to smaller businesses in the development or identification of alternatives will be an important element of any Oregon strategy.

Oregon is primarily a small-business state: businesses with fewer than 100 employees account for 51 percent of private sector employees in the state, and 98 percent of the firms with employees are small businesses (Johnson, 2010). Larger businesses are better positioned for internal research and development investments related to safer alternatives and many are moving in that direction in response to European regulations and risk management considerations. Smaller businesses, however, often lack sufficient

#### Box 10. Decision Support Tools

- Washington's Department of Ecology is using a Quick Chemical Assessment Tool (based in part on Cleaner Production Action's Green Screen) to get businesses to identify and adopt alternatives to chemicals on the Toxic Release Inventory list (Stone 2009; Lauren Heine, personal communication, April 7, 2011).
- GreenXchange is an apparel industry initiative to share knowledge about green alternatives for business and manufacturing applications (<http://greenxchange.force.com/>).
- An Integrated Pest Management Options Evaluation Tool developed for use in California with funding from the Natural Resources Conservation Service can help users evaluate feasible alternatives to their current chemical usage patterns.
- NRCS funding is also supporting the development of a Pesticide Risk Mitigation Tool with involvement by OSU's Integrated Plant Protection Center, which would assist producers in assessing site-specific options to reduce erosion, chemical use, etc.

resources to explore such alternatives. As supply chains increasingly incorporate consideration of safer alternatives, smaller businesses will be at an increasing disadvantage. Alignment of university-based research and development resources through ONAMI and Oregon BEST and small-business investment programs through the Small Business Administration and Business Oregon may help address this issue.

#### *Mobilizing capital*

Access to adequate capital to support research, development and commercialization is another important “input” to innovation. A public-private partnership that engages Oregon’s venture capital community, commercial banking community, community development finance institutions and signature research institutes can help meet this need. Such a network could help align research investments with capital needs and provide a supportive infrastructure to bridge transition to commercialized products. Oregon BEST’s commercialization grants are one example of the type of financial assistance that can help grow the supply of safer alternatives.

#### *Collaborating to ensure safer consumer products*

Developing safer alternatives for consumer products has emerged as a national priority as the harmful impacts of chemicals used in these

products on human health and the environment have become more evident. At the federal level, the Consumer Product Safety Improvement Act of 2008 includes a ban on six **phthalates** and has tightened the restrictions on lead in children’s products, and many states are working actively to curtail the use of chemicals of concern in consumer products.

Given the number of chemical product manufacturers and their distribution across the United States, developing safer alternatives requires collaboration between states and across agencies. In addition to supporting the Interstate Chemicals Clearinghouse’s efforts in this area, Oregon may want to consider targeted stakeholder engagement (building on the work of the National Conversation on Public Health and Chemical Exposures); participation in developing scientific/technical collaboration networks to better leverage the capacities of different agencies to conduct certain types of scientific assessments; and development of an interagency federal-state task force (Tickner and Eliason 2011).

#### **ACTION 4: EXPAND EDUCATION AND WORKFORCE DEVELOPMENT**

Investments in education and workforce development create a long-term foundation for innovation (Pool 2010). Developing educational programs for all ages will

position Oregon to supply the innovators and workforce to lead in green technology in the future (Oregon Environmental Council 2010). While Oregon is already a leader in incorporating green chemistry into chemistry programs, these efforts could be expanded to include a broader set of disciplines and more experiential, hands-on learning opportunities, perhaps modeled after the programs at the Berkeley Center for Green Chemistry (<http://bcgc.berkeley.edu/mision>). Reaching beyond chemistry education to engage disciplines including business, planning, community health and other areas will provide the broad range of expertise needed to move new products and processes into the market. An internship program that brings students from different Oregon universities and different disciplines together to work with businesses that are developing safer alternatives offers one approach to building Oregon’s leadership in this area. Oregon can also take the lead in developing education and training programs that are tailored to the needs of small businesses to enhance their competitiveness in this arena.

