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Moving Toward Beyond Waste

In the Industrial Sector

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Table of Contents

1. Introduction 1

THE CHALLENGE 1

PAPER SCOPE AND METHODS 1

2. Influencing Environmental Performance in the Industrial Sector 3

DESIRED BEHAVIOR CHANGE AND PERFORMANCE OUTCOMES FOR THE INDUSTRIAL SECTOR 3

BEYOND WASTE OPPORTUNITIES AND THE INDUSTRIAL "LICENSE TO OPERATE" 5

LOOKING FOR EXAMPLES OF BEYOND WASTE BEHAVIOR IN THE INDUSTRIAL SECTOR 9

Key Factors in Moving Beyond "Stuck" 11

ACHIEVING THE BEYOND WASTE VISION IN THE INDUSTRIAL SECTOR 12

INTEGRATED STRATEGIES FOR ADVANCING THE VISION 13

Integrated Strategies: Targeting Substances 14

Integrated Strategies: Targeting Industry Sectors 14

Selecting Appropriate Policy Tools 19

Key Principles for Advancing the Vision 22

3. Voluntary Initiatives and Regulatory Responsiveness Programs 25

REGULATORY RESPONSIVENESS PROGRAM ELEMENTS 26

Eligibility Requirements 26

VERIFICATION MECHANISMS 27

INCENTIVES/RESPONSIVENESS 28

EXAMPLES OF REGULATORY RESPONSIVENESS AND COVENANT PROGRAMS 32

Voluntary Challenges 32

Voluntary Regulatory Responsiveness and/or Certification Programs 32

Covenant Programs 33

TOOL EVALUATION: REGULATORY RESPONSIVENESS PROGRAMS 35

Political feasibility 35

Technical/practical feasibility 35

Cost Considerations 35

Expected Outcomes 36

Challenges and Key Success Factors 39

Tool Bottom Line Assessment 39

4. Price Signals 41

INTRODUCTION 41

Scope 41

Context 41

GENERAL PRICE SIGNAL RESEARCH OBSERVATIONS 43

Price Signals and Economic Efficiency 46

Regarding The Term "Fee" Used in this Chapter 46

A BRIEF OVERVIEW OF IMPLEMENTATION EXPERIENCE 47

TOOLS: OPTIONS FOR ECOLOGY'S CONSIDERATION 48
Tool #1: Modified and expanded Hazardous Waste Planning Fee (Fee Team Model 1) 49
Tool #2: New Hazardous Waste Assistance Fee based on hazardous substance use (Fee Team Model 2) 54
Tool #3: Revised and expanded Hazardous Substance Tax (Fee Team Model 3) 56
Tool #4: Targeted feebate 59
Tool #5: Targeted Deposit/Refunds 64
Tool #6: Hazardous product tax (tax on products with hazardous content) 68
Tool #7: Fee on Waste Disposal (Incineration/landfilling) 69

CONCLUSION 72

5. Industry Sector Profiles: Electronics and Chemicals 73

ELECTRONICS INDUSTRY SECTOR 73
Industrial Hazardous Waste & Toxic Release Profile 73
What are the Process-Level Sources of Hazardous Waste? 75
Types of Waste 76
Trends affecting the Electrical and Electronics Industry Sector Waste Generation 77
Resource Productivity Improvements 78
Nanotechnology 79
Churn 79
Extended Producer Responsibility 79
Products of Service 80
Public Awareness and Empowerment 80
Critical Customers 81
Buyers 81
Industry associations 81
Current Industry Environmental Status and Key Initiatives 82
ISO Certification and EMS 82
The Bigger Picture: What are the Issues? What is being done about them? 83
The Issues 83
What is being done 84
Opportunities for change within the Electronics Industry 87

CHEMICAL INDUSTRY 87
Industrial Hazardous Waste & Toxic Release Profile 89
What are the Process-Level Sources of Hazardous Waste? 90
Types of Waste 91
Trends affecting the Chemical & Allied Products Industry Sector Waste Generation 92
Resource Productivity Improvements 93
Churn 93
Public Awareness and Empowerment 93
Critical Customers 94
Buyers 94
Suppliers 94
Industry associations 94
Current Industry Environmental Status and Key Initiatives 94
Responsible Care® 94
Responsible Care 14001 95

6. Goals and Action Steps 96

FIVE-YEAR GOALS (2008) 97
Overall Goals 97

Goal #1: The public in Washington is aware of the Beyond Waste Vision, as well as its expected benefits for the State. *97*
Regulatory Responsiveness Related Goals 99
Goal #2: Ecology is actively collaborating with at least 10 industrial sectors to develop sector-specific strategies for progressing toward the Beyond Waste Vision. *99*
Goal #3: Ecology is leveraging and linking with external voluntary initiatives to encourage and facilitate beyond waste behaviors and performance outcomes. *100*
Goal #4: At least 50% of industrial actors in Washington have implemented some form of continuous improvement-focused environmental management system. *102*
Price Signal Related Goals 103
Goal #5: Washington has a revamped Hazardous Waste Planning Fee that is aligned with the Beyond Waste Vision and that has stronger incentives for reducing hazardous wastes and toxic releases. *103*
Goal #6: The State has determined whether it wants to be a leader in using price signals to achieve the Beyond Waste Vision, and has identified specific opportunities to use targeted price signals in its substance and sector-focused integrated strategies. *105*

TEN-YEAR GOALS (2013) 108
Regulatory Responsiveness Related Goals 109
Goal #7: Ecology is actively collaborating with 15-20 industry sectors in the State to develop, implement, and adapt sector-specific strategies for progressing toward the Beyond Waste Vision *109*
Goal #8: 70% of industrial actors in Washington have implemented some form of continuous improvement-focused environmental management system. *109*
Price Signal Related Goals 110
Goal #9: The State has successfully implemented price signal tools identified during the five-year evaluation program. *110*

7. Works Cited 111

8. Glossary 119

Appendix A: Possible Considerations for Program Evaluation Criteria 121
Technical feasibility 121
Practical feasibility 121
Political feasibility 121
Cost effectiveness 121
Expected outcomes 122
Challenges and key success factors 122

Appendix B: Examples of Regulatory Responsiveness and Covenant Programs 123

EPA'S PERFORMANCE TRACK PROGRAM 123
Environmental Benefits 123
Performance Track Membership Requirements 124
Program Verification 125
Participant Benefits 125
Performance Track and State Regulatory Responsiveness Programs 127

ENVIROSTARS PROGRAM—WASHINGTON 127
GREEN PERMITS PROGRAM—OREGON 128
PROPOSED GREEN TIER PROGRAM—WISCONSIN 129
BAVARIAN COVENANT PROGRAM - GERMANY 130
DUTCH COVENANT PROGRAM - NETHERLANDS 131
Appendix C 133
TOOL #1, REVISED PLANNING FEE OPTION B 133
APPENDIX D 135
TOOL #1, REVISED PLANNING FEE OPTION C 135
Appendix E: Overview of the Minnesota Toxic Pollution Prevention Act Fee Structure 141
CALCULATING THE FEE 141
TRI reporters 141
Total pounds of toxic chemicals 141
Calculating the fee 141
Total number of toxic chemicals 142
Large Quantity Generators (LQGs) 142
Appendix F: Overviews of the Materials Accounting Programs in Massachusetts and New Jersey 143
MASSACHUSETTS TOXICS USE REDUCTION ACT 143
Results 143
NEW JERSEY WORKER AND COMMUNITY RIGHT TO KNOW ACT 143
Results 144
Appendix G: Overview of Sweden's NOx Feebate Program 145
AN OVERVIEW 145
POLICY ISSUES 146
SOME FURTHER READING 146
Appendix H: Getting the Taxes Right 148

1. Introduction

THE CHALLENGE

The Washington Department of Ecology (Ecology) has established a bold vision to improve economic competitiveness, environmental quality, and public health in the state. The end goal of driving the need for vigilance associated with waste and hazardous substances from the Washington economy offers a compelling vision, with substantial economic and competitiveness benefits to Washington businesses and the overall economy. To the extent that business can move "Beyond Waste" by eliminating the use of practices and substances that require a high degree of environmental management vigilance, the long-term competitiveness of Washington businesses will improve along with environmental quality and public health.

Ecology's Beyond Waste Vision:

"We can transition to a society that views waste as inefficient uses of resources and believes that most wastes can be eliminated. Eliminating wastes will contribute to social, economic, and environmental vitality."

The core challenge is how to get to this compelling vision without creating significant economic dislocation along the way. In other words, the challenge is to find a path to achieving the Beyond Waste Vision that effectively aligns desired environmental improvement behaviors with behaviors needed for business success and competitiveness. Since the industrial sector plays a significant role in generating wastes and using hazardous substances in Washington, concerted attention and action to change certain behaviors among industrial sector actors are key to achieving the Beyond Waste Vision.

PAPER SCOPE AND METHODS

This paper begins with some thoughts about the behaviors and outcomes, as well as opportunities and constraints, which are likely to shape the ability and timing for achieving the Beyond Waste Vision in the industrial sector. Chapter 2 presents two approaches for targeting Beyond Waste efforts to reduce the presence of hazardous or toxic substances in the Washington economy and to reduce the generation of solid and hazardous waste. Based on our research and interviews, we also share several key considerations that we encourage Ecology to keep in mind during the 2003 Beyond Waste strategic planning exercise.

Chapters 3 and 4 explore the potential effectiveness and feasibility of utilizing two types of policy tools to influence industrial behavior – regulatory responsiveness programs and price signals. In these chapters, we assemble and synthesize key evidence and lessons from the broader experience with these tools in the U.S. and internationally so as to inform Ecology's consideration of these tools. While these two policy tool categories were selected by Ecology for more detailed assessment, they should not be viewed as the only policy tools that can be effective in moving the industrial sector toward the Beyond Waste Vision. A more comprehensive summary of policy tool options, including

regulatory bans technical assistance, and education, was developed earlier for this project.[1]

Chapter 5 examines two industry sectors, electronics and chemicals manufacturing, that dangerous waste projections indicate could account for a significant share of overall industrial hazardous waste generation over the coming decade.[2] We use these industry profiles to highlight the importance of understanding the opportunities and constraints that affect specific industry sectors. Such information is essential to optimize the targeting and alignment of policy interventions to reduce waste, hazardous substance use, and environmental risk in the industrial sector.

Finally, Chapter 6 of this report presents a set of mid-range goals (5-year and 10-year) related to regulatory responsiveness programs and price signals. In addition, the goals and action steps include a set of first steps that the consultant team believes would be necessary to launch a broader sector-based initiative which could include the use of other tools that are not evaluated in this report.[3] These goals reflect the level of achievement that Ecology would need to strive for in the short to mid-term (5 to 10 year time frame) to progress aggressively toward the Beyond Waste Vision in the industrial sector. This section also recommends specific action steps that the consultant team believes Ecology would need to take to achieve these goals.

Clearly achieving the Beyond Waste Vision in the industrial sector will be a long-term effort. The goals and action steps represent initial steps along this journey that are designed to actively engage government, industry and others in collaborative efforts to move toward the Beyond Waste Vision in a manner that maximizes benefits to all.

The consultant team hopes that the ideas and assessments provided in this report will be useful to the Department of Ecology as the agency begins development of its Strategic Plan for achieving the Beyond Waste Vision.

[1] The Consultant Team's Tools Matrix Memo of September 25, 2002 catalogues many of the policy tools available for influencing industrial sector behaviors that affect material use and waste generation. Chapter 2 of this report briefly discusses this broader range of tool options.

[2] The chemicals and electronics industry sectors were selected by Ecology for more detailed consideration in this report.

[3] The goals and action steps in Chapter 6 do not address substance-focused integrated strategies, such as the Mercury Chemical Action Plan. The consultant team believes that both substance-focused and sector-focused integrated strategies are important approaches for achieving the Beyond Waste Vision. Although discussed in Chapter 2, this report does not focus on substance-based strategies since the Department of Ecology has made significant progress in addressing this approach through its Persistent Bioaccumulative Toxins (PBT) Strategy and Implementation Plan (see http://www.ecy.wa.gov/programs/eap/pbt/pbtfaq.html).

2. Influencing Environmental Performance in the Industrial Sector

This chapter explores several of the factors that influence industrial sector environmental performance, as well as the broad implications that these factors have for the effectiveness of policy tools designed to alter behaviors and performance outcomes. The chapter also presents two approaches for developing integrated strategies to achieve the Beyond Waste Vision.

DESIRED BEHAVIOR CHANGE AND PERFORMANCE OUTCOMES FOR THE INDUSTRIAL SECTOR

What behavior changes and performance outcomes does Ecology's Beyond Waste Vision imply for industrial sector actors? A clear articulation of these desired behaviors and outcomes is essential to building support and understanding for the vision, and for identifying appropriate policy tools for achieving the vision as it relates to the industrial sector. Potential desired behaviors include:

- Foster continual improvement-focused, organizational cultures that produce systemic approaches to waste elimination and environmental management.
- Increase attentiveness to the risk profile of materials used in processes and products.
- Extend attentiveness to and responsibility for the lifecycle environmental impacts of products, processes, and materials.

Potential desired performance outcomes include:

- Generate less waste (solid and hazardous).
- Use fewer hazardous substances (in products and processes).
- Reduce the environmental risk profile of materials used in products and processes.
- Participate in efforts to maximize the recovery and reuse of materials.

For the Beyond Waste Vision to succeed, individual industrial actors will need to probe deeper to understand "what does the Beyond Waste Vision imply that I, as an industrial sector actor, need to do differently than I'm doing today?" For some industrial organizations, they will be well along toward the vision and have identified a path that links business success with the behaviors and performance outcomes implied by the vision. For others, they may not be able to envision their organization operating in a manner consistent with the long-term Beyond Waste Vision due to technology or cost barriers, and they may perceive the vision to be a threat to their business survival. Understanding the opportunities and constraints that shape industrial sector behavior and outcomes is essential to identifying policy solutions that can navigate society toward the Beyond Waste Vision.

We believe that achieving the Beyond Waste Vision in the industrial sector will require behavior changes that address two key fronts: efficiency and eco-effectiveness. Significant opportunity exists for reducing material and waste flows and the overall environmental footprint of industrial activity through efficiency improvements. As McDonough and Braungart note, however, being highly efficient at the "wrong" things is not necessarily a good thing.[4] Efforts are also needed to transition to production techniques and materials that have no or minimal harmful impacts on human health, environmental quality, and ecosystem integrity – or, as McDonough and Braungart call for, that even have a positive and nurturing effect. Both paths are necessary for transitioning to the Beyond Waste Vision. A variety of policy tools must be aligned to form integrated strategies to encourage both efficiency and eco-effectiveness improvements in various industrial sectors.

Efficiency. In the case of efficiency, globalization and economic competitiveness needs are driving trends such as lean manufacturing and dematerialization of products that have important spillover environmental benefits. Business goals and environmental goals are well-aligned, as businesses are receiving strong signals that they must reduce costs and improve resource productivity to stay in business. Businesses and trade associations are typically taking the lead in driving efficiency improvements in the industrial sector, with some sectors far in front of others. Often, these efforts translate into less capital, energy, space, and materials needed to produce a given level of output.

Government can play three key roles in encouraging efficiency improvements. First, government can serve as a catalyst for implementing efficiency improvements, providing information or resources that enables companies to implement efficiency improvements. Second, government can remove regulatory obstacles to efficiency improvements. Third, government can respond to and reinforce efficiency advancements made by specific companies and sectors by demonstrating that there is external demand for such performance improvement.

Eco-Effectiveness. Government has a much larger role to play in leveraging eco-effectiveness improvements, which aim to replace materials and practices having environmental and/or public health hazards or risks with environmentally-benign or nurturing materials and practices. In many cases, increasing eco-effectiveness in the industrial sector is a demand-side challenge. Drivers for increasing eco-effectiveness are felt by businesses when critical customers – product purchasers, shareholders, regulators, neighbors, or the public – demand these attributes (shifting expectations associated with their social license to operate, and in some cases, the regulatory license to operate). Drivers for increasing eco-effectiveness are also felt when their customers are willing to pay more for a product or service with eco-effective attributes (improving their economic license to operate).[5]

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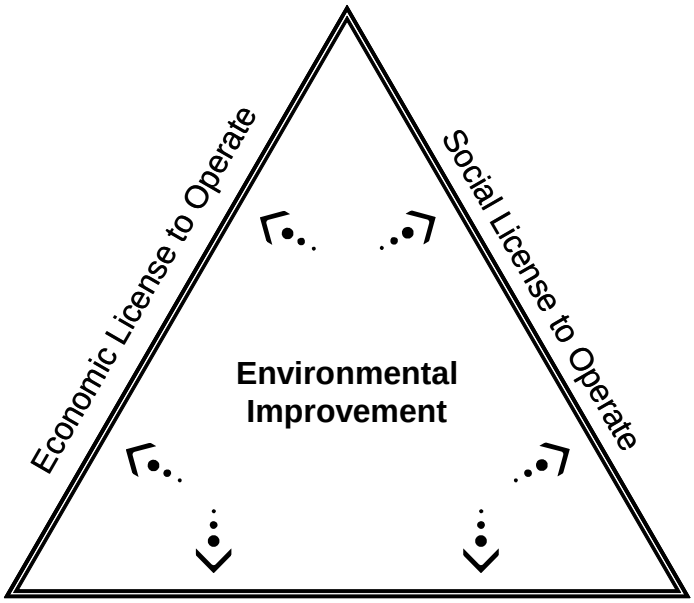
[4] McDonough, William and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make Things.* North Point Press, April 2002. pp. 63-67.

[5] In many cases, producing eco-effective products or services may actually cost less than producing conventional products and services. However, the conversion to producing eco-effective products and services is often likely to entail some risk, uncertainty, investment, and culture change. In many cases, the challenge will be to get over this initial hump.

BEYOND WASTE OPPORTUNITIES AND THE INDUSTRIAL "LICENSE TO OPERATE"

While industrial sector actors have made significant progress in reducing waste and environmental impacts in recent decades, opportunities to further reduce waste, inefficiency, and risk abound. At the level of individual industrial organizations, some experts suggest that as much as 70 to 90 percent of industrial activity comprises non-value added activity – movement, capital, materials, energy, and processing that do not add value to completed products and services or address customer needs.[6] Others point to the opportunity to eliminate liabilities posed by the use of numerous hazardous substances in production processes and products.[7]

At the state level, businesses and the public bear the sizable cost of the vigilance necessary to manage wastes and hazardous substances. Despite these compelling inefficiencies and opportunities, many industrial actors appear to be "stuck" in an equilibrium that does not reflect a trajectory fully toward Beyond Waste, bounded by economic, regulatory, and cultural constraints.[8] The presence of significant opportunities for efficiency improvements does not necessarily mean that they are easy to achieve. There is a growing sense that picking the remaining low-hanging fruit will not be sufficient to achieve the goals consistent with the



[6] For two examples of inefficiency estimates, see Simon Caulkin, "Waste Not, Want Not," *Guardian Observer*, September 8, 2002, and E.U. von Weizsacker, Amory Lovins, and Hunter Lovins. *Factor Four: Doubling Wealth, Halving Resource Use*. London: Earthscan, 1997. Lean manufacturing research and literature has documented productivity improvements approaching these estimates.

[7] For example, William McDonough and Michael Braungart us the term "products plus" to refer to additives that the customer did not request and did not know were included in a product but that may be harmful to human health or environmental quality. See William McDonough and Michael Braungart. 2002. *Cradle to Cradle: Remaking the Way We Make Things*. North Point Press, April 2002.

[8] Robert Kagan at the Center for Law and Society at UC Berkeley and Neil Gunningham are conducting interesting research on how firms react to market conditions and regulatory policies when setting environmental policies. See Kagan and Gunningham. *From Adversarialism to Partnership: Business, Regulation, and the Environment*. forthcoming.

Beyond Waste Vision, with relatively few companies able to break free with significant environmental and economic performance gains.

In the current equilibrium, the actions of industrial actors are bounded by three key "licenses to operate" – regulatory, social, and economic – that affect environmental outcomes.[9] The regulatory license to operate sets the floor for performance, ensuring that organizations cannot fall too low without penalty. The social license to operate drives some actors to be responsive to specific societal expectations and needs by improving environmental performance beyond that required for regulatory compliance. Finally, the economic license to operate constrains how much they are able to invest in improving environmental performance. The relative balance of these three "licenses" can vary significantly among industry sectors, but in all cases they guide and constrain the actions of industrial actors.

This begs the question – how can we move beyond "stuck" to unleash substantial progress toward the Beyond Waste Vision among industrial sector actors? The answer lies in altering one or more of the three dimensions in the current equilibrium.

Regulatory License to Operate. Expanding environmental laws and regulations to require behavior change can be an effective and powerful approach for achieving a desired environmental performance outcome. Significant new regulatory requirements, such as bans on certain practices or the use of certain substances, are likely, however, to be limited to circumstances where there is significant public consensus on the need for change and where alternative production technologies or materials are readily available to minimize the economic dislocation of change. As one expert stated, "Though there may still be need for new regulations in certain areas, no one realistically expects the current regulatory structure to be expanded to cover every imaginable substance and circumstance."[10]

It does not seem likely that clear and powerful drivers for major regulatory "ratcheting" will emerge in the next 2 to 5 years. One can point to evidence that pollution and waste continue to pose increasing problems for environmental quality, ecosystem integrity, and public health.[11] Our research suggests, however, that these signals are not sufficiently focused or intense to generate the type of major legislation and regulatory actions that followed the Union Carbide accident in Bhopal in 1986 (e.g., EPCRA and the Toxic Release Inventory) or the groundswell of state and federal interest in pollution prevention that precipitated legislation in the late 1980s and early 1990s (e.g., Federal Pollution Prevention Act of 1990, Massachusetts and New Jersey chemical use reporting).

At present, we do not see evidence of governments pursuing bold, broad-based legislative and regulatory actions that aim to significantly raise the floor for environmental performance related to toxic substances and waste. Instead, new regulatory activity appears to be focused on specific substances that exhibit persistent risk, that have viable alternatives, and that have broad public support for action. For example, phasing out or banning certain persistent bioaccumulative toxic substances (e.g., mercury, lead) will likely become politically and economically feasible.

[9] See Kagan and Gunningham, forthcoming.

[10] Speir, Jerry. "EMS and Tiered Regulation, or Getting the Deal Right," *Regulating from the Inside: Can Environmental Management Systems Achieve Policy Goals* Cary Coglianese and Jennifer Nash, eds., Resources for the Future, 2001.

[11] See examples of local evidence in "Special Report: Our Troubled Sound", *Seattle Post-Intelligencer*. November 18-22, 2002. http://seattlepi.nwsource.com/specials/sound/

New and expanded regulation will undoubtedly play an important role in reaching the Beyond Waste Vision, although in the absence of powerful new drivers or crises, regulatory-driven progress will be incremental. The inability of the command and control regulatory system to deliver fully on the Beyond Waste Vision underscores the importance of approaches that encourage performance beyond the legal minimums.

Social License to Operate. The social license to operate is an increasingly powerful force leveraging beyond compliance environmental performance.[12] Industrial actors have a range of *critical customers* – product purchasers, shareholders, employees, suppliers, neighbors, non-governmental organizations, and the interested public – whose behavior or responsiveness the organization depends on to maintain its license to operate and to deliver consistently increasing shareholder value. The environmental performance expectations of critical customers play a powerful role in shaping an organization's willingness and success in embracing environmental improvement opportunities beyond those required. It should be noted that the presence and strength of environmental performance expectations can vary across organizations and industry sectors. For example, large consumer product companies and chemical companies are likely to have greater social license to operate pressures than a small manufacturer that is a less visible target of environmental performance expectations or that has small and less risky environmental impacts.

It is likely that the social "license to operate" pressures for environmental improvement will continue to rise, with legal and regulatory responses lagging behind.[13] While the effects of these trends will vary across organizations and industries, social license to operate pressures are likely to be a key and essential driver for the industrial environmental performance improvement necessary to achieve the Beyond Waste Vision. Government can play important roles in leveraging this dimension. First, government is a critical customer of many industrial sector organizations as a purchaser of goods and services. Government procurement is a powerful tool for leveraging Beyond Waste behavior.[14]

Second, social license to operate pressures from the public and third parties often stem from information on environmental quality, public health, and industry environmental performance that is collected and shared by government agencies. Government efforts to enhance the quality, presentation, and scope of information available to the public can directly affect the formation of critical customer expectations, as well as the strength of political support for regulatory change.

Third, government, through its publicly-stated vision statements, goals, partnerships, and voluntary programs, can provide a coordinating framework in which diverse social license to operate pressures can be harnessed constructively and efficiently to facilitate beyond compliance behaviors. For example, the U.S. Environmental Protection Agency

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[12] See John Elkington. *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*. New Society Publishers, 1998.

[13] The consultant team's trends memo outlines several trends that are raising the environmental performance expectations held by critical customers. See Cascadia Consulting Group and Ross & Associates. *Beyond Waste Task 2—Trends and Targeting*: *Draft Report*. Washington State Department of Ecology, July 31, 2002.

[14] For example, California recently established state procurement guidelines for modular office equipment that incorporate environmental performance criteria (http://www.ciwmb.ca.gov/GreenBuilding/Specs/Furniture/). For more information on leveraging government procurement, see the Government Purchasing Project (http://www.gpp.org/).

partnered with the Water Environment Federation and the Association of Metropolitan Sewerage Agencies to develop a voluntary Environmental Management System program for biosolids management, with public participation and third-party verification components.[15] The development process involved diverse critical customers, including environmental interest organizations, and it has brokered a framework that efficiently and effectively channels critical customer expectations to leverage desired behaviors. Government activities that leverage the social license to operate are important for fostering *demand* for behaviors consistent with the Beyond Waste Vision.

Economic License to Operate. The economic license to operate typically constrains how much an organization is willing and able to invest in environmental performance improvement beyond regulatory minimums. While the specific economic license to operate may vary, organizations are typically expected to maintain profitability and to meet established shareholder expectations. The resources available to support activities that result in beyond compliance environmental performance can vary significantly by industry sector and company, based on the market structure and numerous organizational management and strategy factors. For example, industrial actors in highly competitive markets with low product differentiation can have limited ability to invest heavily in beyond compliance environmental performance improvement without the promise of rapid financial returns.

Furthermore, some industries have significant investment tied up in capital and infrastructure which inhibits their ability to rapidly convert to more environmentally-benign alternative technologies. In addition, environmental improvement and pollution prevention initiatives typically must compete with other business needs for limited resources and organizational attention.[16]

There are several trends underway that affect industrial sector actors' economic license to operate. First, the current recession has put significant economic pressure on many industrial actors, causing deep cuts in research and development, capital equipment and projects, and non-revenue generating activities and programs. Interviews with company environmental representatives indicate that the weak economic outlook translates into the need for them to make a stronger business case for activities that go beyond regulatory minimums. Second, an increasing number of Washington businesses are pursuing major resource productivity improvements through the implementation of lean manufacturing methods.[17] Many industrial efficiency improvements achieved through lean methods translate directly into less waste and less risk.[18] Third, the mobility of capital limits the tolerance of industrial actors for absorbing environmental costs. If environmental costs, taxes, or fees are raised sufficiently high, businesses have the potential to close or relocate their facilities, or avoid citing new development in the jurisdiction. The exact level of this threshold is likely to vary significantly among industries and companies.

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[15] For information on the National Biosolids Partnership and its EMS program, see http://www.biosolids.org.

[16] The Michigan Source Reduction Initiative Report found that even pollution prevention projects that have a high return on investment often do not compete effectively for internal resources and organizational attention due to factors such as relatively small project size (see http://www.nrdc.org/cities/manufacturing/msri/msriinx.asp).

[17] See http://www.nwlean.org for information on lean manufacturing, with a particular focus on the Northwest.

[18] See Ross & Associates. *Lean Manufacturing and the Environment: Research on Advanced Manufacturing Systems and Their Relationship to Environmental Performance and the Regulatory Framework*. U.S. Environmental Protection Agency, forthcoming.

Government can affect the economic license to operate in several ways. First, it can take steps that lower the cost to industry of maintaining regulatory compliance or engendering environmental performance improvement. For example, there is evidence that reducing the lead time for obtaining regulatory information, applicability determinations, and permits can facilitate the implementation of pollution prevention activities and lean manufacturing resource efficiency gains.[19] Low interest loans for pollution prevention can also enhance the economic license to operate, as can government support for research and development targeting more environmentally-friendly technologies. Second, it can alter price signals through the imposition or relaxation of taxes, fees, or subsidies to increase the relative cost of hazardous material use and waste generation. Third, it can use its purchasing power, as discussed above under the social license to operate, to create economic opportunity for those achieving levels of improved environmental performance.

Moving beyond "stuck" will require shifts in the current equilibrium. By working to push the boundaries of all three dimensions – regulatory, social, and economic – government has a better chance of breaking through the constraints and tapping the opportunities that can result in new equilibriums that are progressively closer to the Beyond Waste Vision.

LOOKING FOR EXAMPLES OF BEYOND WASTE BEHAVIOR IN THE INDUSTRIAL SECTOR

What industrial actors are already exhibiting these "Beyond Waste" behaviors and outcomes, and why? One approach to determining how to encourage desired behaviors and performance outcomes is to look for examples of companies that have moved beyond "stuck" and to understand why and how they achieved this.

A first set of examples comes from companies that have openly committed to Beyond Waste types of behaviors and performance outcomes or that have demonstrated a willingness and ability to perform significantly above regulatory minimums. Companies such as 3M, BP, Collins Aikman, Cutter & Buck, DuPont, Interface, Patagonia, and others frequently appear in the literature as "case studies" of companies that are embracing Beyond Waste type behaviors.[20] Most of these companies cite a combination of factors for their commitment to implementing Beyond Waste behaviors. Some of these companies face strong social license to operate pressures, and they believe that business value can be increased by actively working to communicate with and address critical customer expectations. Some see these actions as also contributing to the organizations' long-term competitive advantage – expanding opportunities and success under their economic license to operate.

[19] See U.S. EPA. *Evaluation of Implementation Experiences with Innovative Air Permits: Results of the U.S. EPA Flexible Permit Implementation Review*. http://www.epa.gov/ttncaaa1/t5/meta/m24005.html; and *Lean Manufacturing and the Environment.* U.S. EPA, November 2002.

[20] The companies listed here are frequently cited, along with a limited number of other companies, as leaders in some aspects of environmental performance, commitments, and/or activities. It should be noted that the relatively small list of companies that have, for a variety of reasons, stepped out in front and are routinely profiled in environmental literature and case studies represent a very small percentage of the overall number of companies in the industrial sector. Achieving the Beyond Waste Vision in the industrial sector will require efforts that engage the mainstream of companies.

In most cases, these organizations have worked hard to create internal management systems that hold superior environmental performance as a core business value and that focus on continual environmental improvement. For example, the 3M Company's Pollution Prevention Pays initiative has had a strong impact on the company's internal culture since 1975, and has prevented more than 807,000 tons of pollution and saved the company $827 million.[21]

Two key factors that are often common to many companies in this set are (1) the presence of strong leadership within the organizations that see proactive environmental management and improvement as key to business success and the maintenance of the social and economic licenses to operate, and (2) the presence of strong internal management systems that focus on continual environmental improvement and that work systematically to incorporate environmental considerations and goals throughout the organizations (beyond just for the environmental staff).

A second set of examples from recent research on the implementation of lean manufacturing systems at U.S. companies provides compelling examples in which industrial facilities have achieved resource productivity improvements ranging from 30 to 70%.[22] Lean methods, typically based on the Toyota Production System pioneered in Japan, are realigning factories to drive unnecessary capital equipment, material, energy, movement, space, and materials from production processes. In addition to such major efficiency improvements, there is also evidence that implementation of lean systems creates an effective platform for incorporating sustainability considerations and tools into an organization. For example, lean pre-production planning (3P) and kaizen events have been used by some companies to eliminate hazardous materials and waste streams from manufacturing processes.[23] Similarly, a furniture manufacturer found that Design for Environment tools dovetailed well with their lean design for manufacturability process, enabling the company to meet California's new "green" procurement specifications for office furniture and secure a $60 million contract with the state.[24] These findings suggest that efficiency improvements, if achieved through a dynamic, continual improvement culture like those required for lean implementation, can provide an effective transition path to reduced risk and sustainability.[25]

[21] See http://www.mmm.com

[22] See examples in Jeffrey Liker, ed. *Becoming Lean: Inside Stories of U.S. Manufacturers*. Productivity Press, 1998; Richard McCormack. *Lean Machines: Learning from the Leaders of the Next Industrial Revolution*. Publishers & Producers, 2002; Paul Hawken, Amory Lovins, and Hunter Lovins. *Natural Capitalism*. Little, Brown and Company, 1999; and Ross & Associates. *Pursuing Perfection: Case Studies Examining Lean Manufacturing Strategies, Pollution Prevention, and Environmental Regulatory Management Implications*. U.S. EPA, 2000.

[23] Kaizen is a Japanese term used to describe team-based rapid improvement events that are central to many companies' lean manufacturing initiatives. 3P is a related team-based rapid improvement technique that focuses more on product or process design. 3P appears to be highly compatible with Design for Environment techniques.

[24] Ross & Associates. *Lean Manufacturing and the Environment: Research on Advanced Manufacturing Systems and Their Relationship to Environmental Performance and the Regulatory Framework*. U.S. EPA, forthcoming.

[25] William McDonough and Michael Braungart discuss the hazard of becoming efficient at the wrong thing in their book *Cradle to Cradle*, but they acknowledge the value of efficiency improvements "as a tool within a larger, effective system" (p.65).

KEY FACTORS IN MOVING BEYOND "STUCK"

So what lessons can be drawn from companies that have made significant advances toward Beyond Waste behaviors and performance outcomes? One or more of the following three factors appear in examples of programs and industries that have made significant "beyond compliance" progress toward the Beyond Waste Vision.

Culture Change. Many successful organizations create organizational cultures based on employee-involved continual improvement. Common elements of these organizational cultures include:

- A systemic approach to *continual improvement*.
- A systemic and on-going effort to identify, evaluate, and *eliminate waste* that is *embraced and implemented by operations personnel*.
- *Metrics* that provide rapid performance feedback.
- Engagement with the *supply chain* to improve enterprise-wide performance.

It should be noted that these are precisely the cultural attributes that environmental management agencies and organizations are working to promote with Environmental Management Systems (EMSs). Many leader organizations are implementing continual improvement-focused management systems that not only address operations, but that also address product and process design, strategic planning, and other business functions.

Powerful Drivers. Most companies that have made substantial progress toward the Beyond Waste Vision are backed by powerful drivers, such as business competitiveness and public and stakeholder pressures. Even in the handful of cases where a corporate leader has a strong personal conviction to pursue sustainability goals, the leader typically must find a strong business case that aligns environmental objectives with business and competitiveness needs to make significant progress.[26]

Powerful drivers are beneficial for several reasons. First, the organizational upheaval necessary to implement a waste elimination-focused, continual improvement culture (discussed above) is often massive. Some veteran managers go as far to say, "if you don't have a crisis, invent one." Second, research on pollution prevention has found that environmental drivers can often be relatively weak when compared with drivers associated with core business operations. Pollution prevention often "pays", but evidence suggests that such projects do not always effectively "compete" for limited organizational attention and resources.[27] When drivers for environmental improvement are aligned with business and competitiveness drivers, the business case for change is strong.

External Responsiveness. Responsiveness from critical customers – such as product or service purchasers, shareholders, regulators, environmental organizations, and the public – is often key to encouraging companies to take additional steps toward the

[26] Several companies in the U.S., such as Interface, Inc., have aggressively embraced sustainability as a fundamental business goal. See The Natural Step, www.thenaturalstep.org, for additional examples.
[27] Studies such as the Michigan Source Reduction Initiative Report (NRDC) indicate that even when P2 projects have positive return on investment (ROI), they are often too small in value or peripheral to core organizational activities to win attention and resources.
http://www.nrdc.org/cities/manufacturing/msri/msriinx.asp

Beyond Waste Vision. Responsiveness from critical customers can come in different forms, including willingness to purchase goods or services at a higher price or in greater amounts, recognition, support for company plans, reduced insurance premiums, regulatory responsiveness, or financial incentives. In each case, these response actions send reinforcing signals to the company that recognize progress and encourage further action. Corporate environmental managers report that positive external responsiveness to Beyond Waste-type behaviors and outcomes are often critical ingredients for making the business case for change.[28] Businesses often move to respond to changing demand from customers. It is perhaps through this third, "demand-side" driver that pressures will mount for reducing the presence of hazardous materials in products.

ACHIEVING THE BEYOND WASTE VISION IN THE INDUSTRIAL SECTOR

For the industrial sector, the Beyond Waste Vision is both bold and compelling. It is bold in that achieving the Vision will require major efficiency improvements in some areas and entirely new production modes in others. It is compelling in that achievement of the Vision will undoubtedly improve environmental quality and public health while alleviating business and society of the economic costs that are currently required to manage wastes and hazardous materials.

"What will it take to achieve the Beyond Waste Vision in the industrial sector?" We believe that it is important to recognize that achieving the Beyond Waste Vision in the industrial sector will require technological change, time, and financial resources, and responsiveness by critical customers.

Technological Change. In many cases, altering the economic license to operate sufficiently to significantly reduce material flows and waste generation will require new production modes and technological change. While trends such as lean manufacturing are delivering quantum leaps in production efficiency for many firms, more fundamental changes will be needed for many production processes to meet the goals of the Beyond Waste Vision. Unfortunately, the economic license to operate constrains the ability of many individual companies to invest sufficiently in the new technologies that will be required to bring new, "eco-effective" technologies on-line.[29] Partnerships (intra-industry, inter-industry, and industry-government) to research, develop, and commercialize such new technologies are essential to making this generational technology shift. In many cases, it will make sense to shift funding for new and better treatment processes to the development of new and better manufacturing and production techniques.

Time. The journey to achieve the Beyond Waste Vision in the industrial sector will be a long-term one, with progress made faster in some sectors than others. First, it will take time to plan, implement, and adapt programs. While some progress can undoubtedly be made quickly, building broad support for bold action will not occur overnight. If the

[28] These findings are based on interviews with corporate environmental managers. Also see Global Environmental Management Initiative (GEMI) *Environmental Improvement Through Business Incentives*. GEMI, March 1999. www.gemi.org/IDE_004.pdf

[29] "Eco-effective" refers to being *effective*, or successful, at addressing a "rich mix of considerations and desires", which includes conventional design objectives (e.g., functionality, cost) as well as environmental and social design objectives. See *Cradle to Cradle*, pp. 68-91.

Department of Ecology moves too fast on certain fronts without taking time to build support, the political backlash could set back broader efforts to achieve the Beyond Waste Vision.

Second, given that the lifespan of some industrial sector equipment and infrastructure (which often defines modes of production, resource use and waste generation) is more than 30 years, technological change will take time. It can take just as long to truly and broadly change behaviors and organizational cultures. Yet steady progress that builds over time can lead to exponential change in later years. The seeds of change for the next generation are planted in the present.

Financial Resources. Achieving the Beyond Waste Vision in the industrial sector will require societal investment in key areas. It should be noted that significant progress can be made toward the Beyond Waste Vision in some sectors, primarily through efficiency improvements, at a net savings. Lean manufacturing achievements of 30 to 70 percent increases in resource productivity are currently demonstrating this reality, reducing material use and waste generation while enhancing profitability and competitiveness.

Efficiency improvements, however, are not sufficient to achieve the Beyond Waste Vision. Investment will be necessary to develop new technologies and production techniques, particularly where environmentally-benign alternatives (materials and process techniques) are not readily available or economically viable. In addition, shifts in the economy that are linked to achieving the Beyond Waste Vision may cause economic hardships for specific groups of companies and/or workers in the short to mid-term. Washington may decide that it is in society's interest to support financially the economic transition in certain sectors for finite periods of time.[30]

Achieving the Beyond Waste Vision is also likely to require significant, sustained investment by the State of Washington and the Department of Ecology. Developing and implementing bold and aggressive integrated substance-based and sector-based strategies (see discussion below) will likely take increased levels of staff time and financial resources.

Critical Customer Responsiveness. As discussed above, external responsiveness is essential for enabling companies to take bold steps in advancing toward the Beyond Waste Vision. To the extent that customers are "willing to pay" for Beyond Waste behaviors (e.g., through product prices or taxes), or are otherwise able to reduce costs or increase value for the company (as in the case of regulators or NGOs), companies will be able to advance further toward the Vision.

INTEGRATED STRATEGIES FOR ADVANCING THE VISION

A key challenge of developing effective integrated strategies for achieving the Beyond Waste Vision in the industrial sector is deciding where to focus. There are two major "entry points" for developing integrated Beyond Waste strategies: material flows/waste

[30] Government may opt to direct financial resources, in the form of grants/direct compensation, job training, low interest loans, etc., to assist firms and workers if it is determined that they will be affected adversely and significantly by efforts to achieve the Beyond Waste Vision. It should be noted that several research studies indicate that the net (and long-term) economic and employment benefits of policy efforts to improve environmental quality are often positive. However, specific pockets of economic dislocation in the short and mid-term can be very real, and it may be in the State's interest to mitigate these economic impacts.

streams and industrial sectors/processes. Both approaches should be employed simultaneously to make progress toward the Beyond Waste Vision.