## SUMMARY AND CONCLUDING REMARKS

Oregon can strengthen its chemicals policy by developing a set of goals and implementation strategies that engage and are shared by state agencies, industry, nonprofits, and individuals across the state. No single strategy or approach can address all of the shortcomings of current chemicals policy. A combination of regulatory and voluntary efforts will be needed to create an environment in Oregon that fosters ongoing innovation in the development of effective alternatives to chemicals of concern. These efforts should include targeted information development and dissemination, greater alignment between the capacity to develop safer alternatives and the areas where such alternatives are needed, and expanded education and workforce development programs.

Although the actions described above could be pursued individually, efforts to structure policy frameworks that encourage innovation work best as a suite. Governments would “do well to take a systems-thinking approach to measuring and strategically bolstering the inputs of innovation, so that we can all enjoy its outputs: progress, growth, prosperity, and ... competitiveness” (Pool 2010). By taking an

integrated approach that aligns regulatory objectives, information development and dissemination, investments in developing safer alternatives, and education and workforce programs, Oregon can play a leadership role in addressing the human and environmental impacts of chemicals of concern and can simultaneously take advantage of the market opportunities related to safer alternatives.

While Oregon policy decisions may not have the immediate, far-ranging impact that California policies can have, given the relatively smaller size of Oregon’s population and economy, Oregon already has a track record for pioneering innovative policies that have served as models for other states and regions, such as land use planning laws and the bottle bill. More recently, policies such as Executive Order 00-07, directing that public buildings be built to green standards have helped create a highly competitive niche for Oregon businesses by building market demand (Allen and Potiowsky 2008). Where Oregon can join with California and Washington to advance regional policy approaches, the impact on both demand for and supply of alternatives can be significant. Such efforts will position Oregon businesses competitively as concerns increase regarding the use of hazardous chemicals. Oregon has the opportunity to emerge as a leader in chemicals policy reform by modeling a partnership

approach that aligns with and supports the state’s economic base and that focuses on priorities shared across state agencies and other institutions. Such an approach will take focused effort on the part of state agencies and industry leaders but will offer long-term gains in terms of health outcomes, environmental quality and economic competitiveness that far exceed the costs. This strategy must also engage a broad range of Oregonians to lay the strong, long-term foundation of support needed for such an effort to succeed. As concern over the impacts of toxic chemicals continues to grow, Oregon can take a leadership role as an innovator in integrating sustainability policy and economic development. The health of Oregonians, their environment and their economy will all benefit from such an effort.

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# GLOSSARY OF TERMS

**Bioaccumulative:** a substance that is biologically sequestered at a higher concentration than that at which it occurs in the surrounding environment or medium.

**Biomonitoring:** the direct measurement of a person's exposure to environmental contaminants by measuring substances or their metabolites in blood, urine or other biological specimens. Biomonitoring has become the standard for assessing people's exposure to toxic substances and for responding to serious environmental public health problems.

**Brownfield:** an industrial or commercial site that is idle or underused because of real or perceived environmental pollution.

**Chemicals of concern:** used here to denote chemicals that may pose significant risks to human health or the environment because of their characteristics or use. This term is used by a number of agencies in different ways: in December 2009, EPA issued a list of "chemicals of concern" based on "serious environmental or health concerns" and the fact that in some cases these chemicals "may present an unreasonable risk of injury to health and the environment." Washington State uses the term "chemicals of concern" to refer to chemicals that persist in the environment, build up in animal tissues, and can be toxic ([http://www.ecy.wa.gov/programs/eap/toxics/chemicals\\_of\\_concern.html](http://www.ecy.wa.gov/programs/eap/toxics/chemicals_of_concern.html)).

**Endocrine systems:** also referred to as hormone systems, are made up of glands located throughout the body, hormones that are made by the glands and released into the bloodstream or the fluid surrounding cells, and receptors in various organs and tissues that recognize and respond to the hormones.