INTEGRATED STRATEGIES: TARGETING SUBSTANCES

First, there are certain *substances* (in material flows and/or waste streams) for which an integrated strategy that cuts across multiple industrial sectors in the Washington economy is likely to be the most effective approach for driving rapid progress. For example, the Department of Ecology has developed a Persistent Bioaccumulative Toxin (PBT) Strategy that targets 22 PBTs that the State wishes to virtually eliminate.[31]

The following criteria could be used to determine whether a specific material or waste might be appropriate for targeting:

- High volume/amount of the substance is flowing through the State economy;
- Substance is known to have adverse human or ecosystem health impacts at current or projected concentrations and/or exposure levels;
- Substance is ecologically persistent or bioaccumulative in nature; and/or
- Alternative substances or techniques exist that reduce the need to rely on this substance.

Mercury was selected as the first PBT to address, and a Chemical Action Plan has been developed using a collaborative process led by Ecology and the Washington Department of Health.[32] The Mercury Chemical Action Plan provides an excellent example of the analytical approach needed to identify an integrated strategy (and collection of policy tools) for a specific substance. The Action Plan identifies the key sources of mercury in the Washington economy, highlighting industry sectors, manufacturing processes, business activities, and products that contribute to the use and/or release of mercury. The Action Plan then identifies the key policy tool(s) (or "Recommended Actions") that appear to be most promising for addressing each of these sources. The Action Plan recommends implementation of a variety of policy tools, ranging from targeted education and outreach campaigns to voluntary partnerships to regulatory prohibitions on certain practices.

To achieve the Beyond Waste Vision, similar initiatives will be necessary to strategically address particular substances or waste streams that are of greatest concern.

INTEGRATED STRATEGIES: TARGETING INDUSTRY SECTORS

Second, integrated strategies for achieving the Beyond Waste Vision in specific *industry sectors* can be a powerful means for changing behaviors that affect multiple material flows and solid and hazardous waste streams.[33] While the specific substance focus discussed above may affect the activities in a particular industry sector in one or more ways, a sector-based approach takes a more holistic perspective, looking at behaviors,

[31] The Washington PBT Strategy Implementation Plan was completed in December 2001 and is available at http://www.ecy.wa.gov/programs/eap/pbt/pbtfaq.html. As of February 2003, 22 PBTs are on the State of Washington's PBT Working List.

[32] Washington Department of Ecology and Department of Health. *Washington State Mercury Chemical Action Plan*. Publication No. 03-03-001. February 2003. http://www.ecy.wa.gov/biblio/0303001.html

[33] A variation on this approach would be to focus on a particular industrial process, such as electroplating, that may be common to multiple industry sectors.

Develop Integrated Sector-based Strategies

1. *Identify key industry sectors to target*. Use selection criteria. Identify some sectors where there are likely to be early successes. A proposed list of sectors for initial focus is included in Chapter 6 of this report.
2. *Conduct a brief background assessment and map the value chain for each sector*. Identify the number of actors, key trends, waste profiles, and other factors to understand "where the sector is at" and "where it is likely to go". Identify key environmental impacts affecting the Beyond Waste Vision, desired behavior changes, and key leverage/decision points. Also identify "critical customers" along the value chain who could play a role in altering the sector's economic or social license to operate. Parts of this step could be done in partnership with an industry association or company representatives. See the "Beyond Waste Partnerships" recommendation in Chapter 6.
3. *Determine priorities for focus and resource allocation*. Leverage points within a sector's value chain should be prioritized based on importance for achieving the Beyond Waste Vision or other criteria (e.g., ease of addressing). Tough decisions need to be made about the relative importance of focusing government, industry, and societal resources to address the particular intervention point, as this can guide tool option selection. Stakeholder involvement is key to this process. Some of these decisions may need to be revisited once a more detailed assessment is made of the benefits and costs associated with various tool options for addressing the leverage point.
4. *Identify policy tools that could be used to target priority leverage points*. Draw ideas from the table of tool options[1], as well as examples of tools that other jurisdictions have identified. Engage with sector representatives to identify opportunities and constraints. Identify tools that address those opportunities and constraints. Identify what tools are currently targeting each leverage point (by other government jurisdictions, NGO initiatives, industry programs), and what additional support or reinforcement could be provided with additional tools.
5. *Evaluate policy tool options for addressing each priority leverage point*. While general assessments of policy tools (like those provided in this report) can be useful, it is essential to assess the anticipated impacts of a tool in the *context* of where it might be used. Appendix A provides a list of questions that can facilitate this assessment.
6. *Select and implement tools*. In some cases, multiple tools may be needed to address the leverage point. For example, education & outreach efforts are often needed to support implementation of new regulatory requirements or voluntary programs.
7. *Look for synergies*. Just because it's a sector-based approach, does not mean that completely new programs and initiatives need to be developed. Wherever possible, tools, programs, and initiatives should leverage or supplement tools, programs, and initiatives that are already established.
8. *Adapt integrated strategy and tools over time*. Most tools can be adjusted over time as new information and trends emerge.

material flows, and waste flows throughout the full *value chain* of companies in the sector.[34] A sector-based approach can align multiple signals and tools that reinforce the behaviors and performance outcomes that are desired from the sector.[35] Working directly with specific sectors is the best way to develop integrated strategies for fostering systemic Beyond Waste behavior change in these sectors.

[34] A value chain depicts the key steps needed to transform ideas and raw materials into goods and services, and then onto their final disposition. Specific activities and decisions occur at each stage in the value chain. In many cases, materials flow through the value chain, as they are transformed from raw materials to finished good to waste or inputs to a new value chain.

[35] See the discussion of desired behaviors and performance outcomes discussion on page 3.

The following criteria can be used to identify or prioritize industry sectors which might be most appropriate for developing integrated Beyond Waste strategies:[36]

- Sectors that generate the most solid and/or hazardous waste (e.g., total pounds of hazardous waste);
- Sectors that release the most toxics (e.g., total pounds of Toxic Release Inventory reported substances);
- Sectors that use, generate, or release certain substances that are deemed to be high priorities for reduction (see discussion of substance targeting above);
- Sectors that have a high incidence of compliance issues (e.g., number of violations) which could potentially be reduced through a sector-based initiative;
- Sectors in which companies and/or industry associations have expressed interest in participating in collaborative partnerships to reduce environmental impacts or in making progress compatible with the Beyond Waste Vision;
- Sectors in which there are multiple companies required to prepare pollution prevention plans;
- Sectors in which there Is an opportunity to influence large numbers of people or to "lead by example";
- Sectors being targeted by other sector-specific initiatives, such as EPA's Sector-based Initiative or industry association-led initiatives; and/or
- Sectors in which a "window of opportunity" exists due to key trends that are producing changes likely to impact progress toward the Beyond Waste Vision either beneficially or adversely.[37]

Leverage Point:

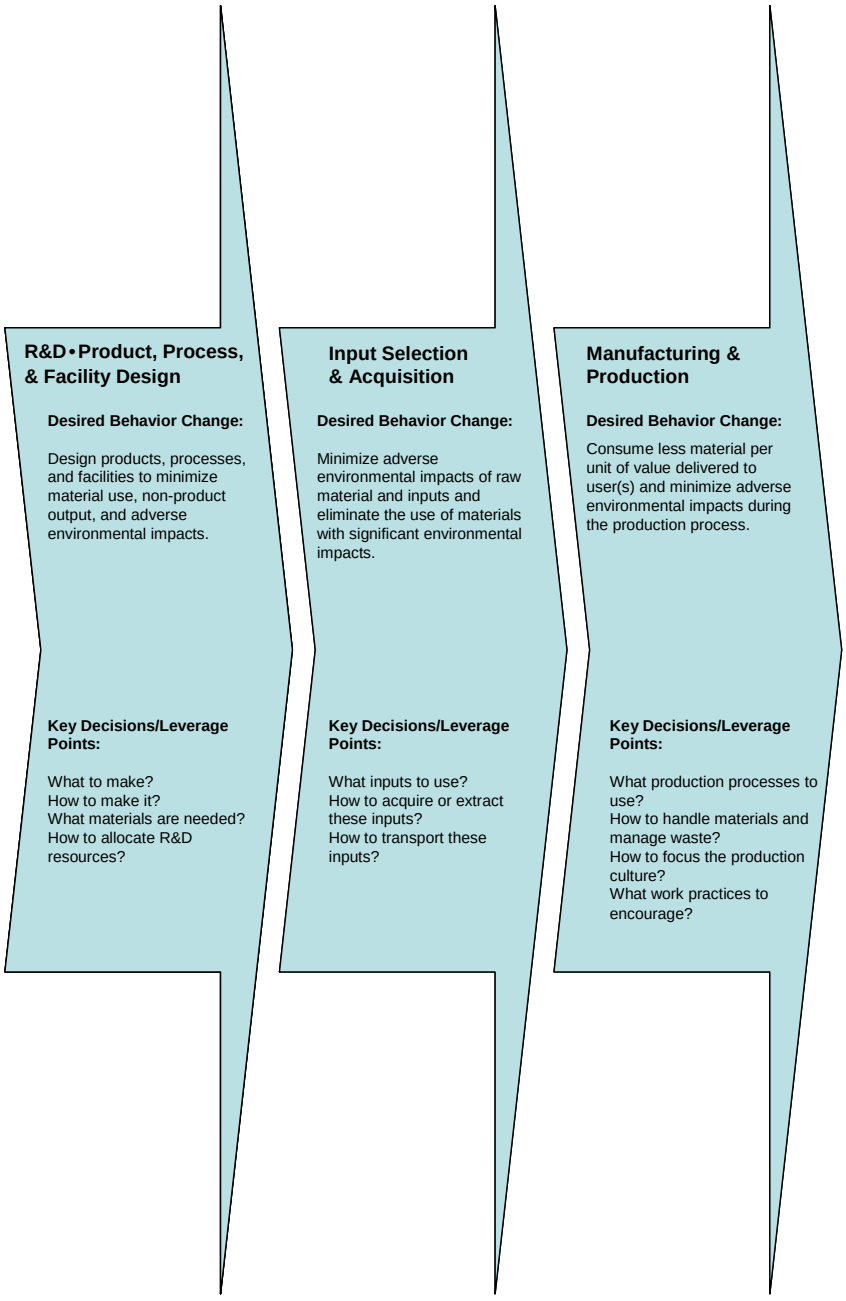
Key decisions that can affect progress toward the Beyond Waste Vision. Influencing these decisions has potential to reduce material use, waste generation, or otherwise improve environmental and public health outcomes.

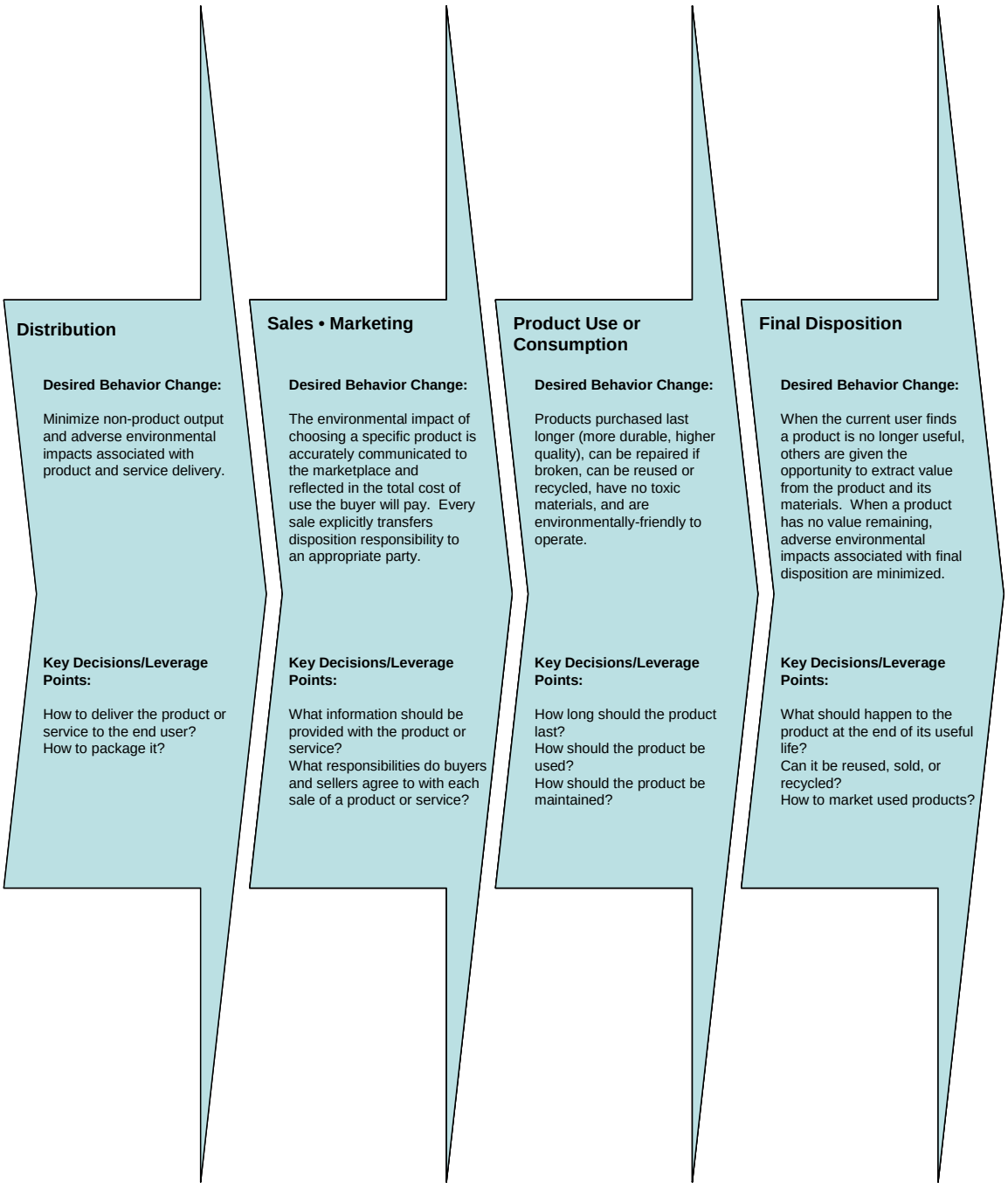
When developing a sector-based approach, mapping the value chain for the industry sector can be a helpful tool for identifying the specific places to focus tools, as part of an integrated strategy for the sector. Figure 2 presents a generic value chain model which depicts the key steps needed to transform ideas and raw materials into goods and services, and then onto their final disposition. While the value chain steps can differ among sectors and companies, the model in Figure 2 provides a useful template for tailoring a sector-specific value chain map. Environmental impacts occur at each stage in the value chain, and they are influenced by the key decisions that are made at each point along the chain. Each of these key decisions represents a *leverage point* for influencing Beyond Waste behaviors.

[36] The Department of Ecology assembled draft Sector Prioritization Data in April 2000 that provided weighted scores for various industry sectors (i.e., SIC codes) based on hazardous waste data, TRI data, the number of P2 planners, and the number of compliance violations. This type of approach, potentially supplemented with some of the additional criteria listed above, could be useful in targeting sector-based initiatives.

[37] When a sector is experiencing trends that are driving significant change, there are often important opportunities for ensuring that Beyond Waste goals are being considered. In some cases, a trend may have valuable spillover benefits for the Beyond Waste Vision. In such cases (e.g., lean manufacturing implementation in electronics, aerospace, hospitals, and manufacturing sectors), government can typically take steps to leverage even greater environmental performance improvement from these external trends.

Industrial Sector Value Chain




Distribution
Desired Behavior Change:
Minimize non-product output and adverse environmental impacts associated with product and service delivery.
Key Decisions/Leverage Points:
How to deliver the product or service to the end user?
How to package it?
Sales • Marketing
Desired Behavior Change:
The environmental impact of choosing a specific product is accurately communicated to the marketplace and reflected in the total cost of use the buyer will pay. Every sale explicitly transfers disposition responsibility to an appropriate party.
Key Decisions/Leverage Points:
What information should be provided with the product or service?
What responsibilities do buyers and sellers agree to with each sale of a product or service?
Product Use or Consumption
Desired Behavior Change:
Products purchased last longer (more durable, higher quality), can be repaired if broken, can be reused or recycled, have no toxic materials, and are environmentally-friendly to operate.
Key Decisions/Leverage Points:
How long should the product last?
How should the product be used?
How should the product be maintained?
Final Disposition
Desired Behavior Change:
When the current user finds a product is no longer useful, others are given the opportunity to extract value from the product and its materials. When a product has no value remaining, adverse environmental impacts associated with final disposition are minimized.
Key Decisions/Leverage Points:
What should happen to the product at the end of its useful life?
Can it be reused, sold, or recycled?
How to market used products?

Value chain maps should identify (1) where environmental impacts arise, (2) where key leverage (or decision) points exist which affect material use and waste generation, and (3) where changes in behavior or performance outcomes are desired. While the value chains for each individual company or facility will vary, value chains for organizations within the same industry sector will have many processes, practices, materials, etc. in common. Understanding the generic value chain map for a particular industry sector can be a powerful tool for identifying the key leverage points, or decisions, which can be targeted to produce Beyond Waste behavior change.

A sector-focused value chain can also be useful for highlighting the steps and leverage points that are likely to occur within Washington, and that might be most appropriate for addressing through State initiatives. Other steps in the value chain may be implemented by actors in other jurisdictions or occur in other states or countries. Where these broader steps are important to Washington's Beyond Waste Vision, Ecology, or other actors in the State of Washington, would likely be best served to join others in partnership to address these challenges. For example, Washington has partnered with other states to work with the carpet industry to enhance carpet recycling activities and product stewardship.

Goal 2 and the associated action steps at the end of this report propose an approach for developing sector-based Beyond Waste Partnerships. These initiatives can be used to develop tailored, integrated strategies to address the Beyond Waste challenges that arise throughout the value chains of the targeted sectors. Goal 2 also includes a list of industry sectors which the consultant team believes to be prime candidates for participation in the proposed Beyond Waste Partnerships, based on the criteria discussed above.

SELECTING APPROPRIATE POLICY TOOLS

Policy tools can be aligned to address each of the leverage points along a sector's value chain. Often multiple policy tools could work, with varying effectiveness, direct cost, equity implications, political feasibility, etc. For example, a ban could be used to prohibit use of a certain substance. Alternatively, taxes or fees could be placed on the substance to increase its cost and reduce its attractiveness in the marketplace. A third alternative could be to regulate the way the substance is managed and to require reporting of use or releases of the substance. Another approach could be to use education and voluntary initiatives to raise awareness and commitments to minimize use of the substance. While banning the substance will likely reduce use of it faster than outreach and voluntary reduction challenges, the economic and social costs of doing so are also likely to be much higher than those associated with education and outreach. Decisions on which tools to use to address specific leverage points ultimately depend on the amount and type of resources society is willing to invest to achieve a given outcome.

Understanding the specific nature and magnitude of policy tool benefit and cost trade-offs requires an evaluation of the various tool options in the context in which they would be used (e.g., to address a leverage point in a sector value chain). In most cases, consideration of several key factors can be useful for striking an appropriate balance. Appendix A to this report lays out such key factors and questions that can facilitate this evaluation of specific tool options.

Two guidelines for "bundling" policy tools can improve both the effectiveness of tools and industry and public receptiveness to the tools:

- Education and outreach tools (e.g., communications strategies, publications, training, hotlines, educational partnerships, social marketing activities) can often increase the effectiveness of other tools by ensuring that targeted actors are aware of the other tools and understand how to use or comply with these tools. Education and outreach is also critical for communicating the need for action or behavior change.
- Tools that mitigate the economic costs to specific groups that result from policy interventions can lessen economic and social impacts and increase the political feasibility of change. For example, price signal tools that include refunds, rebates, or tax credit provisions can off-set the adverse economic impact of tax and fee increases on targeted actors. In effect, this approach can sometimes focus the intervention on discouraging use of a substance or practice, rather than punishing an industry sector.

  As another example, a requirement to ban a particular substance within 10 years could be paired with other tools such as technical assistance, low interest loans for technology conversion, and/or joint government-industry R&D of alternative processes or substances. Such approaches can allow for bold action, while mitigating economic and social impacts that can otherwise slow or prevent environmental improvement efforts. As a third example, actors could be made exempt from the impact of one tool (e.g., removal of the hazardous waste generation fee cap in Washington) provided they take some specified action (e.g., develop an EMS, participate in the Cleaner Production Challenge, or some other regulatory responsiveness program).

Increasing Diversity of Policy Tool Options

Governments are expanding implementation of a range of policy tools to supplement conventional regulatory requirements. Based on current activity to implement and expand these tools, it is likely that use of them in the U.S. and elsewhere will increase in the years to come.

- Strategic partnerships (inter-industry, intra-industry, government-industry, NGO-industry)
- Environmental-focused taxes and fees
- Regulatory innovation initiatives
- Product take-back initiatives
- Voluntary product and process certification programs
- Sector-based EMS initiatives
- Voluntary reporting / transparency initiatives

This report presents a general evaluation of two categories of tools – regulatory responsiveness programs and price signal tools. For both tool categories (see chapters 3 and 4), "bottom line" messages are provided that summarize *at a general level*, our best assessment of how useful these tools can be for achieving the Beyond Waste Vision. As mentioned above, the effectiveness of these tools can vary significantly depending on the context (e.g., targeted sector, substance, or leverage point) or design. For example, in one sector a moderate disposal fee may drive significant waste reduction or P2 progress, while in another sector technological or other constraints prevent impacted parties from altering their behavior to reduce disposal volumes. In the case of tool design, the effectiveness of voluntary regulatory responsiveness programs can vary significantly depending on the balance of requirements and incentives. This variation in tool effectiveness highlights the importance and usefulness of engaging with specific industry sectors to understand and

identify the range of broad and targeted policy tools that can be implemented to influence key decisions along the value chain.

Table 3 presents some examples of tools that are being used to address key leverage points in the value chain for the electronics sector. While these examples are by no means exhaustive, they illustrate how multiple tools can be aligned to encourage Beyond Waste behaviors at various points in the value chain.

Table 3 **Examples of Policy Tools Targeting Steps in the Electronics Sector Value Chain**

Policy Tool	*Examples*
R&D – Product, Process & Facility Design	
R&D Partnerships	The Institute of Electrical and Electronics Engineers' (IEEE) Components, Packaging, and Manufacturing Society coordinates and communicates about research initiatives (e.g., lead-free manufacturing initiative) focused on eliminating adverse environmental impacts from electronics production. (see http://www.cpmt.org)
Input Selection & Acquisition	
Environmental Regulations	Federal EPCRA regulations require manufacturers to follow specific management and notification protocols when handling, storing, and managing certain hazardous substances used in the production of electronic components.
Manufacturing & Production	
Technical Assistance	Washington's TREE program provides P2 technical assistance to electronics manufacturers. Circuit board manufacturers are targeted under Washington's Cleaner Production Challenge. (see http://www.pprc.org/cpc/)
Environmental Regulations	Federal RCRA regulations requiring manufacturers to follow specific management and reporting protocols associated with managing hazardous waste generated in the production of electronic components.
Regulatory Innovation / Flexible Permitting	EPA's Pollution Prevention in Permitting Program (P4) has developed pilot air permits for some electronics sector firms, enabling them to make rapid operational changes (expanding their economic license to operate) while encouraging and facilitating P2.
Voluntary Certification Initiatives	In part due to supply chain pressures, electronics manufacturers are increasingly developing environmental management systems (EMS) and seeking ISO 14001 registration to certify that they have an EMS.
Sales – Marketing	
Fees	In August 2002, the California Senate and Assembly approved a CRT recycling bill that would place a $10 advance fee on purchases of new computers and televisions sold in California, with proceeds funding a state program to recycle CRTs.
Education & Outreach	The Northwest Product Stewardship Council has produced a brochure titled "A Guide to Environmentally Preferable Computer Purchasing". (see http://www.govlink.org/nwpsc/CompBroch.pdf)
Labeling	EPA's Energy Star recognizes office machinery, appliances, and home electronics that require less energy and/or conserve energy better than

	comparably priced products.
Final Disposition	
Disposal Bans	Minnesota is currently debating a proposal that would ban CRT-containing electronics from landfills by 2004.
Used Industrial Material Exchanges	King County's Hazardous Waste Program maintains IMEX, an electronic market clearinghouse for used industrial materials. Users can list available/wanted materials including solvents, chemicals, sludge, and used electronic equipment. (see http://www.metrokc.gov/hazwaste/imex)

KEY PRINCIPLES FOR ADVANCING THE VISION

As the Department of Ecology moves forward to develop its strategic plan for achieving the Beyond Waste Vision, we encourage the State to consider six key concepts or considerations that are woven throughout this report. These concepts emerged from our research and interviews and have shaped our thinking and recommendations about bold, effective, and realistic strategies for moving the industrial sector toward the Beyond Waste Vision. The concepts below aim to alter the "license to operate" equilibrium and to tap the factors that enable successful industrial change.

1. **Clear Articulation of Desired Behaviors, Outcomes, and Benefits Establishes a Foundation for Concerted Action**. Industrial actors will want to know "what does the Beyond Waste Vision mean that I need to do differently?" A clear articulation of the behaviors and outcomes needed to achieve the Beyond Waste Vision can provide an essential benchmark for focusing both industrial actions and government activities. Industrial actors will also need to assess the business case for moving toward the Beyond Waste Vision. Improved understanding of the business and technological constraints that bound industrial actors' behaviors can spur creative approaches for strengthening the business case for action toward the Beyond Waste Vision.`
2. **Signals are More Powerful When Aligned and Linked**. As discussed above, Ecology can play an important role in encouraging and facilitating beyond compliance behavior among industrial actors in Washington. State government "touches" the industrial sector in numerous ways – through regulation, permitting, inspections, procurement, public recognition, information collection and sharing, technical assistance, fees and taxes, among others.[38] By aligning all of the ways in which government "touches" industrial sector actors to demonstrate responsiveness to beyond compliance environmental performance and behaviors, the State can encourage further progress by expanding the business case for change. No one policy tool is likely to provide a silver bullet for reaching the Beyond Waste Vision, but a well-aligned system of policy tools can ensure that all government "touch points" focused on the industrial sectors are pushing in the same direction and sending strong signals about the benefits to individual firms and the Washington economy of moving toward the Beyond Waste Vision.

[38] The Consultant Team's memo and tools matrix of <insert date> catalog many of the policy tools available for influencing industrial sector behaviors that affect material use and waste generation.

3. **Continual Incremental Improvement is Essential for Achieving Bold Change**. While it can be enticing to respond to a bold vision with swift and bold action, windows of opportunity for bursts of bold action are often few and far between. Yet focused, continual incremental improvement is often underrated for its ability to bring about transformative change. Phased, continual improvement approaches give organizations certainty about future directions, while providing time for industrial sector adaptation. Adaptive management strategies enable government agencies to learn while implementing, and to adjust further action to capitalize on opportunities and to mitigate constraints. In the absence of powerful drivers, bold bursts of action into untested areas frequently become mired in political controversy, which can paralyze even modest progress on related fronts. This does not mean that there is no place for bold bursts of action. In many cases, the information and feedback generated by incremental improvement efforts often create windows of opportunity for aggressive improvement and accelerate the justification for bolder bursts of action.[39]
4. **Collaborative Efforts and Creative Partnerships are Key to the Future**. A common theme in much of the recent academic literature on environmental policy and improvement is that collaborative efforts and create partnerships will be increasingly important to supplementing regulatory approaches to environmental improvement. Many corporate environmental leaders believe that society is just beginning to scratch the surface of partnership opportunities – partnerships between companies, between companies and NGOs, between companies and government, and between government and NGOs.
5. **Look for Horses Riding in the Direction You Want to Go**. Change is difficult. Lasting behavior and culture change requires powerful and sustained motivators to counteract the forces of inertia and the costs of change. Ecology will be well served to leverage, or piggyback, on trends and third party actions that are fostering the desired behaviors and outcomes needed to reach the Beyond Waste Vision. Trends such as increasing community interest in local environmental quality and expanding information access and analysis over the Internet are altering the social license to operate. Ecology can support these trends by expanding efforts to share environmental information with the public. Other trends, such as the explosive growth in lean manufacturing implementation and advances in environmentally-friendly technologies, are altering the economic license to operate. Ecology can seek to remove regulatory obstacles to these trends, and to support or supplement the trends with information, partnerships, and resources.
6. **Bold Change Requires Bold Commitment and Culture Change**. Achieving a vision as bold as the Beyond Waste Vision will require significant commitment, investment, and culture change. Rapid progress toward the vision will not just require these from industrial sector actors. Ecology and the broader government of the State of Washington must also develop commitment, invest resources, and work to change organizational cultures that have often focused on regulation and

[39] These observations are drawn from literature on change management, as well as discussions with business leaders about their experiences in transforming large organizations to advanced manufacturing paradigms. Also see Peter Senge. 1990. *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York: Currency Doubleday.

> enforcement rather than integrated strategies for achieving a desired vision or outcome. In fact, the inability of governments to transform their organizational culture has consistently been identified as a primary barrier to innovative and collaborative approaches to environmental improvement. Requiring bold change from industrial actors will also prove difficult if government behaviors and performance outcomes are lagging behind. Government commitment, investment, and culture change does not need to be a prerequisite for starting toward the vision, but it needs to be an integral part of Ecology's strategy to achieve the Beyond Waste Vision.

The following two sections examine two categories of tools – regulatory responsiveness programs and price signals – that have potential to fit well within a broader effort by the Department of Ecology to align a set of strong signals that encourage Beyond Waste behaviors and outcomes.

3. Voluntary Initiatives and Regulatory Responsiveness Programs

While the system of environmental regulation in this country – at federal, state, and local levels – has made great strides in achieving desired improvements, most would agree that traditional "command and control" regulatory approaches are insufficient to address the full spectrum of environmental improvement needs. For example, scientific studies and regulatory standards are unable to keep pace with the thousands of chemicals that have potential to cause environmental impacts. In addition, there is a whole range of desired environmental improvements that remain largely outside the jurisdiction of the environmental regulatory framework. Such areas include energy usage, water consumption, and solid waste generation and disposal practices. These factors have spurred many public policy experts to call for new policy approaches to supplement traditional regulatory approaches. Key objectives of these desired approaches are listed below.

- Clearly articulating and publicizing of the behaviors that are desired from industrial actors by public environmental management agencies – moving beyond just regulatory statements of "what not to do".
- Sending positive feedback to organizations that behave in the manner desired by public agencies, creating incentives for further desired behavior.
- Increasing the attractiveness of environmentally-preferable behaviors and actions and decrease their marginal cost, prompting more "beyond compliance" behavior faster.
- Engaging public agencies in a constructive, collaborative dialogue with specific companies and industry sectors that can enable tailoring of public policy strategies to effectively address economic and technological constraints to environmental improvement.
- Providing a coordinated umbrella that can accommodate multiple approaches of engagement between government and industrial actors.

For several years, several governments in the U.S. and Europe have been experimenting with voluntary initiatives, performance-based environmental improvement programs aimed at achieving the above objectives. In this report, we refer to this collection of voluntary initiatives as regulatory responsiveness programs. Regulatory responsiveness programs utilize regulatory and other incentives to encourage voluntary, "beyond compliance" behavior and environmental outcomes from regulated entities. Regulatory responsiveness programs typically share several attributes:

- Participation is voluntary;
- Participants are required to meet certain requirements (e.g., commitment to certain practices or performance targets, implementation of an EMS) to enter or remain eligible for participation the program;

- Actual performance relative to program eligibility requirements is verified through some mechanism (e.g., self-certification or reporting, third party audits); and
- Government or other stakeholders provide some form of incentives (e.g., recognition, access to streamlined regulatory procedures) to provide positive feedback and "responsiveness" to participants, with the objective of leveraging further "beyond compliance" performance in the future.

REGULATORY RESPONSIVENESS PROGRAM ELEMENTS

As discussed above, regulatory responsiveness programs typically consist of several key elements: (1) eligibility requirements (desired behavior changes and performance outcomes), (2) verification mechanism, and (3) participation incentives/responsiveness.

ELIGIBILITY REQUIREMENTS

Eligibility requirements vary from program to program, but they typically fall in the categories outlined below.

Environmental Management System (EMS). Program participation requires a company to have implemented a mature, well-designed EMS. The EMS provision is designed to help ensure that member facilities will continue to meet, and ideally exceed regulatory obligations. The EMS requirements may stipulate specific EMS elements or attributes:

- **Policy.** For example, a policy statement that includes commitments to regulatory compliance, pollution prevention, continuous improvement in environmental performance, and the sharing of EMS performance information with the local community.
- **Planning.** For example, planning procedures that include the identification of significant environmental concerns and legal requirements at the facility, measurable objectives designed to meet legal requirements, and program commitments.
- **Implementation**. For example, implementation activities that include the development of roles and responsibilities for communicating and meeting EMS objectives, defined programs and procedures for maintaining compliance and meeting environmental performance objectives outlined in the EMS, environmental training programs for all employees, and an emergency preparedness program.
- **Checking.** For example, audit and performance measurement activities, such as a program for assessing performance and preventing and detecting non-conformance with legal and other requirements of the EMS.
- **Management Review.** For example, a procedure for the documented review of EMS performance by a designated manager.

Environmental Improvement. In many programs, participants must demonstrate past evidence of, and/or future commitments to specific, measurable environmental improvement. This is a common characteristic of most voluntary challenges, where targets (e.g., 33%, 50%) are often established for emissions or waste reductions. In

other instances, specific pollution prevention or waste minimization actions may be required that are either identified by the facility or in a government-company agreement. For example, EPA's Performance Track Program stipulates that facilities must present an environmental record for the previous two years of operation, and show progress *beyond* the minimum requirements over the course of these two years. More specifically, facilities must be able to identify accomplishments, in at least two[40] aspects of any of the following environmental categories: energy use, water use, materials use, air emissions, waste, water discharges, accidental releases, habitat preservation/restoration, and product performance. Also to qualify, a facility must commit to future improvements in four aspects of the categories listed above.[41]

Sustained Compliance. In addition to environmental improvements, some programs (such as EPA's Performance Track Program) require that facilities demonstrate a solid record of sustained compliance with environmental requirements (i.e., all applicable federal, state, local, and tribal environmental regulations), certification of current compliance, and commitment to maintain compliance.

Community Outreach. Facilities may be expected to have an established public outreach program (e.g., newsletters, performance reporting, etc.) prior to involvement in the program. Such activities may vary depending on facility size and operation, but often include active identification of, and response to, the local community's environmental concerns, and a process for informing the community of important environmental matters affecting it. The annual reporting requirements, if required, may also need to be made available for public review. Such public scrutiny opportunities are designed as an incentive for firms to make and achieve meaningful commitments.

Periodic Performance Reporting. Programs may also require companies to commit to providing periodic reports on the status of their efforts to achieve stated environmental commitments and/or overall environmental performance. For example, EPA's Performance Track Program requires an annual performance report that includes: a summary of the facility's EMS assessment activities and progress towards meeting EMS objectives and targets; a brief report on progress made in meeting environmental performance commitments; a summary of public outreach activities; and a self-certification that the facility continues to meet program criteria.

VERIFICATION MECHANISMS

There are a range of verification mechanisms that can be used to ensure that program participants satisfy the program eligibility requirements. These include the following mechanisms:

- **Self-certification or reporting**. Participants submit periodic information (e.g., annual reports) to the agency administering the program that can be used to assess whether the organization is meeting the established program requirements. The information could be in the form of actual environmental

[40]One for smaller facilities.

[41]Two for smaller facilities.

performance information, letters certifying that the company is meeting the program requirements, or some other form.

- **Audits**. In some cases, the agency administering the program conducts periodic or occasional audits to verify that a company is meeting the program requirements. In other cases, the administering agency may accept the results of company self-audits or audits conducted by an independent third-party auditor.

INCENTIVES/RESPONSIVENESS

Government possesses the ability to be responsive, or to provide certain incentives, that send positive signals to industrial actors who exhibit or commit to voluntary progress toward the Beyond Waste Vision. Incentives and responsiveness can alter the regulatory, economic, and/or social license to operate so as to increase the benefits to organizations who continue to demonstrate such progress.

Jerry Speir, Director of the Tulane Institute for Environmental Law and Policy, groups environmental performance incentives into six broad categories -- recognition, technical assistance, money, regulatory flexibility, agency relationship changes, and enforcement discretion.[42] Streamlined environmental reporting is also worthy of consideration as an incentive. Importantly, when selecting incentives to offer, it is critical that such incentives match the needs of businesses; and because business needs vary widely, offering a wide variety of voluntary incentives, if possible, is the best approach to ensuring broad-based participation. A brief discussion of categories of possible incentives is provided below, along with a few examples of incentives under each category.

Recognition. Public recognition of industry leaders in environmental improvement can be in the form of press releases, special letterhead logos, and membership in special environmental leadership councils, among other options. Some companies may find benefit in simply being acknowledged as an environmental leader, while others may see such public recognition as a true competitive market advantage.

- EPA's Energy Star program is a voluntary program aimed at promoting energy-efficient products to reduce carbon dioxide emissions. This program relies heavily on use of the Energy Star label, now recognized nation-wide as a symbol of energy efficient products. Compliant companies have found the Energy Star label helps to differentiate them from companies with less efficient products. http://www.energystar.gov

- Maine's Environmental Leadership Program offers incentives to independent gas stations that have achieved full or beyond-compliance with environmental requirements. Certification stickers, press releases, and information brochures for customers represent the primary incentives offered.

Technical Assistance. Technical assistance can also serve as a simple incentive for participation in voluntary performance programs. In utilizing free government agency assistance in select areas of potential environmental performance, companies have a

[42] Coglianese, Cary and Jennifer Nash, eds. *Regulating from the Inside: Can Environmental Management Systems Achieve Policy Goals?* Resources for the Future, 2001.

higher degree of likelihood that they will achieve desired environmental improvement outcomes that can benefit their public image as well as (depending on the improvements made) their bottom line.

- Ecology's Technical Resources for Engineer Efficiency (TREE) team works with individual businesses to improve efficiency. The team uses research, process modeling and engineering analysis to find ways to reduce waste while saving money. In 2002, TREE made suggestions to four companies that could annually reduced water use by 22.6 million gallons, hazardous waste generation by 38,700 pounds, and solid waste generation by 116 tons. By using the information supplied TREE, the four companies can potentially save a total of $214,100 each year. http://ecy-hqapp19/programs/hwtr/TREE/index.html
- The "Clean Break" program initiated by the Illinois Environmental Protection Agency (IEPA) offers regulatory assistance to small businesses, and guarantees enforcement actions will not proceed if violations are found. This has dramatically increased environmental compliance among small businesses in Illinois.
  http://www.epa.state.il.us/environmental-progress/v22/n1/clean-break.html
- King County Washington's EnviroStars Program has a site consultant who works with EnviroStar members by suggesting new ideas and improvements to their businesses that go even further in advancing members' environmental progress.
  http://www.envirostars.com

Financial Incentives. Financial incentives can serve as an obvious motivator for program participation, and can include grants, tax incentives, low interest loans, and fee rebates (see Chapter 4 for a discussion of feebate programs).

- One approach under development by U.S. EPA (Region 5) and the Michigan Department of Environmental Quality (MDEQ) will provide limited lender liability protection to lending institutions that finance redevelopment of sites covered under RCRA.
  http://www.michigan.gov/deq/0,1607,7-135-3307_11105-22192--,00.html
- Through its Environmental Cleanup Financing Committee, the State of Oregon examined a broad range of economic and financial alternatives to encourage cleanup of contaminated properties. Among the options discussed were better access to loans, tax incentives, and insurance programs.
  http://forrestergroup.com/ODEQ/
- A Colorado Environmental Leadership proposal includes granting qualified companies (who meet environmental performance standards) a "preferred status" in state competitive bidding processes.
  http://www.cdphe.state.co.us/el/elphom.asp
- The State of Delaware awards tax credits to companies who reduce TRI releases. Participants receive $400 in tax credits for every 10 percent in emissions reductions. http://www.state.de.us/revenue/obt/taxcred.htm
- Numerous states around the country are experimenting with water pollution (effluent) trading programs as incentives to encourage nonpoint source reductions and to better facilitate cost-effective NPDES permit and TMDL compliance in watersheds. http://www.epa.gov/owow/watershed/hotlink.htm

Regulatory Flexibility. Providing enhanced regulatory flexibility is perhaps the most controversial of incentives that can be offered, but also one of the most valuable. This may be because many industries believe that lack of flexibility in the regulatory system is often harming their ability to obtain superior environmental results. Enhanced flexibility may be enabled through existing regulations, or through other means such as facility-specific exemptions or relaxation of certain regulatory requirements.

- Many regulatory responsiveness program participants have become increasingly interested in flexible air permitting as a potential incentive for program participation. A recent EPA-sponsored evaluation of the implementation experience with flexible air permits found that they can be highly beneficial to companies, while actually encouraging and facilitating emissions reductions and P2 project implementation.[43]

  For example, Lasco Bathware, in Yelm, Washington, was reluctant to engage in activities that would result in lower air emissions per unit produced, because such an effort would require time-consuming permit revisions to alter its emissions factors. Through involvement in the Pollution Prevention in Permitting Program (P4), however, the facility received a flexible air permit from the Olympic Air Pollution Control Authority that greatly facilitated pollution prevention while ensuring compliance with all applicable requirements. These air permits do not relax applicable regulatory requirements, but rather seek alternative administrative approaches to provide greater flexibility.