**Epidemiological:** from "epidemiology," which is the branch of medicine that deals with the study of the causes, distribution and control of disease in populations.

**Green chemistry:** also known as sustainable chemistry, green chemistry is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. Green chemistry applies across the life cycle of a chemical product, including its design, manufacture and use.

**Hazard:** the potential to cause harm or the inherent toxicity of a chemical.

**Health disparities:** unique, more prevalent, or more serious occurrence of diseases, disorders or health conditions in subpopulations in socioeconomically disadvantaged and medically underserved communities.

**Health effects:** any change in body function or the structures of cells that can lead to disease or health problems.

**Nanotechnology:** the understanding and control of matter at the nanoscale, at dimensions between approximately 1 and 100 nanometers.

**Pathways:** the means by which toxic contaminants move through the environment, based on the physical and chemical nature of the chemicals, as well as the environment in which the chemicals are introduced (e.g., pervious vs. impervious surfaces).

**Persistence:** the ability of a chemical substance to remain in an environment in an unchanged form. The longer a chemical persists, the higher the potential for human or environmental exposure to it.

**Pollutant:** any substance, such as certain chemicals or waste products, that renders the air, soil, water or other natural resource harmful or unsuitable for a specific purpose.

**Phthalates:** a group of industrial chemicals used to make plastics like polyvinyl chloride more flexible or resilient; they can also be used as solvents. Phthalates, also called "plasticizers," have been found to disrupt the endocrine system.

**Risk:** the chance or probability that a person will be harmed or experience an adverse health effect if exposed to a hazard.

**Safer alternative:** an option, including the option of not doing something, that is healthier for humans and the environment than the existing means for meeting that need. For example, safer alternatives to the use of a hazardous chemicals include replacing the chemical with an inherently less hazardous chemical; eliminating the need for the chemical through material change, product redesign or product replacement; or eliminating the chemical by altering the functional demands for the product through changes in consumer demand, workplace organization or product use.

**Toxic substances:** chemicals or compounds that may present an unreasonable threat to human health and the environment. Human exposure to toxic substances can cause a variety of health effects, including damage to the nervous system, reproductive and developmental problems, cancer, and genetic disorders (EPA, <http://www.epa.gov/ebtpages/polltoxicsubstances.html>).

**Toxicity:** the degree to which a substance can harm humans or animals. Toxicity can be acute, subchronic or chronic.

- Acute toxicity involves harmful effects in an organism through a single or short-term exposure.
- Subchronic toxicity is the ability of a toxic substance to cause effects for more than one year but less than the lifetime of the exposed organism.
- Chronic toxicity is the ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure, sometimes lasting for the entire life of the exposed organism.

**Toxicological:** from "toxicology," which is the study of the nature, effects and detection of poisons and the treatment of poisoning.

# APPENDIX I: OVERVIEW OF AGENCY ROLES AND RESPONSIBILITIES

## AGENCY AND RESPONSIBILITIES

(listed alphabetically by  
agency)

### OREGON DEPARTMENT OF AGRICULTURE

635 Capitol St. NE

Salem, OR 97301

<http://www.oregon.gov/ODA>

The Oregon Department of Agriculture is responsible, through its Pesticide Analytical and Response Center, for collection of information on pesticide use and coordination of investigations about reported pesticide-related incidents that have suspected health or environmental effects. ODA's Pesticide Division is responsible for pesticide user licensing and recertification, pesticide registrations, pesticide compliance monitoring, and fertilizer and pesticide use reporting. Licensing, operator training and labeling are required on forest lands as well as agricultural lands. The Pesticide Use Reporting System that ODA administered during 2007–2008 provided for both online reporting of all nonhousehold applicators and a survey of household pesticide use at the level of watershed or zip code. This reporting system was suspended in 2009 due to budget constraints;

while there are still record keeping requirements, these do not require submission of information into a central data tracking system.

ODA's Natural Resources Division is responsible for implementing the Agricultural Water Quality Management Program (also known as SB 1010) to help reduce water pollution associated with activities on agricultural and rural lands. SB 1010 implementation is closely linked to DEQ's Total Maximum Daily Load process.

### DEPARTMENT OF ENVIRONMENTAL QUALITY

811 SW 6th Ave.

Portland, OR 97204

<http://www.oregon.gov/DEQ/>

DEQ is responsible for protecting and enhancing Oregon's water and air quality, cleaning up spills and releases of hazardous materials, managing the proper disposal of hazardous and solid wastes, and enforcing Oregon's environmental laws.

Specific to the management of toxics, DEQ is responsible for specific actions related to water quality, air quality and land management; the Toxics Reduction Strategy currently under development seeks to better integrate and streamline these programs.

**Water.** DEQ is responsible for establishing water quality toxicity criteria to protect both aquatic life and human health. These criteria are established

to allow Oregonians to consume fish and shellfish and to use state waters for drinking water supply without adverse health effects, and to protect surface water to sustain aquatic life. DEQ's current standards are based on EPA-recommended criteria. Human health criteria for toxics are currently being revised to protect Oregonians who consume higher levels of fish than the norm. DEQ is also in the process of implementing SB 737, which targets persistent pollutants affecting water quality.

DEQ is also responsible for establishing Total Maximum Daily Loads to address non-point-source pollution. DEQ monitors water and fish tissue for a range of contaminants including lead, copper, mercury and over 100 organic toxic chemicals as part of the Toxics Monitoring Program at broad-basin scale (e.g., Willamette River basin, Deschutes River basin), and collects pesticide monitoring data in six sub-basins and watersheds in the state.

DEQ's Drinking Water Source Protection program — in partnership with the Department of Human Services/Oregon Health Authority's Drinking Water Program — monitors for the same substances tracked under the Toxics Monitoring Program in untreated surface water and groundwater bodies that serve as sources of public drinking water supplies. These programs do not currently have adequate

resources to allow coverage of the entire state, and available resources are focused on areas with the greatest levels of human health and ecological vulnerabilities and where willing partners help to ensure the success of follow-up reduction efforts.

**Air.** DEQ is responsible for monitoring air quality to ensure that communities meet the national ambient air quality health standards; of particular concern in Oregon are ground-level ozone (i.e., smog); fine particulate matter from wood smoke, other combustion sources, cars and dust; and hazardous air pollutants. The Air Toxics program establishes benchmarks and works with communities and local governments to create and implement plans to reduce airborne toxics. The program also coordinates with other DEQ programs that reduce airborne toxics including industrial permitting, vehicle inspections and vapor recovery at gasoline stations and terminals.

**Hazardous waste.** DEQ is authorized by the EPA to regulate hazardous waste in Oregon. Specific activities include coordination of hazardous waste reporting (see HazWaste.net), training, management of used oil and waste pesticides, and electronic waste management.

Oregon's Toxics Use Reduction and Hazardous Waste Reduction Act mandates pollution prevention planning,

targeting industries required to report under EPA's Toxics Release Inventory program and both large- and small-quantity hazardous waste generators.

DEQ monitors toxic sites and spills throughout Oregon and maintains a database of both reported and confirmed toxic sites and spills. The data include information on the site's location, type of substances involved, media contaminated and status of cleanup efforts.

DEQ is also reviewing the status of sediment control policies and regulations to determine whether they adequately protect water bodies from contamination.