- A flexible permitting effort is under consideration by EPA's PrintSTEP program (Printers Simplified Total Environmental Partnership). The project is seeking to develop a streamlined permitting process, as well as a multi-media, modular approach to regulatory oversight.
  http://www.epa.gov/sectors/pdf/csifactsheet.pdf

Agency Relationship Changes. As discussed in Appendix B, EPA is encouraging states, with programs similar to Performance Track, to negotiate MOUs that will enhance the incentives offered to participants, while best ensuring that the requirements and goals of both regulatory entities are met. Such agreements can also provide participants with a greater level of certainty that desired incentives for performance will be offered. Other relationship changes may involve offering companies a "single point of contact" for regulatory processes (i.e., one person who can facilitate the full gamut of environmental regulatory interactions required of the company). With such a single contact, the company is spared the time and expense of interacting with representatives from different regulatory media (air, water, waste, enforcement, etc.).

- New Jersey's "One Stop" Facility Permitting effort is one example of this concept. This was designed as a "total facility" approach to permitting and compliance where permit applicants need only turn to one source which can assist them in identifying all necessary permits and associated permit requirements.
  http://www.state.nj.us/dep/opppc/back.htm

Enforcement Discretion. Particularly with performance programs where EMSs are required, enforcement discretion may be critical to enticing voluntary participation. This is largely because even the most diligent of companies may discover environmental

[43] See http://www.epa.gov/ttncaaa1/t5/meta/m24005.html

violations in the course of EMS implementation, and such companies may be less willing to go down the EMS path knowing their good faith efforts might result in strict enforcement actions.

- As mentioned, members of EPA's Performance Track receive agency discretion in penalty assessment due to clear "good faith efforts" to comply.
- Oregon's Green Permits program used a discretionary, problem-solving approach to compliance that focuses on system-wide improvements. http://www.deq.state.or.us/programs/greenpermits/index.htm

Streamlined Reporting. Facilities with robust Environmental Management Systems may be particularly interested in streamlined reporting processes, because the very nature of their EMS dictates full awareness of environmentally sensitive processes and the need for access to meaningful environmental data. Because EMS's may result in even greater monitoring and reporting than would otherwise be required, processes to consolidate or streamline reporting for compliance purposes may be appealing to some companies.

- Proposed additions to EPA's list of Performance Track incentives include streamlined reporting requirements for POTWs and facilities subject to Clean Air Act MACT standards (see Appendix B).
- Florida's Department of Environmental Protection's "Ecosystem Management Initiative" offers a "team permitting" approach designed to increase permit flexibility and accelerate permit processes. In exchange for superior compliance records and commitment to improved environmental performance, participants receive "Ecosystem Management Agreements" that offer alternative monitoring and reporting requirements among other incentives. http://www.wri.org/wri/incentives/barnett.html

Other Incentives. In the coming years, there are likely to be efforts to develop other incentives and responsiveness activities that tap government functions and activities beyond those offered directly or solely by environmental management agencies.

- *Environmentally Preferable Procurement*. Government can exercise significant market power in certain areas by granting preference to the purchase of goods or services with environmentally preferable attributes. In many cases, environmentally preferable purchasing can be codified in specific procurement standards. For example, the State of California has issues office furniture standards.[44] In addition, there is potential to link preferential purchasing with regulatory responsiveness. For example, participants in EPA's Performance Track Program or Washington's Cleaner Production Challenge could receive some form of preference in government purchasing decisions (e.g., participation in regulatory responsiveness programs could be included in the weighted factors used to make purchasing or contract decisions.
- *Streamlined information provision through certification*. In some cases, it may be useful for government agencies to assist with the development of (or to otherwise support or recognize) some voluntary product or process certification initiatives. In certain areas, government leadership or support related to certification efforts

[44] See http://www.ciwmb.ca.gov/GreenBuilding/Specs/Furniture/

can produce significant benefits for companies or organizations by helping them address social license to operate pressures in a credible manner. Successful efforts typically have a significant stakeholder involvement process, and provide a streamlined, consistent flow of information to the public that is independently verified. For example, EPA has worked with the Water Environment Federation and the Association of Metropolitan Sewerage Agencies to develop a voluntary EMS certification program for biosolids management (see http://biosolids.policy.net). Product or process certification efforts could be linked with other regulatory responsiveness programs, providing a more comprehensive and attractive set of requirements and benefits for voluntary industrial action.

EXAMPLES OF REGULATORY RESPONSIVENESS AND COVENANT PROGRAMS

Multiple examples of voluntary regulatory responsiveness programs have emerged in recent years. There is a spectrum of regulatory responsiveness programs.[45]

VOLUNTARY CHALLENGES

At one end are voluntary challenges, such as Washington's Cleaner Production Challenge, EPA's 33/50 Program and National Waste Minimization Partnership, and Canada's ARET Program. These programs typically establish specific requirements (or commitments) for participation, and provide government recognition as a primary incentive.[46]

VOLUNTARY REGULATORY RESPONSIVENESS AND/OR CERTIFICATION PROGRAMS

In the middle are voluntary regulatory responsiveness and/or certification programs, which typically involve a broader and more detailed set of participant requirements, while providing a variety of incentives to participants in addition to government recognition. Examples of initiatives in these categories include EPA's National Performance Track Program, the Envirostars Program (in several Washington counties), and numerous state programs. At least 14 states have implemented programs designed to reward environmental leadership and encourage superior environmental results. Among these programs are Colorado's Environmental Leadership Program; Michigan's Clean Corporate Citizen Program; New Jersey's Silver and Gold Track Program for Environmental Performance; and South Carolina's Environmental Excellence Program. Many of the state programs contain similarities to the National Environmental Performance Track, including the establishment of different performance "tiers," requirements for EMSs, environmental improvement, public outreach, strong compliance records, membership renewal requirements, and a combination of incentives for voluntary performance.

[45] For a useful taxonomy and analysis of various regulatory responsiveness programs, see Kathryn Harrison. 1999. "Talking with the Donkey: Cooperative Approaches to Environmental Protection – State of the Debate", *Journal of Industrial Ecology*. Volume 2, Number 3. Cambridge, MA: MIT Press, pp. 51-72.
[46] Washington's Cleaner Production Challenge has also provided technical assistance to participants.

COVENANT PROGRAMS

At the other end of the spectrum are covenant programs, such as Wisconsin's Green Tier Program (under development) and programs in Holland and Bavaria, Germany. Covenant programs typically involve the development of contracts with specific sectors or companies that tailor requirements and incentives.

The Netherlands and the German State of Bavaria have pioneered the use of voluntary written agreements (known locally as covenants and contracts) between industry and government to enhance environmental protection. Facing public pressure and diminishing environmental returns, the Netherlands and Bavaria decided to employ private agreements between public agencies and regulated entities to generate momentum towards a more cooperative and productive effort to improve their respective environments. As written agreements based on contract law, these systems are highly flexible in their form and content. Negotiators are constrained only by current regulatory requirements and their own creativity.

Contracts and covenants are private agreements, operating in between environmental statutes. They are often characterized as supplementing the existing regulatory structure. As a result, the practice of using contracts or covenants is criticized for the lack of clarity regarding the degree to which the parties are bound by the covenant. The Netherlands has developed a "code of conduct" on environmental covenants, setting up the principles on how an agreement is to be translated down to individual companies. In addition, a covenant must include, at a minimum:

- Agreements on actual waste reduction measures to be undertaken to achieve the standard, timing of implementation, and a cost-effectiveness analysis;
- Agreements on how the actions will be implemented, who is responsible, for implementing them, and in what form these actions will be codified in eventual regulation;
- Agreements about actions necessary to support implementation of the program, such as an internal Environmental Management System or a public information campaign;
- Agreements on research needed for future decisions and action; and
- A summary of next steps, including discussion of the need for further negotiation.

As private agreements outside the bounds of the regulatory structure, covenants and contracts need a reliable and defensible verification system. Standard integrated environmental management systems are often used for this purpose. The EU Eco-Management and Audit Scheme (EMAS) is the most popular verification system used in Dutch and Bavarian agreements. To receive EMAS registration a facility must comply with the following steps:

- Conduct an environmental review considering all environmental aspects of the organization's activities, products and services, methods to assess these, its legal and regulatory framework and existing environmental management practices and procedures.
- In the light of the results of the review, establish an effective environmental management system aimed at achieving the organization's environmental policy defined by the top management. The management system needs to set

responsibilities, objectives, means, operational procedures, training needs, monitoring and communication systems.

- Carry out an environmental audit assessing in particular the management system in place and conformity with the organization's policy and program as well as compliance with relevant environmental regulatory requirements.
- Provide a statement of its environmental performance which lays down the results achieved against the environmental objectives and the future steps to be undertaken in order to continuously improve the organization's environmental performance.

The practice of creating these written agreements evolved from the common problems many environmental agencies experience using a traditional regulatory approach. Legislation takes too long to prepare and implement. Permits require revision as laws change. Regulation is often single-media focused and inflexible. Permit writers suffer from an information deficit compared to industry engineers. Litigation is the rule, not the exception. The economic impacts of further regulation are often times considered politically infeasible. Under these circumstances, the prospect of achieving long-term environmental goals may be difficult. Signing a covenant or contract usually requires the parties to comply with stricter standards compared to the regulatory framework, but the standards are set below what the government believes the industrial sector could achieve.

The main advantages of written agreements often cited by government officials include:

- Shifting the burden to devise solutions from government to industry;
- Substituting a cooperative, problem solving approach for litigation;
- Creating the opportunity for flexibility in designing solutions;
- Saving time—getting solutions implemented more quickly than through legislation;
- Reducing environmental costs;
- Encouraging comprehensive, multi-media strategies rather than individual permits; and
- Ease in maintaining confidentiality of business information.

Both Bavaria and the Netherlands rely on a consensus based process to reach written agreements between the government and other parties (local authorities and industry) aimed at realizing policy objectives that a "command and control" regulatory structure fails to attain. The agreements usually are targeted towards specific economic actor sectors to elicit behavior changes. The agreements may be signed by specific businesses, or may be created by umbrella groups representing several other parties. Industry associations, with more influence over industrial norms and practices compared to their counterparts in the United States, have often been lead negotiators in the Dutch and Bavarian agreements.

Examples of these programs are profiled in greater detail in Appendix B.

TOOL EVALUATION: REGULATORY RESPONSIVENESS PROGRAMS

This section discusses the potential relevance that regulatory responsiveness programs could have in Washington, examining political feasibility, technical feasibility, cost-effectiveness, expected outcomes, and key challenges and success factors.

POLITICAL FEASIBILITY

In general, regulatory responsiveness programs can have relatively high political feasibility among industrial actors due to their voluntary nature.

The overall political feasibility can be reduced, however, if legislators or others in the state do not perceive that the investment of state budget resources to operate such a program result in sufficient environmental improvement benefits. The current presence of large budget deficits in many states, including Washington, has reduced the political feasibility of significant investment for full-fledged regulatory responsiveness programs in the short-term. Voluntary challenges are likely to be less costly than full-fledged regulatory responsiveness and covenant programs, increasing their political feasibility.

In addition to budgetary issues, some regulatory responsiveness programs are likely to require enabling legislation, particularly to facilitate the provision of incentives. Voluntary challenges often do not require such legislative action.

TECHNICAL/PRACTICAL FEASIBILITY

Technical feasibility can vary significantly based on program design. Most U.S. states that have regulatory responsiveness programs have between one and five FTEs staffing their state regulatory responsiveness program. As a general rule, voluntary challenges require fewer staff than regulatory responsiveness programs, which require fewer staff than covenant programs. For example, Wisconsin estimates that it will need 5 FTE staff to develop and operate its Green Tier program over the first three years. In many cases, regulatory responsiveness programs also tap staff in other programs to assist with the provision of specific program functions, such as incentive delivery (e.g., technical assistance, streamlined permitting) and program verification.

It can take several years to develop a full-fledged regulatory responsiveness program, although voluntary challenges can require significantly less time to develop. For example, Wisconsin estimates that it will take three years to firmly establish the Green Tier Program. Most programs that have been around for several years continue to evolve through time, with primary focuses on (1) increasing participation, (2) increasing incentives, and (3) occasionally adjusting eligibility requirements.

COST CONSIDERATIONS

The cost to develop and implement a State-level regulatory responsiveness program depends upon the type and design of the program. Voluntary challenges typically cost less to implement than full-fledged regulatory responsiveness programs. Annual state program implementation costs are likely to fall in the range of $100,000 to $500,000 per year (not including staff costs), with costs likely to be great in program start-up years.

For example, Wisconsin estimates that it will cost approximately $350,000 per year to operate its program over the first three years.

Costs to industry participants will vary depending on the specific program eligibility requirements. In assessing the business case for participation in a program, managers will typically weigh the likely costs that the facility will incur in meeting the eligibility requirements against the perceived benefits of participation. In general, the greater the perceived benefits, the more companies will be likely to participate. At the same time, the cost-benefit consideration equation will likely differ depending on the relevance and value of various incentives to a particular industry sector or business. For example, businesses that feel strong social license to operate pressures may place greater value on the recognition benefits of participation.

EXPECTED OUTCOMES

There is evidence that regulatory responsiveness programs can be effective at accelerating progress toward the goals outlined in the Beyond Waste Vision. Evidence on program outcomes is somewhat limited, however, and there is significant skepticism about the effectiveness of these programs in delivering results. At the same time, several experts see these programs as essential to enabling the broader public policy toolbox of the future to leverage beyond compliance behavior among industrial sector actors.[47] Several factors make regulatory responsiveness programs stand out as attractive elements for inclusion in 21st century environmental policy.

- They can clearly articulate and publicize, in a positive manner, the behaviors that are desired from industrial actors by public environmental management agencies.
- They can send positive feedback to organizations that behave in the manner desired by public agencies, creating incentives for further desired behavior.
- They can increase the attractiveness of environmentally-preferable behaviors and actions and decrease their marginal cost, prompting more "beyond compliance" behavior faster.
- They can engage public agencies in a constructive, collaborative dialogue with specific companies and industry sectors that can enable tailoring of public policy strategies to effectively address economic and technological constraints to environmental improvement.
- They can serve as a coordinated umbrella for multiple voluntary and incentive-based programs and initiatives, and provide a platform for adding future performance expectations and incentives.

Two important questions are relevant to assessing outcomes associated with regulatory responsiveness programs.

- What behavior change is the regulatory responsiveness program able to produce?
- What are the environmental improvements that result from that behavior change?

[47] For a discussion of the need for regulatory responsiveness programs in the long-term public policy toolbox, see Cary Coglianese and Jennifer Nash, ed. 2001. *Regulating from the Inside: Can Environmental Management Systems Achieve Policy Goals?* Washington, DC: Resources for the Future.

Regulatory responsiveness program outcomes should be considered along several dimensions. First, it is worthwhile to consider outcomes at the levels of both individual participating organizations and the overall program. Second, the mix of program elements, requirements, and incentives (e.g., EMS requirements, performance commitments) can significantly affect outcomes. Third, there are different types of outcomes (e.g., environmental performance, behavior or culture change) that warrant consideration.

Organization-level outcomes. The performance outcomes of individual organizations participating in regulatory responsiveness programs can be examined from several vantage points: EMS implementation, progress towards performance commitments, environmental performance improvement derived from specific program incentives, and overall environmental performance outcomes.

EMS implementation. Many voluntary regulatory responsiveness programs have an EMS requirement. While having an EMS does not necessarily translate into improved environmental performance, several recent studies have found a significant association between having active EMS and P2 programs and improved environmental performance outcomes.[48] These results, coupled with anecdotes and case studies, suggest that at a minimum, EMS implementation can at least increase the likelihood that industrial actors have systems in place to routinely review their environmental aspects and impacts and maintain systems designed to improve performance over time.

In addition, EMSs that incorporate a focus on pollution prevention, product design (e.g., Design for Environment), lifecycle impacts, the Natural Step methodology, total cost accounting, transparency, supply chain initiatives, and other eco-sustainability tools and initiatives will likely enable those organizations to make further progress toward the Beyond Waste Vision. The importance of management commitment to their organizations' EMSs is also commonly cited as an important element of effective EMSs. Some regulatory responsiveness programs require periodic management review and approval of their organization's EMS.

While EMSs are by no means the "answer" for reaching the Beyond Waste Vision, they are likely to be an important building block.

Progress toward performance commitments. For programs that require companies to make actual performance improvement commitments, program success can be evaluated based on the actual implementation results of these commitments. For example, EPA's Performance Track program requires companies to periodically make environmental performance improvement commitments and to document and/or report on progress toward meeting these commitments. Voluntary challenges also typically have some verification or reporting process for companies to indicate actual performance improvement outcomes. While it is often not possible to attribute such environmental performance improvements directly to regulatory responsiveness programs, interviews with company representatives indicate that these efforts can have a powerful "focusing effect" for the organization. Company environmental managers often find it useful to reference such external program commitments for rallying internal support for environmental improvement initiatives.

[48] The results of several studies on EMS and environmental performance outcomes are included in *Regulating from the Inside: Can Environmental Management Systems Achieve Policy Goals?*

Several studies are currently being prepared which document the actual environmental performance improvements that have been made by companies participating in the Performance Track Program.

Incentive-related outcomes. Some environmental performance improvements can result directly from specific incentives provided to companies as part of regulatory responsiveness programs. For example, a recent evaluation of pilot flexible air permitting efforts in six states indicates that innovative Title V air permits can directly facilitate company P2 efforts and result in improved environmental performance.[49] Technical assistance can also result directly in environmental performance improvements, as evidenced by Washington's TREE Program. Environmentally-preferable purchasing requirements can also result directly in industrial sector environmental performance improvements, as companies alter practices to secure access to government sourcing opportunities.

Overall environmental performance outcomes. For most of the regulatory responsiveness programs, it is too early to assess the overall extent of environmental performance improvements associated with regulatory responsiveness programs. However, several important benefits of these programs were identified during consultant team interviews with several government agencies and companies participating in such programs.

- Voluntary regulatory responsiveness programs are providing a means to track and document beyond compliance environmental activities and performance in a manner that was not possible under conventional regulatory programs;
- Voluntary regulatory responsiveness programs can open an important dialogue between government and participating companies, and provide a platform for future collaboration and partnerships;
- Voluntary regulatory responsiveness programs are typically viewed as a business asset by companies. Once they make the commitment to participate, they typically focus efforts to ensure that they are investing in these initiatives sufficiently to meet or exceed program requirements to protect this business asset. Failure to meet program requirements can have significant impacts on corporate image and reputation; and
- Voluntary regulatory responsiveness programs can provide company environmental managers with an important tool for securing support and investment from company management and employees.

Program-level outcomes.

The overall program-wide outcomes of regulatory responsiveness programs depend on several factors, including:

- The number of facilities participating in the program;
- The market conditions affecting the facility and/or industry;
- The value of available incentives to participating organizations.

Several factors account for the limited evidence on program outcomes.

[49] See http://www.epa.gov/ttncaaa1/t5/meta/m24005.html

- Most regulatory responsiveness programs are either under development or have only been recently developed, limiting the available track record for analysis.
- Program outcomes can be difficult to measure and aggregate, as they can affect diverse media. Behavior change is very difficult to measure directly.
- It is difficult to discern how program participants would have performed in the absence of the program, and/or how their performance compares to that of non-participants.

Skepticism around the effectiveness of regulatory responsiveness programs typically rest on the limited participation in many programs. Program benefits and incentives are not sufficient to secure participation of many organizations. As a result, most program implementers are actively engaged in developing new incentives that can be used to leverage additional environmental performance improvements from participating companies, and that can also be used to attract new program participants

CHALLENGES AND KEY SUCCESS FACTORS

The following list outlined several key challenges and success factors that should be considered during program design and implementation.[50]

1. Messages and commitment must be clear and consistent throughout government
2. Need to understand needs and constraints of targeted industry sectors
3. Must have a clear connection to a statutory base
4. Weak incentives limit participation
5. Up-front multi-stakeholder involvement in program formulation
6. Thought must be given to performance metrics
7. Flexibility is important (e.g., EMS requirements could allow some flexibility for companies to integrate EMS activities into broader company continual improvement initiatives); minimize administrative burden

TOOL BOTTOM LINE ASSESSMENT

In many senses, voluntary regulatory responsiveness programs are in their infancy. Over the next decade, significant new information and lessons learned should emerge from those programs that are being developed. These program results and lessons should be closely monitored.

At this point, it probably does not make sense for Washington to focus resources on developing a "full-blown" regulatory responsiveness program. However, there are certain steps in that direction which make a lot of sense in the short to mid-term. Expanding the voluntary Cleaner Production Challenge into "Beyond Waste Partnerships" (see Goal #2 in Chapter 6) with more industry sectors would provide a strong foundation for increasing collaboration between the State and key industrial actors. Ecology can offer recognition and technical assistance as part of these initiatives, providing important incentives for beyond compliance environmental

[50] Tellus Institute. *Do Voluntary Mechanisms Work? An Evaluation of Current and Future Program Performance*. Submitted to the Michigan Great Lakes Protection Fund. Tellus Institute, April 2000.

performance. The sector-based dialogues associated with the Beyond Waste Partnerships can also be used to identify additional government actions or responsiveness that could facilitate improved environmental performance in various sectors.[51] The Partnerships could provide a platform for Ecology to clearly articulate the Beyond Waste Vision, while identifying tools and approaches that can be targeted to advance the Beyond Waste Vision.