### OREGON OFFICE OF STATE FIRE MARSHAL AND LOCAL EMERGENCY PLANNING COMMITTEES

4760 Portland Rd. NE  
Salem, OR 97305  
[http://www.oregon.gov/OSP/SFM/Local\\_LEPC\\_Information.shtml](http://www.oregon.gov/OSP/SFM/Local_LEPC_Information.shtml)

Responsibility for collecting data on the storage of chemicals falls under the Office of the State Fire Marshal, which collects site-specific information about chemicals that are stored by businesses or organizations through its Hazardous Substances Information Survey. While limited to tracking the storage of chemicals, the Fire Marshal's office tracks a broader range of chemicals than do other agencies, including substances requiring Material Safety Data Sheets, any quantity of

radioactive material poisons and explosives, certain gases, and substances on the EPA's Extremely Hazardous Substances list. Reporting requirements are triggered by a minimum threshold, which varies depending on the chemical substance; fees collected by the Office of the Fire Marshal are directed to DEQ to support the management of orphan sites and hazardous waste programs.<sup>12</sup>

The Fire Marshal is also the formal contact point in Oregon for the Toxics Release Inventory administered by EPA, which includes information about the release of industrial chemicals into the environment, including locations, annual data on releases and transfers of certain toxic chemicals from industrial facilities, waste management data and pollution reduction activities (<http://www.epa.gov/TRI/triprogram/whatis.htm>). The level of involvement of the Fire Marshal in the Toxics Release Inventory program has become more limited as most data is now reported directly to the inventory through an electronic reporting system.

### OREGON DEPARTMENT OF FORESTRY

2600 State St.  
Salem, OR 97310  
<http://www.oregon.gov/ODF/>

Under the "chemical and other petroleum products" rules under the Forest Practices Act, the department regulates nonpoint sources of pollution

<sup>12</sup>The fees collected by the Office of the Fire Marshal from those storing chemicals are not structured in a way that provides any incentive for users to shift from chemicals that pose significant hazards to others that are safer.

related to commercial forest activities. (Some forest-based activities not regulated under the Forest Practice Act are subject to maintaining water quality and other standards under the Agricultural Water Quality Management Program.)

### **OREGON HEALTH AUTHORITY**

**Public Health Division**

800 NE Oregon St.

Portland, OR 97232

<http://www.oregon.gov/OHA>

The OHA's Public Health Division administers a number of data collection and monitoring programs related to environmental and occupational public health. OHA's Office of Environmental Public Health is responsible for statewide control of environmental hazards through drinking water protection; protection from radiation; regulation of food, pool and lodging facilities; investigation of environmental and occupational exposures; and outreach and education to affected communities.

OHA also works with DEQ to implement Oregon's Drinking Water Program, which administers and enforces drinking water quality standards for public water systems, source water protection, technical assistance, and water system operator training.

Several work units within OEPH's Research & Education Services section collect and manage chemical data, including the following:

- **Healthy Workplaces**, which includes the surveillance and outreach efforts related to occupational illness, injuries and fatalities; tracks chemical releases in Oregon; and helps communities to prepare for unexpected events and businesses to identify and use safer alternatives to chemicals that pose significant risks to workers and communities.
- **Healthy Homes and Schools**, which tracks hazards and works to reduce exposures to pesticides, radon, lead and other contaminants commonly found in homes and schools.
- **Healthy Communities**, which works to prevent or reduce exposure to hazardous substances, unplanned releases of toxic substances and other sources of pollution, and to assess the risks, opportunities and mitigation options for communities considering land use decisions and policies.
- **Healthy Waters**, which includes surveillance of Oregon beaches and recreational waters, monitors and advises on the health of Oregon recreational fisheries and addresses risks to drinking water drawn from unregulated drinking water sources.
- **Environmental Public Health Tracking Program**, which brings together environmental and human health data into a web-based portal to allow for and assist with the assessment of hazards and environmental health effects.

### **OREGON OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION**

350 Winter St. NE, Room 430

Salem, OR 97309

<http://www.orosha.org>, <http://www.osha.gov/>

Oregon OSHA compliance officers inspect workplaces, provide guidance to employers, and offer hazard-abatement assistance to employers who have received citations. Other enforcement staff members investigate workplace fatalities and serious injuries. Scheduled inspections are based on criteria reflecting an employer's history of workplace injuries and illnesses, previous Oregon OSHA inspections, number of employees, and an overall hazard rating of the employer's industry. Compliance officers also conduct workplace inspections on referral and complaints of unsafe working conditions.