In addition, Ecology could opt to leverage EPA's National Performance Track program by encouraging Washington companies to participate. Ecology could provide recognition or other incentives to companies who are accepted into Performance Track.

[51] For example, a recent EPA study suggests that efforts to clarify guidance on acceptable compliance strategies for converting to lean, chemical point-of-use management systems has the potential to reduce RCRA compliance violations while enabling companies to reduce chemical use and decrease waste associated with expired chemicals. See *Lean Manufacturing and the Environment: Research on Advanced Manufacturing Systems and Their Relationship to Environmental Performance and the Regulatory Framework.*

4. Price Signals

INTRODUCTION

SCOPE

This chapter focuses on a group of economic tools which can directly alter the "price signals" experienced by industrial actors. Government agencies are increasingly employing economic instruments in their broader toolbox for addressing environmental problems. According to EPA's 2001 report, *The U.S. Experience with Economic Incentives for Protecting the Environment*, environmental policy experts are increasingly calling for the use of market-based mechanisms, including the use of taxes and fees, to supplement traditional regulatory approaches to environmental improvement. [52] This chapter examines several "price signal" tools and assesses the potential for using these tools to help achieve Beyond Waste goals in Washington State.

This chapter focuses on regulated industries within Washington State. Given that the average quantity of toxic chemicals incorporated into products at industrial facilities is 10 to 20 times greater than the amount generated as waste[53], additional work geared toward the broader universe of actors (including out-of-state manufacturers, consumers, waste/toxic substance managers, and other stakeholders) will ultimately be needed to achieve the Beyond Waste Vision. For this reason, coordination and collaboration with other federal and state efforts will continue to be important.

Ecology's "Fee Team[54]" has already written a Beyond Waste Issue Paper (#10) on Fee Systems (hereafter referred to as the "Fee Team Paper."). This paper builds upon and responds to the Fee Team Paper's ideas and recommendations. For this reason, readers who have not read the Fee Team Paper (or are not already familiar with Washington State's existing fee programs), are encouraged to do so in order to better understand and contextualize this chapter.

CONTEXT

Over the past several years, the excitement surrounding the use of economic instruments to improve environmental conditions has increased substantially. Common reasons for the interest in price signal tools include: [55]

- price signal tools can sometimes be structured to achieve larger reductions in pollution than would result from conventional regulatory approaches;

[52] U.S. Environmental Protection Agency, National Center for Environmental Economics. *The United States Experience with Economic Incentives for Protecting the Environment*. EPA-240-R-01-001. January 2001. Also see Dennis Rondinelli. November 2000. *Rethinking U.S. Environmental Policy: Management Challenges for a New Administration*. Arlington, VA: The PricewaterhouseCoopers Endowment for the Business of Government.
[53] INFORM, Inc. "Tracking Chemicals and Human Health: The Community's Right to Know More." 2002.
[54] The "Fee Team" includes David Giglio, Larry McCallum, Jerry Parker, Joanne Phillipson, and Jim Sachet.
[55] Reasons are drawn from *The United State Experience with Economic Incentives for Protecting the Environment*, pp. ii-iv.

- price signal tools can often control pollution at lower costs than can conventional regulatory approaches;
- price signal tools can control pollution from a large number of small and dispersed sources, who may fall under conventional regulatory thresholds; and
- price signal tools can stimulate technological improvements and innovations in situations where conventional regulatory approaches may not.

Increases in relative prices can drive behavior change. In practice, however, the use of economic instruments to improve environmental conditions can be complex and the outcomes of doing so are at times uncertain. In addition, price increases imposed through government fees or taxation can have significantly different political implications than price fluctuations caused by market forces. As discussed above, however, there are reasons to be enthusiastic about the potential for price signals to affect change over time toward the Beyond Waste Vision. In situations where targeted industrial actors have time to respond, viable material or technological alternatives are available, and an economic license to operate that can accommodate necessary investments is in place, it should be reasonable to expect some degree of behavior change. In situations where price changes are precipitously steep, viable alternatives are scarce, or the company's economic license to operate is not sufficient to tolerate the investment needed to change behavior, price signal increases will likely result in more economic and social dislocation than actual behavior change. In the extreme, steep increases in price signals could cause businesses to slow investments, reduce production, or relocate operations.

There are short-term actions that can be taken to better align existing price signals in Washington with the Beyond Waste Vision (see Goals #5 and #6 in Chapter 6), and to begin strengthening the signals that they send. In addition, as the State of Washington pursues its substance-focused and sector-focused efforts[56] to develop integrated strategies, there are likely to be instances (leverage points) that can be targeted using focused price signal tools. For example, deposit-refund tools could be used to ensure that proper collection and recovery of specific products.

The extent to which the State of Washington pursues a very bold use of price signal tools will be driven by the degree of economic and social impacts that the State is willing to tolerate, or the amount of resources the State is

Using Price Signal Tools to Reach the Beyond Waste Vision

If Ecology decides that it is interested to expand the use of price signal tools, the following strategy is likely to be consistent with Ecology's efforts to make rapid progress toward the Beyond Waste Vision. See Goals #5 and #6 in Chapter 6 for more discussion.

1. Improve the alignment and strength of existing price signal tools by adjusting the current Hazardous Waste Planning Fee and removing or altering the fee cap.
2. Conduct more detailed economic evaluations of options for revising and expanding the Hazardous Substance Tax.
3. Evaluate opportunities to use price signal tools – including feebates, deposit/refunds, and product taxes – to target specific needs and leverage points (e.g., substances, products, practices) identified through the substance-focused or sector-based integrated strategies.
4. Continue to monitor and adjust price signal tools over time. Periodic, planned increases in certain price signals could foster more behavior change over time.

[56] See discussion on pages 13-22 in Chapter 2.

willing to allocate to mitigate any adverse economic or social impacts. Aggressive use of price signal tools would undoubtedly include a significant public involvement process and/or legislative action.

This chapter includes general reviews of several key price signal tools, along with "bottom line" assessments of the potential usefulness for achieving the Beyond Waste Vision in the industrial sector.

GENERAL PRICE SIGNAL RESEARCH OBSERVATIONS

The following observations have been culled from our review of the available research related to price signals. Addressing these considerations in the design of price signal tools is likely to significantly increase their effectiveness.

1. **Leveraging companies' economic "license to operate" is crucial to achieving the desired results.** As described in Chapter 2, the ability of industries to change depends on the structure of their economic "license to operate". The ability of many companies to change their business practices is constrained by factors such as the availability of alternatives, the cost of the change relative to customer willingness to pay, competition within the sector, and the cost of the change relative to the overall cost of their business activities.

   Dramatic increases in the fees or taxes (without mitigating compensation, such as rebates) could significantly hinder Washington companies' ability to compete, or even drive companies out of business or out of the state. Fees that are enacted without sensitivity to their impacts on particular sectors or stakeholders, especially when the stakeholders have not had a role in shaping them, are not necessarily substantially different from blunt, "command and control" regulation in their financial impacts and reputations.

2. **Very few price signals have been geared toward influencing the behavior of industrial actors (and few conclusive studies have been conducted on those that have been).** With rare exception, fees, taxes, and charges are not set at a level to change behavior, nor are they intended to do so. Instead, they have focused on raising revenues that are typically spent either on government-run projects (e.g., such as technical assistance) or on off-setting the costs of regulation, recycling programs, or cleanup.

3. **Price signals aimed at reducing hazardous substance use are rare.** Most existing price signals focus on waste and toxic releases, not hazardous substance use, the purchase of materials with hazardous content, or any potential Beyond Waste target other than "end-of-pipe" flows. Few scientific studies have been conducted on the existing price signal programs in general, with fewer on price signals that have focused on targets other than waste. There are no conclusive studies that provide much insight into the "price-elasticity of demand", or would answer the question, "What outcomes could Ecology expect if a fee of X amount were imposed on X (actor/industry)."

4. **Setting the right "price" is extremely difficult.** Two obstacles are in the way of determining the right "price" for new price signal programs in Washington State. First, there is insufficient experience and evidence to use as a gauge of reasonable expectations. Second, experts agree that setting the "price" (e.g., fee

level) at the right level to enact the *desired* change and still be politically feasible is extremely difficult under any circumstances.

If the price is set too low, industrial behavior will not be affected, and if the price is too high, undesirable behaviors such as illegal dumping, will be encouraged. Even a thorough quantitative economic analysis (which would be costly) would at best provide a ballpark estimate of the right fee level. Many factors, such the strength of the local and global economies, influence the sensitivity of specific industrial sectors to fee levels. In many cases, the costs associated with a price signal program are likely to be small relative to the overall costs of the industrial activities, and the other costs (e.g., cost of labor, equipment, raw materials) are typically more likely to influence behavior just as much if not more than a price signals program. For this reason, to truly gauge the expected outcome of price signal programs, it is necessary to evaluate the major factors and constraints influencing industrial behavior. A potential solution could be to start with a relatively modest price signal tool and incrementally increase the price signals over time, assessing and responding to outcomes and impacts over time.

5. **To understand the expected outcomes of various price signal options, a sector-by-sector assessment is needed.** To assess the economic impacts of price signal tools on both the public and private sector actors, gauge the expected environmental results, and anticipate political opposition, it is necessary to do a sector-by-sector (and in certain cases where a handful of companies are likely to experience significant impacts, even company-by-company) assessment. Industries' sensitivities, the availability of substitutes[57], their willingness to participate[58], etc. differ from industry to industry and company to company. This is true regardless of whether the program is blunt and all encompassing (e.g., aimed at all hazardous waste generators) or tailored to specific substances or activities.

6. **Carefully-targeted price signals are more likely to provide the "biggest bang for the buck" and be more equitable than are broad, "blunt" (e.g., fee on all waste) price signals.** Unlike large, blanket programs that apply to every industry, carefully-targeted programs can focus on a specific substance, practice,

[57] Are substitute/alternative technologies or materials available and easily implemented so that the industries/businesses can improve their pollution prevention practices without significantly reducing their "bottom line"? The question is, do any adequate alternatives exist, and, if so, are their costs within reach and competitive with the tax in place? (Tellus Institute and Environmental League of Massachusetts, 2001) Will the facility/generator know about the alternatives and have the needed incentives to change to the new product or practice? Will public awareness be high enough to promote switches to these alternatives as was the case with DDT, ozone depleting substances, and lead paint?

[58] Redefining Progress, a non-profit organization that works to create policies that are economically, environmentally, and socially sustainable, has researched the factors that answer the question "when will business want environmental taxes?" Their article in 2000 by this name was aimed at identifying "win win" market solutions, concludes that business will theoretically be more likely to support sectoral environmental tax reform if either of two conditions were met: (1) positive externalities (e.g., advances in technology, industry associations) at the industry level are funded by a rebate; or (2) a regulatory action is inevitable and an (environmental tax) with revenues kept within the industry is the lesser of the evils facing the industry. The first condition would be possible under feebate programs like the Swedish NOx policy discussed below. The second condition has occurred with unusual, but highly-visible examples such as DDT and recently proposed federal regulations for confined animal feeding operations, which have already resulted in industry reform. However, Redefining Progress acknowledges that these two conditions are rarely met and that these results are preliminary (Wolff, 2000).

process, or product for which cost-effective, less polluting options are available and overall success is more likely. Generic large scale programs are inevitably inequitable because their impacts on different stakeholders will vary dramatically, sometimes in undesirable ways such as penalizing a disproportionate share of small companies. Different stakeholders have different abilities to instigate change and absorb costs.

7. **Different price signal tools are appropriate for different purposes.** There is general agreement that there are a set of pros and cons associated with the use of various price signal tools (see Table 4-1). Fees, for example, are commonly viewed as having uncertain environmental outcomes and potentially large distributional effects. Other price signal tools, such as feebates or deposit-refunds are likely to be most appropriate for targeting specific substances or products, as opposed to broader substance use or waste generation. In other cases, other policy tools, such as bans, regulatory requirements, or takeback programs might be more attractive than price signal tools for affecting change in a specific area.

8. **Aligning and linking: price signals typically do not and should not stand alone.** The most innovative price signal programs in existence provide a mix of price signals with other types of instruments, such as outreach programs, targeted research and development, and technical assistance[59]. Program "packages" (e.g., programs that include fees, technical assistance, and financial rewards) should be considered, taking full advantage of the suite of regulatory tools available. In many cases, price signals will be most successful where they are part of a larger, complementary set of tools that collectively push in the same direction. Price signals can push on certain leverage points linked to industrial actors' economic "license to operate", but numerous other leverage points exist that can send consistent and reinforcing signals. The net effect is to reduce the "lifting" that a single tool must do, and to spread the economic and political costs of change more broadly.

9. **"Carrot-and-stick" will be more attractive to industrial stakeholders.** Programs that combine costs with rewards are increasingly recommended in order to encourage industrial participation while instituting price signal programs that are significant enough to affect change. In effect, these approaches improve targeting by punishing certain practices or substances instead of industry sectors. A trend in this direction is likely to be revenue neutral taxes that "first punish and then reward". (Most of these programs are either called "feebates" or "revenue neutral taxes.") These programs may involve either reducing government income or instituting programs that provide no net government revenue at all.

10. **Phased implementation approaches can provide time for desired behavior change.** Changing behavior often takes time, resources, and culture change. Gradually phasing the implementation of price signals over longer time horizons can provide room for change without producing major economic dislocations. Starting small and "ramping up" over time can also increase the political feasibility of price signals, particularly when paired with technical or other assistance that reduces barriers to change.

[59] One could argue that technical assistance is a subsidy and therefore is itself a price signal program.

Price signals can play a useful role in policy toolbox for achieving the Beyond Waste Vision, but they are unlikely to be a "silver bullet" for driving rapid, broad-based progress.

PRICE SIGNALS AND ECONOMIC EFFICIENCY

There is notable a distinction between a purely *economic* perspective on price signals and actual implementation by policy makers of price signals to date. Economists generally support price signals because they help to bring the market closer to the point of economic efficiency. Economic efficiency, or "equilibrium", is typically defined in economic literature as the "Pareto optimal" point where no allocation rearrangement could benefit some people without incurring deleterious effects on at least one other person.[60] Economists often refer to environmental taxes or fees that would achieve this efficiency as a "Pigouvian tax" where the tax is set equal to the external cost (of the pollution/waste/activity) and the price plus the tax is equal to the marginal social cost.[61]

In practice, achieving economic efficiency is not the primary desired outcome or even a focus of most price signal programs. As described by Hoerner in *Harnessing the Tax Code for Environmental Protection*, state agencies have generally been more motivated to promote public environmental goals and address wide distributional issues and basic fairness rather than achieve economic efficiency.[62] Even if economic efficiency were achieved, questions of rights (e.g., property rights and the perceived/legal rights to clean air and clean water) and distributional equity are unlikely to be addressed or resolved.

For these reasons, this chapter does not factor in economic efficiency as either a goal or a major fee program criterion.

REGARDING THE TERM "FEE" USED IN THIS CHAPTER

Although the terms "fee," "charge," and "tax" are often used interchangeably in reference to payments required from pollution sources, there are sometimes intentional, though subtle, differences in these terms' meanings. In general, a tax is generally thought of as a revenue raising instrument, whereas charges or fees are intended to offset program costs (EPA 2001). However, any of these instruments, when set at the right levels, can also be used to influence behavior and the outcomes. There are also more specific uses of several terms (e.g., charges can be broken up into pollution charges, user charges, and product charges). This chapter generally uses the term "fee" to apply to a charge, tax, or fee.

[60] Tietenberg, Tom. *Environmental and Natural Resource Economics, Third Edition*. Harper Collins, New York, 1992.
[61] Hoerner, J. Andrew. *Harnessing the Tax Code for Environmental Protection: A Survey of State Initiatives*. Center for Sustainable Economy. 1998. www.sustainableeconomy.org/taxcode.htm
[62] Ibid.

A BRIEF OVERVIEW OF IMPLEMENTATION EXPERIENCE

This chapter provides only a brief overview of price signals because publications that amply describe price signals are readily available[63] and because the Fee Team paper also provides an overview. In *The U.S. Experience with Economic Incentives for Protecting the Environment*, EPA provides an overview, including pros and cons, of several economic approaches used to reach a broad set of environmental goals. A table summarizing this information is provided below in Table 4-1. (The economic incentives that are considered in this chapter as price signals are marked with an asterisk.)

As of 1996, state agencies in the U.S. had implemented over 450 environmental tax instruments, of which 157 were geared toward hazardous waste. The breakdown of these 157 hazardous waste programs is as follows: 141 trust fund taxes; 61 charges on waste generation, transport, and disposal; 21 storage tank charges; 31 petroleum product taxes; approximately 40 charges on hard-to-dispose-of materials; and 2 oil severance taxes.[64]

Table 4-1: Uses of Economic Incentives

Incentive	Examples	Pros & Cons
Pollution Charges & Taxes*	Emission charges Effluent charges Solid waste charges Sewage charges	*Pros:* stimulates new technology; useful when damage per unit of pollution varies little with the quantity of pollution *Cons:* potentially large distributional effects; uncertain environmental effects; generally requires monitoring data
Input or Output Taxes & Charges*	Leaded gasoline tax Carbon tax Fertilizer tax Pesticide tax Virgin material tax Water user charges CFC taxes	*Pros:* administratively simple; does not require monitoring data; raises revenue; effective when sources are numerous and damage per unit of pollution varies little with the quantity of pollution *Cons:* often weak link to pollution; uncertain environmental effects
Subsidies	Municipal sewage plants Land use by farmers Industrial pollution	*Pros:* politically popular, targets specific activities *Cons:* financial impact on government budgets; may stimulate too much activity; uncertain effects
Deposit-Refund Systems*	Lead-acid batteries Beverage containers Automobile bodies	*Pros:* deters littering; stimulates recycling *Cons:* potentially high transaction costs; product must be reusable or recyclable
Marketable Permits	Emissions Effluents Fisheries access	*Pros:* provides limits to pollution; effective when damage per unit of pollution varies with the amount of pollution; provides stimulus to technological change *Cons:* potentially high transaction costs; requires

[63] Two specific papers are recommended for readers who are interested in learning more about these initiatives than is provided in the Fee Team Paper and this chapter. They are: (1) EPA's 2001 report, *The U.S. Experience with Economic Incentives for Protecting the Environment*, and (2) The Center for Sustainable Economy's (J. Andrew Hoerner) 1998 publication, *Harnessing the Tax Code for Environmental Protection: A Survey of State Initiatives*. (See the bibliography for complete references and Web addresses).

[64] Ibid (Hoerner 1998).

		variation in marginal control costs
Reporting Requirements*[65]	Proposition 65 SARA Title III	*Pros:* flexible, low cost *Cons:* impacts may be hard to predict; applicable only when damage per unit of pollution does not depend on the quantity of pollution
Liability	Natural resource damage assessment Nuisance, trespass	*Pros:* provides strong incentive *Cons:* assessment and litigation costs can be high; burden of proof large; few applications
Voluntary Programs	Project XL 33/50 Energy Star	*Pros:* low cost; flexible; many possible applications; way to test new approaches *Cons:* uncertain participation
Source: U.S. Environmental Protection Agency, National Center for Environmental Economics. *The United States Experience with Economic Incentives for Protecting the Environment.* EPA-240-R-01-001. January 2001		

In addition to the U.S. experience with price signals, several other government agencies have also been implementing price signals for a number of years. Individual European nations (namely Sweden, Finland, Great Brittan, and Germany) have taken bold steps with favorable results. The European Community on the whole is far ahead of the U.S. in terms of price signal implementation.[66]

A more detailed discussion of individual price signal options is provided in the Tools section below.

TOOLS: OPTIONS FOR ECOLOGY'S CONSIDERATION

Several price signal tools have significant potential relevance for achieving the goals outlined in the Beyond Waste Vision in Washington State. The following discussion focuses on seven potential tools – three that were developed by the Fee Team and four that respond to a combination of Beyond Waste focus areas (e.g., hazardous substance use). These tools include:

1. Modified and expanded Hazardous Waste Planning Fee (Fee Team Model 1);
2. New Hazardous Waste Assistance Fee based on hazardous substance use (Fee Team Model 2);
3. Revised and expanded Hazardous Substance Tax (Fee Team Model 3);
4. Targeted feebate;
5. Targeted deposit/refunds;
6. Hazardous product tax (tax on products with hazardous content); and
7. Waste disposal fee.

[65] EPA defines reporting requirements as information disclosure or information approaches that "influence the behavior of firms and individuals through the dissemination of information on inputs, production processes, and the environmental consequences of final product." (EPA 2001) These instruments are only considered in this chapter because they are the major components of the materials accounting programs that are the most prominent examples of hazardous substance *use* programs in the country.

[66] The Fee Team Paper's Appendix A includes an overview of several programs, including the well-known examples in Sweden (taxes on sulfur dioxide and nitrogen oxide emissions), Germany, and elsewhere.

Each of these tools is discussed in this section, along with a brief assessment of the expected outcomes, political feasibility, practical feasibility, cost considerations, and key challenges and success factors. These assessments draw heavily on the experience of other agencies that have implemented price signals (with similar goals in mind) that we have collected through literature reviews and interviews. It is important to note, however, that the results within these assessments can vary widely depending on the specific design and targeting of the tool. For example, the political feasibility of a tool could be significantly increased with the use of rebates or tax credits. Specific design approaches can make or break their success.

TOOL #1: MODIFIED AND EXPANDED HAZARDOUS WASTE PLANNING FEE (FEE TEAM MODEL 1)

Model 1 proposes to eliminate the current Hazardous Waste Education Fee and modify the Planning Fee by: eliminating the current exemption if TRI releases do not meet certain levels, creating a generator fee to support permitting and compliance, removing the cap on both individual firms and on total revenue, and instigating a cap that adjusts for both inflation and population.

The Hazardous Waste Planning Fee is currently calculated according to a formula described in Highlight 4-1. The annual per-pound fee varies according to that year's total fee cap and the reported amounts of dangerous waste, extremely hazardous waste, and TRI releases. For the past three years, the per-pound fees have been $.048 (2000), $.038 (2001), and $.059 (2002).

Table 4-2 shows how much facilities would pay if the fee cap was lifted and the lowest of the three years' fees ($.038) were charged.

The political feasibility of eliminating the current exemption depends on program implementation. This chapter offers three options which each eliminates the current exemptions and caps and also involves the following:

Option A: Charging a per-pound fee (approximately $.04 per pound) that is commensurate with the past few years.

Option B: Per-pound fee or, for larger generators (>350,000 fee pounds), lump

Highlight 4-1. Hazardous Waste Planning Fee: Formula calculation

Source: Fee Team Paper – Appendix A

Chapter 173-305 WAC outlines the formula used to calculate the planning fee. The formula considers the pounds of hazardous waste generated and reported on the most current Dangerous Waste Report. For fee calculation purposes, the only type of hazardous waste that is counted is recurrent manifested waste, less recycling credits. Other waste types are not counted.

The fee calculation also considers the pounds of on-site toxic releases, if any, reported on the previous year's Form R. There is an annual cap for any individual facility or an interrelated facility preparing a single plan. For example, the 2002 cap was $13,706. There are also limits on the total amount of revenues that can be collected annually ($1 million plus inflation). This year's cap on total revenues was $1,319,217. The fee for each individual facility is calculated based upon a statewide rate per pound and calculated in two steps:

Step 1: Total pounds of extremely hazardous waste multiplied by 10; plus the total pounds of dangerous waste; plus the total pounds of toxic releases; equals the total pounds reported by all facilities.

Step 2: Total pounds from Step 1; divided by program revenue cap; equals the rate per pound for that particular year.

The formula for an individual facility using the statewide rate is: Total pounds of extremely hazardous waste multiplied by 10; plus the total pounds of dangerous waste; plus the total pounds of toxic releases; multiplied by the rate per pound; equals the fee due from each individual facility.

sum plus per-pound overage fee. A per pound base fee ($.038) that is approximately the same as recent fees up to 350,000 pounds (which is approximately where the fee cap "kicked in" in recent years).

For all facilities with more than 350,000 fee pounds, a lump sum (of approximately $13,300/the same amount as the existing fee cap) plus a small per pound fee (e.g., $.001/pound) for all additional pounds. The per pound base, lump sum, and/or overage fees could incrementally increase over time (in a predictable manner).

Option C: Per-pound fee up to 350,000 fee pounds plus escalating fees for each additional 100,000 fee pounds up to 1,150,000 pounds.

A per pound base fee ($.038) that is approximately the same as recent fees up to 350,000 pounds (which is approximately where the fee cap "kicked in" in recent years)

A multi-tiered fee *increase* for each successive 100,000 fee pounds (e.g., $.01 per pound for each additional 100,000 pounds) up to 1,150,000 total fee pounds.

Option D: This option would involve charging a smaller per pound fee (e.g., $.002) than the current rate. Under this option, at least 90% of the regulated facilities would pay less than they do under the existing fee plans. This fee reduction would only provide an incentive to generate more waste and therefore this option is not considered further in this chapter.

Options A through C are only three of many possible fee options for Ecology to consider. They are also very simple assessments that do not account for trend data (past or projected), inflation, market volatility, facilities' ability to pay, etc. In other words, Options A through C are not a substitute for a full detailed quantitative analysis that would be needed to more carefully evaluate fee options. These options do provide a preliminary basis for understanding the general "ballpark" of fee feasibility and expected revenue.

Table 4-2 outlines the fees/revenues that could be anticipated under Option A. The tables showing fees/revenues for Options B and C are provided in Appendices C and D.

Political Feasibility: Option A appears to be the most politically challenging. Table 4-2 demonstrates that Option A, which involves removing the current facility cap ($13,192 in 2001) while still charging approximately the same fee per-pound, would result in a severe fee increases for the larger TRI reporters and hazardous waste generators. The fee increase for the top twenty companies (based on their total number of fee pounds would range from nearly four times to nearly one hundred times what they currently pay. These increases may affect the economic competitiveness of certain industrial actors that would experience significant fee increases, and are constrained from significantly reducing waste generation in the short-term due to the structure of their economic license to operate.

Options B and C (see Appendices C and D) are likely to be somewhat more politically feasible, only because they would involve smaller fee increases than Option A. If, under Option B, the per pound overage fee (fee charged for each pound above 350,000 fee pounds) were $.001, most facilities would not pay dramatically more than they do under the current fee plan, and the facilities with the largest number of fee pounds would pay less than $45,000 in total. However, even this increase may not be politically "palatable" for the facilities that would be hardest hit. One option to ease a transition to this kind of new fee structure would be to start with a very small overage fee (e.g., $.0002) and then

incrementally increase the overage fee each year. This kind of increase could apply also to the base fee in order to increase the incentives to all facilities to reduce waste and toxics. If the base fee and/or the overage fee were to be increased, it would be important to increase the fee in a pre-ordained and predictable manner so that industrial actors can anticipate and account for the expected increases.

Option C also limits fee increases compared to Option A. However, the largest generators do face fees of $79,700 annually. In addition, the tiered approach offers facilities at the margin of each tier a definable target on which to base their behavior change. This model sends a stronger price signal (compared to the current fee system) to all facilities enjoying the benefits of the current cap, providing larger economic incentives to the worst waste generators for changing their behavior. There are currently 54 facilities at or near the cap. 22 of these facilities generated between 350,000 and 750,000 fee pounds in 2001. Eight other facilities produced between 750,000 and 1,200,000 fee pounds that year. Under Option C these facilities likely have the best opportunities and incentives to reduce their waste generation. The transition to this system could be phased in over an extended period of time, allowing facilities to make capital investments and lowering political resistance.

Options A through C offer only a few of many ways that fee restructuring can be approached. In general, the higher the fee, the harder it will be to garner support for the changing the existing program, though further evaluation on facility-by-facility basis is still needed. There is always the option of starting small and increasing the per-pound fee over time, which would encourage facilities to employ pollution prevention measures to avoid paying larger fees in the future.

Table 4-2. Top 20 (2001) facilities: Projected Fees/Income if Existing Fee Cap Were Eliminated and Current (2001) Per Pound Fee Were Charged Per Pound.

Facility	DW	EHW	EHW * 10	TRI	Fee Pounds	Fee Pounds * .038
Goldendale Aluminum Co.	31,644,632	2,105	21,054	148,200	31,813,886	$1,208,928
KAISER ALUMINUM	15,471,654	1,306,576	13,065,760	1,130,384	29,667,798	$1,127,376
US Navy Fleet & Industrial Supply Ctr.	20,771,005	186,358	1,863,580	-	22,634,585	$860,114
Birmingham Steel, Seattle Division	21,123,701	-	-	25,691	21,149,392	$803,677
ALCOA-Wenatchee Works	10,720,682	265,535	2,655,353	695,534	14,071,568	$534,720
Boeing-Auburn	6,414,406	103,718	1,037,176	89,517	7,541,099	$286,562
INTALCO Aluminum Corporation	4,369,100	42,650	426,502	615,217	5,410,819	$205,611
Boeing-Fredrickson	4,614,374	49,917	499,166	10,150	5,123,689	$194,700
Boeing-Everett	3,553,930	61,799	617,993	588,502	4,760,426	$180,896
Puget Sound Naval Shipyard	2,357,242	188,608	1,886,079	53,699	4,297,020	$163,287
BOEING	3,316,396	52,450	524,496	180,820	4,021,712	$152,825
Georgia-Pacific West	2,477,660	-	-	608,304	3,085,964	$117,267
TransAlta Centralia Generation, LLC			-	2,813,064	2,813,064	$106,896

Weyerhaeuser Co.	20,311	-	-	2,641,016	2,661,327	$101,130
Toray Composites America Inc.	276,395	156,366	1,563,657	71,500	1,911,551	$72,639
Naval Submarine Base Bangor	205,983	162,964	1,629,644	-	1,835,626	$69,754
Fort James Camas Mill	10,964	10,505	105,049	1,681,290	1,797,304	$68,298
Boise Cascade Corporation	106,780	437	4,365	1,600,293	1,711,438	$65,035
Kenworth Truck Company	1,341,221	-	-	84,359	1,425,580	$54,172
Boeing Plant 2	1,375,072	26	265	2,250	1,377,586	$52,348
Total (top 20 facilities):	**130,171,507**	**2,590,014**	**25,900,139**	**13,039,790**	**169,111,436**	**$6,426,235**
Total (All remaining facilities)	**23,251,101**	**480,076**	**4,800,755**	**10,751,001**	**38,802,857**	**1,474,509**
Grand Total:	**153,422,608**	**3,070,089**	**30,700,894**	**23,790,791**	**207,914,292**	**7,900,743**

Note: Longview Aluminum (formerly Reynolds Metal Company), which generated the greatest number of fee pounds in 2000, 2001, and 2002, has been removed from this table because its operations have been closed.

Practical Feasibility: The practical feasibility of implementing any of the three options is high because existing data, reporting mechanisms, and program resources can be used.

Cost Considerations: As shown in Table 4-2, lifting or changing the fee cap could result in dramatic increases in program revenue. The cost of implementing such a program is likely to be similar to the program costs incurred today under the Education and Planning Fee programs because existing forms, information, reporting mechanisms, etc. could be used.

Projected Outcomes: No programs in the U.S. have enacted per-pound fees like those outlined in Option A. Minnesota charges ($.02 per pound) for TRI pounds, but much less for hazardous waste, and therefore the total amount charged to facilities is substantially less than is outlined under Options A, B, or C (see Appendix E for Minnesota's fee calculation). Although Minnesota has experienced a significant decrease in TRI releases, the exact causes of these decreases are not entirely clear (see Highlight 4-2). It is also unlikely that the Minnesota fee structure would work well in Washington State.[67] Therefore, despite the fact that the Minnesota program is the closest example to the proposed revamped fee program considered for Washington State, the Minnesota results are not a particularly strong indicator of expected outcomes for a Washington program. However, it is reasonable to expect that, if enacted, an ambitious fee program in Washington would reduce the amount of hazardous waste generation and TRI toxic releases because one of the following scenarios would take place: The largest generators (that would pay the largest fees) 1) would leave Washington for other states that did not have these fees; 2) would go out of business; or 3) would find and quickly implement dramatically alternatives ways to conduct business that are to date "untapped."

Highlight 4-2. Minnesota Pollution Prevention Act: Results

The Minnesota program has had the following results:

- Between 1993 and 2000, the amount of reported toxic chemicals generated in Minnesota decreased by 37% (for those manufacturing sectors that have reported continuously).
- The number of facilities reporting in these sectors has decreased from 550 to 357, and the amount of reported toxic chemicals released has decreased by 34%.
- Between 1996 (the first year the fee plan was implemented) and 2001, the amount of fees increased from $.97 million to $1.25 million. At least some of this increase resulted from an increase (in 1997) in the number of chemicals that were required to be reported and an increase (in 2000) in the number of industries required to report to TRI.

Discussion:

Despite these impressive changes, it is unclear why exactly these changes occurred. The Minnesota Office of Environmental Assistance acknowledges that "knowing the change in the quantity of TRI chemicals generated at a facility over time does not precisely tell what caused the change in generation…" (Minnesota Office of Environmental Assistance 2002). It is unclear, therefore, whether the fee plan itself is responsible for some or all of the pollution prevention improvements. However, as the Office of Environmental Assistance points out, identifying the cause of the progress is one thing: the main goal is to make progress in pollution prevention, and that progress is occurring.

Key Challenges: The key challenge of enacting any of the three options will be setting the fee level high enough to "send the right message" and enact change, but not so high as to cause businesses to relocate (out of state) or go out of business, or to enact an unstoppable political backlash. Charging the current per pound fee (of approximately $.04 cents) for all fee pounds is almost definitely going to be politically infeasible, and company-specific

[67] The Minnesota model is unlikely to work in Washington State because it does not include a fee increase for extremely hazardous waste. If the Minnesota fee structure were used in Washington, those facilities that generate extremely hazardous waste would be charged substantially less than they are now, which would amount to encouraging waste generation. Further, the Minnesota fee only applies to facilities that report more than 25,000 pounds to TRI: smaller reporters pay a flat fee of $500 pounds. This minimum pound requirement is not likely to encourage sufficiently the desired reductions.

analyses would likely reveal that several companies could not afford to pay such a fine. The second challenge, also related to political feasibility, will be enacting the program in a "one fell swoop" manner. Several companies are likely to claim that they cannot immediately adapt to cleaner business practices or afford to pay the new fees. A less significant challenge would be determining the best use of the increased revenues.

Tool 1 – "Bottom Line" Assessment: Starting with this "tool" makes a lot of sense if Ecology is interested to expand and improve its use of price signal tools for reaching the Beyond Waste Vision. See Goal #5 in Chapter 6 for more discussion.

TOOL #2: NEW HAZARDOUS WASTE ASSISTANCE FEE BASED ON HAZARDOUS SUBSTANCE USE (FEE TEAM MODEL 2)

The Fee Team's Model 2 proposes to base hazardous waste fees on hazardous substance usage. This program would replace the Hazardous Waste Planning and Education Fees with a new fee on the use of hazardous substances which would be called the Hazardous Waste Assistance Fee. The fee would be assessed at the time of purchase (based on the wholesale value of the product)[68]. The Fee Team predicts that the revenue generated from Model 2 would be equal to the current revenues generated from the existing Hazardous Waste Education Fee and the Hazardous Waste Planning Fee. In other words, the Team believes that this would be a "revenue neutral" option (For more detailed information on this program, see the Fee Team paper and corresponding Appendix.)

Political Feasibility: It is unclear what mechanism would be used to gauge hazardous substance use according to this fee. If the use were measured simply according to purchase (wholesale value of imports) amounts, then this Model would in effect be very similar to (if not the same as) the existing Hazardous Substance Tax. The political feasibility of this option would be solely based on the level of the fee. A revenue-neutral Hazardous Waste Assistance Fee that replaced the Hazardous Waste Planning and Education Fees and was based on hazardous substance purchases would not impact every industry or company equally because the basis of the fee would change from the programs in place today. Some companies – those that purchase many hazardous substances but do not generate any waste – would pay more. Conversely, those companies that generate waste and report toxic releases but do not purchase hazardous substances (e.g., some mining companies), would pay substantially less if anything at all. The overall political feasibility of this option is likely to be high, however, because the revenue from such a purchase-based program would be relatively small, and some companies would likely welcome this program because they would be required to pay less than they do today. This would in effect "reward" hazardous waste generators and those that report to TRI.

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[68] Assessing a use fee based on the wholesale purchase values is a relatively blunt way to measure toxic substance use. Other programs, notably the materials accounting programs, have developed alternative fee that measure use as a function of the several factors. In New Jersey, substance usage is calculated as the total amounts of inventory + produced on site + brought on site + recycled on site - ending inventory. Another measure to consider for the fee base in non-product output (NPO[68]) which the New Jersey program calculates as use - consumed - shipped as (or in) product. Usage fees and/or NPO fees, instead of purchase fees, are more likely to be encourage *efficient use*, rather than discontinued use altogether.

The primary model used by other agencies to measure hazardous substance use is materials accounting. If this Model were to be based upon a materials accounting, the political feasibility of enacting the program would be low. As mentioned previously in the report, several states have tried and failed to enact these programs and controversy still surrounds aspects (e.g., outcomes) of the programs enacted in Massachusetts, New Jersey, and Eugene, Oregon.

Practical Feasibility: The practical feasibility would be high if Model 2 were to be based on the existing Hazardous Substance Tax because the existing data sources and reporting mechanisms are already in place.

If, however, Model 2 were to involve instituting a materials accounting program, the practical feasibility would be low for the following reasons: Materials accounting programs are notably difficult and costly to administer (from both a public and private perspective), price signals have played minor roles in the existing materials accounting programs, and it is unclear how best to implement a fee or alternative price signal component, and doing the "leg work" to gain political support for passing such a program would be tremendously time consuming.

The existing materials accounting programs involve small price signal components: In Massachusetts, regulated facilities pay a small fee based on the number of chemicals that they use and in New Jersey, regulated facilities pay a small fee based on their number of employees. However, neither of these programs was designed with a price signal focus, and the role of the fees in any changes in chemical use, toxic releases, or waste generation remains unclear.

Cost Considerations: The cost of implementing this program if it were to be based on the existing Hazardous Substance Tax data would be low.

The costs of a materials accounting program have been estimated as follows. A report produced by the National Pollution Prevention Roundtable and Kerr, Greiner, Anderson, and April Inc. (2000) explored the costs of the materials accounting programs in Massachusetts, New Jersey, and Eugene, Oregon. The results of their study indicate that the reporting costs for facilities averaged $230 per chemical (over and above TRI costs) for facilities that had been reporting for several years. For facilities that were reporting for the first time, the cost ranged from $625 to $2,400 per chemical. On the agency side, the costs of implementing the programs ranged from a low of $37,500 to a high of $113,000, though these costs did not include technical assistance costs for helping non-governmental organizations and the public to understand and interpret program information.

Projected Outcomes: A use-fee based on purchases would be unlikely to have dramatic results because it would simply add a relatively small increase (roughly $1.8 million) to the Hazardous Substance Tax which generated approximately $34.6 million in 2000. Industrial behavior would not likely to change as a result of this program.

What can be expected from a materials accounting program is unclear for two reasons: First, it is unclear whether the improvements seen in those areas that have materials accounting programs are a direct results of these programs or a result of other influences. Many other areas (like Washington State and the U.S. in general) have experienced dramatic decreases in the amounts of toxic releases and in some cases hazardous waste generation without implementing a materials accounting program. Second, the influence of the (minor) price signal components of the existing materials accounting programs is uncertain at best (see Appendix F).

Key Challenges: The key challenges for a use (purchase) program would involve giving the right "message" to hazardous waste generators and TRI reporters, some of which would experience tax relief from this program. Additional challenge would be making the fee large enough to both differentiate it from the existing Hazardous Substance Tax and to influence industrial actors to use (purchase) few hazardous substances.

The key challenges for implementing a materials accounting program would be those described above: gaining political support from industrial stakeholders, raising the funds needed to implement the program, developing and implementing the needed information systems, determining right price signal level (for influencing industrial behavior), and demonstrating clear results.

Another key challenge would be devising an alternative program to measure hazardous substance use that is not based on a materials accounting program. Although there appears to be increasing interest in establishing new programs that focus on hazardous substance use by more than the regulated community, there do not appear to be any precedents for such programs other than materials accounting programs aimed at regulated facilities.

Tool 2 – "Bottom Line" Assessment: Implementation of this tool would likely create more challenges and costs than benefits. Revising and expanding the existing hazardous substance tax is a more attractive option (see Tool #3 below).

TOOL #3: REVISED AND EXPANDED HAZARDOUS SUBSTANCE TAX (FEE TEAM MODEL 3)

Model 3 would involve replacing the existing Hazardous Waste Planning and Education Fees with a revised Hazardous Substance Tax and would shift funding of both state and local Toxic Control Accounts from petroleum toxic substances to fees based on the amounts used of all other toxic substances. Model 3 would also involve lifting the current pesticide exemption from the Hazardous Substance Tax. (See the Fee Team paper for more information on this Model.)