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## APPENDIX II: GREEN INNOVATION IN OREGON INDUSTRIES: SELECTED EXAMPLES AND RESOURCES

### CLEAN TECHNOLOGY: SOLAR

Oregon is currently the largest photovoltaic manufacturing state in North America, with more than 600 megawatts of annual production capacity, including SolarWorld, the largest solar cell manufacturer in the United States. Oregon's announced solar projects represent an estimated capital investment of \$1.5 billion.

**example:** Chih-hung Chang's group at OSU is working on chemical solution deposition techniques for solar panels and for glass glazings that use more benign materials than currently used for thin-film solar.

**resources:** Oregon Nanotechnology and Microproducts Institute, Oregon Built Environment and Sustainable Technologies Research Center

### CLEAN TECHNOLOGY: GREEN BUILDINGS

Oregon is recognized as a leader in the design and construction of green buildings, with more LEED-certified green buildings per capita than any other state and a strong base of green architects, engineers, builders and producers of sustainable building materials (Allen and Potiowsky 2008).

**examples:** Rating systems offer context for continual improvement and innovation creates opportunity for investment to support ongoing competitiveness of regional players.

Finding substitutes for Living Building Initiative's "Red List" substances is a major obstacle for builders; a system is needed to make alternatives easier to identify.

Priority products for development of less-toxic alternatives include insulation, composite wood and resilient flooring products.

**resource:** Oregon BEST

### FOREST PRODUCTS

Oregon is the largest lumber producer in the United States and has significant number of wood products companies.

**examples:** Oregon lumber manufacturing companies such as Columbia Forest Products, Jeld-Wen, Weyerhaeuser, the Collins Companies, Ochoco Lumber Company and Hampton Affiliates known for continued innovation in their product lines. Kaichang Li, an OSU professor who worked with Columbia Forest Products on formaldehyde-free adhesive, has been working on another soy-based adhesive (post-PureBond) with very different applications.

**resources:** OSU's Wood Innovation Center, Oregon BEST

## HIGH TECHNOLOGY

Oregon is home to many high-tech, "small-tech" and semiconductor companies, including Intel's largest global manufacturing facility,

Oregon has more than 1,500 software companies.

**example:** A green chemistry formula developed in partnership with PSU replaced use of toxic solvents in some wet-etching processes ([http://www.sustainablebusinessoregon.com/articles/2010/09/green\\_chemistry\\_saves\\_millions\\_for\\_intel.html](http://www.sustainablebusinessoregon.com/articles/2010/09/green_chemistry_saves_millions_for_intel.html)).

**resources:** Oregon Nanotechnology and Microproducts Institute

**example:** Opportunities exist to develop decision support tools.

**resources:** Oregon Software Association, university-based computer science programs

## OUTDOOR GEAR AND APPAREL

Oregon is home to Nike, Columbia Sportswear, Adidas America, Keen, Nau, Dakine, Ruff Wear, Sunday Afternoons and LaCrosse/Danner.

Product design, green design and sustainability are a focus area in the industry ([www.oregon4biz.com](http://www.oregon4biz.com)).

**examples:** The sector has been a leader in the development of GreenXchange.

Development of green rating systems has involved Oregon-based Zero Waste Alliance and others.

**resource:** Oregon State University's Design and Human Environment Department

## ADVANCED MANUFACTURING

Oregon Iron Works is a leader in development of streetcars, electric vehicles and renewable energy.

Food processing is a \$6.1 billion industry in Oregon.

**example:** Metals manufacturing has opportunities related to green chemistry.

**example:** Reducing use of bisphenol A in canned foods is an area of opportunity. Truitt Brothers has introduced BPA-free plastic pouches for some products.

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