Given that 85% of the Hazardous Substance Tax revenues were collected on petroleum products, shifting the revenues from petroleum substances to the other taxed substances while maintaining or increasing overall revenues would involve *significant* tax increases on the other hazardous substances. The fee team initially estimated that, to maintain current revenue[69], the fee on non-petroleum products would need to be increased from .7% to 1.2 or 1.3%. Although further assessments would be needed, it is not clear whether an increase to 1.2 or 1.3% would be sufficient to raise the current amount of revenue. A rough calculation illustrates this point:

Let us assume that the existing program generates $100 in total, $85 from petroleum products and $15 from non-petroleum products. If the $85 from the petroleum product revenue were removed, there would have to be a near seven-fold increase in the non-petroleum-based revenues in order to compensate because $15*6.6667=$100. The current tax rate of .7% multiplied by 6.667 = a tax rate of 4.67% in order to remain

[69] It is not entirely clear whether the 1.2-1.3% increase estimate assumed revenue neutrality (i.e., current revenue levels) or a revenue increase.

revenue neutral. Of course, increasing overall revenues would involve a larger tax increase. However, these are simple and crude calculations and further analysis would be needed to determine the actual needed tax increase to achieve revenue neutrality.

An additional issue related to Model 3 include the shift in focus away from petroleum products, even though petroleum products are by far the most abundant (and in some cases, the most toxic) hazardous substances used by our society. Given that that the Beyond Waste Vision aims to eventually eliminate the use of hazardous substances altogether, it may make more sense in the long run to focus programs on petroleum products (as well as petroleum industries).[70] Ecology may even want to consider a completely separate price signal program for the petroleum industries. The extensive knowledge of and information on these industries and products could be extremely useful. However, the political feasibility of increased fees and taxes on these substances and industries is not strong in the near future (as evidenced by the recent failure of the state voters to support even a small increase in gas taxes).

Political Feasibility: The political feasibility of this option would likely be low, especially if a new dramatic tax were introduced all at once.[71] It is unlikely that a fee increase of several times the existing fee would be met without significant opposition by the industries that use non-petroleum hazardous substances. This is particularly true if the affected parties would claim "inequity" because they were "targeted" while the petroleum product tax was left untouched. It may be the case that industries that rely heavily on the hazardous substances (e.g., pesticide manufacturers and rodent control retailers) could experience reduced competitiveness due to the changed cost structures, although a potentially complicated industry-by-industry (if not company-by-company) assessment would be needed to determine the validity of this issue. If the new fee were high enough, it is possible that a grey market for certain products could develop, not unlike the illegal markets today for cigarettes that sidestep state taxes.

There may also be legitimate equity issues in terms of the increased cost of hazardous substances that would be passed down to the consumer. Many non-hazardous products (e.g., "green" building supplies and "cleaner" white goods) are typically higher priced than more common products that contain hazardous materials or were manufactured using hazardous materials. Until non-hazardous product and processes are readily available at competitive prices, increasing the costs of these materials could keep these products out of reach of those in the lower income brackets. This is a generally understood problem associated with gasoline taxes and taxes on less fuel-efficient vehicles.

The political feasibility of removing the pesticide exemption is unclear, but it is unlikely that pesticide manufactures, distributors, and retailers (not to mention those who purchase pesticides) would be willing to pay a new tax without a fight. The history of the

[70] In *Harnessing the Tax Code*, Hoerner provides interesting related commentary: "A preliminary effort to identify a comprehensive environmental tax base including every variety of natural resource throughput, including renewable and nonrenewable resource use and pollution, found that 45 to 55 percent of the revenue came from tax on energy use.* Given that we are a long way from knowing how to properly tax many forms of resource extraction and pollution, energy taxes are going to be the mainstay of large-scale environmental tax reform efforts for the foreseeable future." (Hoerner, p. 43) *Source: John Duffy, "Hey buddy: can you spare me a trillion dollars: A preliminary estimate of necessary tax rates on throughput to support a full ecological tax shift." Unpublished manuscript. (1995)

[71] The tax increase may be more politically palatable if it were phased in over time, allowing for a gradual shift to less- or non-hazardous substance use. The Fee Team paper did not explore a phasing-in option.

existing exemption and the effects that removing the exemption would have on the relevant stakeholders need to be explored.

Perhaps the most important political factor are the overall economic and practical issues concerning whether increasing the tax on non-petroleum products would drive certain industries or companies out of business or out of the state. In some instances, non-hazardous alternatives may not be available. It may take several years for the research and development in these areas to "bear fruit" and make cost-effective alternatives available. A slow phasing-in approach to tax increases would be helpful in this regard, both in terms of allowing those who would absorb the increased taxes to identify and implement alternatives (which sometimes would involve large investments that require years of planning and budgeting) and in terms of encouraging new materials and technologies to be developed and brought to the market.

Practical Feasibility: The practical feasibility of this Model is fairly high because implementation could rely on the existing Hazardous Substance Tax resources. As noted by the Fee Team, some efficiency would likely be gained in fee administration because two of the existing three fee programs would be discontinued. Also, the Model Toxics Control Act (RCW 70.105D) would require amendments.

Cost Considerations: The costs of implementing Model 3 are not likely to be tremendously high because the program would rely on the existing resources, staff, data, etc. The largest costs are likely to be associated with conducting research on program implementation (e.g., answering the question, "What is the right fee level?"), and handling the political pressures that would arise while the program is being proposed and passed.

Projected Outcomes: Although it is likely that a tax set high enough would result in decreased use of hazardous substances, there is a lack of data and previous experience to support this claim. There appear to be very few fee programs like Washington's Hazardous Substance Use Tax[72] and no programs that explicitly use this kind of program to reduce hazardous substance use. Therefore, Washington would have a new, somewhat experimental fee program.

The revenues that could be expected from Model 3 are uncertain[73] for a few reasons: First, it is likely that the only politically feasibly tax increase for non-petroleum products would be insufficient to compensate for the revenues currently generated from the petroleum products. Second, assuming a higher tax (e.g., between 1-5% were implemented), revenues might first increase and then decrease if the tax were in fact high enough to cause a shift to non-hazardous substances. Eventually, if the tax were successful, revenues would drop to zero.

Key Challenges: The key challenges for implementing Model 3 are overcoming political opposition from those that would be charged higher taxes (particularly in regards to the

[72] The Delaware Hazardous Substance Cleanup Tax: Delaware enacted a Hazardous Substance Cleanup Tax on the sale of petroleum products effective for gross receipts after December 31, 1990. The tax is imposed on the sale of most petroleum products except products used "for heating of ambient space" and "cooking of foodstuffs" are exempt from the gross receipts tax. Effective January 1, 1996, House Bill 627 permanently exempted crude oil from this tax. The taxing structure imposed the Hazardous Substance Cleanup Tax on the sale of a petroleum product from the wholesaler or manufacturer to its customer. Source: "Tax Tips for Petroleum Wholesalers and Retailers Conducting Business in Delaware: Things You Should Know." http://www.state.de.us/revenue/obt/taxtips/tt-petroleum_dealers.htm

[73] The Fee Team expects that the revenues from Model 3 would be substantially higher than the revenues from Models 1 and 2 and from the current fee programs. The basis for this expectation is unclear.

current pesticide exemption), establishing the "right" tax levels, and shifting the funding of the state and local Toxic Control Accounts from the petroleum products to non petroleum products.

Tool 3 – "Bottom Line" Assessment: This option has some potential for reducing hazardous substance purchases in Washington. It is an attractive option because it could build on the existing Hazardous Substance Tax. More detailed sector-based research is advised to better understand possible options and the potential impacts that they would have on specific sectors. Political feasibility of this option would likely increase as the economic climate in the state improves.

TOOL #4: TARGETED FEEBATE

The literature suggests that feebates, a combination of fees with rebates, are efficient and cost-effective means to control pollution externalities or allocate common property resource (Collinge, 1997). Perhaps the most well known feebate program is the Swedish NOx program where nearly all of the revenue from a tax applied to power plants over 10 megawatts in size is returned to the participating power plants in proportion to the number of kilowatt-hours of electricity they produce. Despite initial concerns, namely from the electricity industry, the program appears to be very effective.

Within 20 months of the Swedish program's implementation, NOx emissions decreased 35% and the development of cheaper, more efficient technologies was apparent.[74] The main concern of the electricity producers – that the policy would result in an increase in the price of electricity – did not occur, at least on average. In his study *When will business want environmental taxes,* Gary Wolff concludes that the Swedish example "suggests that a tax and rebate "bubble" over the exempted industries – rather than an exemption – can offset the competitiveness concerns and create incentives to reduce energy use within these industries. This means that competitiveness concerns can be addressed by careful design of sectoral approaches (environmental tax reform)."[75]

[74] International Institute for Sustainable Development, *Making Budgets Green: Leading Practices in Taxation and Subsidy Reform*. 1994 http://iisd1.iisd.ca/pdf/greensumm.pdf
[75] Wolff, Gary H. "When will business want environmental taxes?" *Redefining Progress*, February 2000. http://www.redefiningprogress.org/publications/glance.html

Highlight 4-3. The Nitrogen Oxide Charge on Energy Production in Sweden

Source: International Institute for Sustainable Development, Making Budgets Green: Leading Practices in Taxation and Subsidy Reform. 1994. [http://iisd1.iisd.ca/pdf/greensumm.pdf]

The Policy in Brief

Economic Instrument:	Emissions charge and feebate
Problem:	Acidification of soil and water due to nitrogen oxide emissions. Acidification has damaged ecosystems and completely wiped out sensitive organisms in at least 15,000 lakes in southern Sweden. Some 20% of forest land is so acidic that the forests have been damaged
Goal:	Reduction of air pollution from nitrogen oxide emissions without distorting the competitiveness of industry
Description:	The Swedish nitrogen oxide charge is a leading example of how an economic instrument can be used to reduce pollution without distorting an industry's competitiveness. The charge is SEK 40 (US $4.80 at the August 1993 exchange rate) per kilogram of nitrogen oxide emitted, and the revenue from the charges paid by liable operations is redistributed among the plants in proportion to their energy production. The charge on nitrogen oxides began on January 1, 1992
Administering Institution:	Swedish Environmental Protection Agency (SEPA)
Key Stakeholders:	SEPA, large and small combustion plants, and other energy producers

See also Appendix G.

More information about the Swedish Program is provided in Appendix G.

The two most common feebate issue areas have been transportation and air emissions/global warming. In North America, several government agent agencies have explored feebate options surrounding transportation – specifically the promotion of purchasing cleaner-running automobiles. In this context, the feebate would involve tax on high emission vehicles and tax rebates on low emission vehicles.[76] An economic analysis conducted for Environment Canada predicted that a feebate applied in the Canadian market alone would reduce greenhouse gas emissions by approximate 34 megatons over a 22 –year period and that a harmonized Canada-U.S. feebate would reduce greenhouse gas emissions by approximately 73 megatons[77]. The Rhode Island Department of Environmental Management (RI DEM) has formed a Feebate Working Group, comprised of representatives of Brown University, the Tellus Institute, RI DEM, and Raab Associates to analyze the options for a revenue-neutral automobile feebate program that would encourage the purchase of full-efficient vehicles in Rhode Island.[78]

[76] HLB Decision Economics Inc. "Transportation and Climate Change: Assessment of Feebate Schemes for Canada." Vehicle Technology and Fuels Sub-Group of the Transportation Table on Climate Change. June 1999

[77] Ibid.

[78] Tellus Institute. Notes from Rhode Island Greenhouse Gas Process Phase II: Feebate Working Group Meeting. October 15, 2002

Even though these programs are called feebates, they technically are not feebates in that they penalize some parties (those who purchase inefficient vehicles) and reward others (those who purchase efficient vehicles), instead of penalizing everyone and then providing the reward back to those with "good behavior" as is the case in the Swedish example.

Washington State Options: A feebate program directed at hazardous waste, toxic releases (in general), or hazardous substance use would be a new, bold application of the feebate concept. Although there is a lack of strong evidence that such feebate programs would be effective in Washington State, the success of the Swedish NOx program, which was itself the first-of-a-kind bold program, provides reason to be optimistic for the potential of targeted feebates in Washington State.

One of the key success factors in the Swedish examples was that there was a clear, targeted, and measurable instrument to base the rebate upon: the amount of energy produced, which was in effect a measure of the efficiency of the end product against NOx emissions. The industrial actors (energy producers) were clearly defined. If a feebate program were to be successful in Washington State, a clear, targeted, and measurable rebate option – such as a particular set of companies that are releasing a particular measurable chemical and for whom "progress" or process/material use efficiency could be easily measured, would have to be identified.

In Washington State, the two largest potential "targets" for feebate programs (within the Beyond Waste context) are particular industrial sectors that generate recurrent hazardous and those TRI reporters that release particularly abundant or harmful chemicals. Although the amount (in pounds) of recurrent hazardous waste generation far exceeds the amount of TRI releases, a hazardous waste focus for a feebate program is likely to be less feasible than a targeted TRI-release program because the hazardous waste data (in HWIMSY) are less specific (e.g., in terms of the specific constituents in the waste) than are the TRI data and also tracking particular improvements for the rebate would be more difficult. In addition, a TRI focused program would focus directly on the hazardous chemicals that are present in waste in much smaller quantities. In other words, a feebate on TRI chemicals may yield "more bang for the buck."

Nearly two thirds of the toxic releases are in the form of air emissions, which totaled nearly 20 million pounds in 2000. Ecology could evaluate the options for approaching an emissions-based feebate program that is focused on common chemicals released in industry-specific air emissions. For example, two of the three most prevalent chemicals in air emissions, methanol and ammonia, are typically present in the air emissions released by the paper and allied products industry (SIC 26)[79]. An analysis of the options for and costs of pollution prevention in this industry as they relate to these particular emissions would help to reveal whether a targeted feebate for these particular emission reductions would be feasible. Another example would be to target a feebate program on the facilities that release particular PBTs, such as Polycyclic Aromatic Compounds, the most prevalent PBT released in 2000.

Highlight 4-4. Possible Assessment Criteria for Targeted Feebates

Each of the following questions would be explored for several feebate targets:

For the fee:

- Is the target causing a large enough problem to merit a program focus?
- Is the target currently being measured?
- Is the root cause (e.g., the process that results in the emission) of the target understood and documented?
- Are cleaner alternatives (to the root cause) available and known to be effective?
- How much do the cleaner alternatives cost?
- What is the potential financial impact of implementing the alternative technologies/materials/processes?

For the rebate:

- On what basis could a rebate be measured (e.g., percent reduction in emissions, amount of emissions per unit of production, implementation of new technologies)
- What measurable improvements can be expected from implementing the alternative? Can these improvements be expected on an annual basis? Is there reason to believe that the rate of improvement would change from year to year?
- What level percent of tax relief or tax would be financially feasible?
- What level percent of tax relief or tax would be financially attractive enough to the industrial stakeholders to encourage P2 action?
- How can the rebate be distributed equitable to reward those who make progress while still "punishing" those who make no progress?
- Are there alternative "rebate" options, such as P2 assistance, public recognition, or other financial rewards?

A systematic evaluation of the options for a targeted feebate program could be conducted though Ecology's existing programs (e.g., Ecology's Industrial Section, EMS planners, or the TREE program). These types of assessments have been conducted by other many agencies as part of their pollution prevention programs[80]. They are necessary to gauge both the political and technical feasibility of a viable feebate program. The assessment criteria could include those outlined in Highlight 4-4. Once this general assessment has been conducted and the options narrowed to the strongest candidate(s), an additional econometric assessment, including forecasted impacts and calculations of the Net Present Value for

[79] Based on data from TRI Explorer (http://www.epa.gov/triexplorer/) on Weyerhaeuser Co (Longview), Fort James Camas L.L.C. (Camas), and Boise Cascade Paper Division (Walla Walla), the three top TRI reporters for air emissions (2000).

[80] For an example, see the Georgia Department of Natural Resources Pollution Prevention Analyses, available at www.state.ga.us/dnr/p2AD/pblcations/

the program, would be recommended[81]. Finally, all detailed assessments will need to factor in the cumulative impact of all fee programs for affected companies.

It is worth noting that the same types of materials that would be appropriate for feebates may also be appropriate for tradable permit programs, which are relatively new instruments that have only focused so far on air emissions (namely for CO2). Tradable permits have recently been in the U.S. news[82], but are still a nascent and voluntary practice in the U.S.: they should be watched for potential long-term use by Ecology.[83]

Political Feasibility: The potential for targeted feebates to be politically feasible for particular industries is high, however, additional industry-specific (and company-specific) assessments are needed to determine which targeted programs would be the strongest candidates.

Practical Feasibility: The practical feasibility of introducing a targeted feebate program is low in the next few years because doing so 1) will require devoting resource to up-front research and outreach; 2) could require new data collection; and 3) would entail setting up program administration function and staff. Even though the income from a feebate program could possibly increase the State's revenue over time, these up-front costs are unlikely to be feasible in the short run given Ecology's current budget and staffing constraints.

Cost Considerations: Cost considerations in addition to those described under "practical feasibility" will be revealed once the targeted assessments have been conducted.

Projected Outcomes: Given that there are no existing feebate programs like the proposed targeted options, and that the detailed assessments have yet to be conducted, the specific outcomes that can be expected are unknown. However, both from the experience of other feebate programs and the general promise that feebate programs hold, there is reason to believe that a carefully-designed feebate program will yield positive results.

Key Challenges: The key challenges will be identifying a politically and practically viable feebate program, especially given that the program will be one-of-a-kind, and then securing the resources necessary for program implementation.

Tool 4 – "Bottom Line" Assessment: This tool has strong potential for use in advancing toward the Beyond Waste Vision. More detailed analyses are recommended of feebate options that might be appropriate to target specific needs or leverage points that are identified through efforts to develop both substance-focused and sector-based integrated strategies. The rebate component can help to mitigate adverse economic and social impacts that can be associated with price signal tools.

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[81] An example of this kind of assessment was conducted for a vehicle feebate program proposed by Environment Canada. See HLB Decision Economics Inc. "Transportation and Climate Change: Assessment of Feebate Schemes for Canada." Vehicle Technology and Fuels Sub-Group of the Transportation Table on Climate Change. June 1999, available at http://www.tc.gc.ca/envaffairs/subgroups1/vehicle_technology/study4/Exec_Summary/English/Feebate.htm

[82] For example, see Ball, Jeffery. "New market shows industry moving on global warming." The Wall Street Journal. January 16, 2003. p A1

[83] Also see U.S. Environmental Protection Agency, National Center for Environmental Economics. The United States Experience with Economic Incentives for Protecting the Environment. EPA-240-R-01-001. January 2001.

TOOL #5: TARGETED DEPOSIT/REFUNDS

Deposit/refund options are a combination of a product charge (the deposit) and a subsidy for recycling or proper disposal (the refund). The most common deposit/refund systems are aimed at recycling beverage containers: at least ten states have this kind of program. Several states, including Washington, have mandatory lead-acid battery deposit systems, and at least one state (Maine) has a deposit/refund program for pesticide containers.

According to EPA, "Several studies have concluded that deposit systems are more cost-effective than other methods of reducing waste disposal, such as traditional forms of regulations, recycling subsidies, or advance disposal fees (ADF) alone."[84] It is also generally agreed that these types of programs are most well suited to products that would be improperly or illegally disposed of (instead of recycled or properly disposed of) in the absence of the program. Absent these criteria, simple tax or fee programs would be likely to meet the same goal.[85] EPA has characterized the "pros" of deposit/refund systems to be that they deter littering and stimulate recycling, and the "cons" to be that they have potentially high transaction costs and only work on products that are reusable or recyclable.[86] Similarly, in his article "Deposit refund systems for environmental management: empirical results," H.W. Gottinger found that deposit/refund programs are only successful when the transaction costs (e.g., program enrollment, analytical testing, administrative costs) can be controlled and minimized. Otherwise, the other factors of concern (e.g., the risks posted by non-compliance) may become immaterial.[87] Gottinger concludes that more research and real-world case studies are needed.

There are at least five potential target areas for deposit refund programs in Washington State, each of which would be geared toward well-understood and well-publicized substances: lead-acid batteries (an expansion of the existing program), other types of batteries, pesticide containers, materials containing mercury, scrap tires, and Cathode Ray Tubes (an expansion of the new program under the interim enforcement rule[88]).[89]

Lead-acid batteries: Washington State's lead-acid battery program currently provides a $5 refund for each lead-acid battery returned with a five-battery minimum return. Of the ten states that have lead-acid battery deposit/refund programs, Washington State's program is the only one with a minimum number of batteries (beyond a single battery).[90] Therefore, one option for expanding this program is to remove the 5-battery minimum. However, given that the national average for lead-acid battery recovery (recycling) was

[84] Ibid.
[85] Ibid.
[86] Ibid.
[87] Gottinger, H.W. "Deposit refund systems for environmental management: empirical results." In Gottinger, H.W. (Editor) Hazardous Waste: Economic Risk Reduction. International Journal of Environment and Pollution. Vol. 7, No.2 1997.
[88] Washington State Department of Ecology Policy Notice. "Interim Enforcement Policy Conditional Exclusion for Cathode Ray Tubes and Related Electronic Wastes." April 2002. Publication number 02-04-017.

[89] Products containing mercury are less suitable for a deposit/refund program because they are currently not (typically) reused or recycled and because they are being phased out and/or banned altogether in many areas. At least ten states have passed laws banning batteries that contain mercury.

[90] U.S. Environmental Protection Agency, National Center for Environmental Economics. The United States Experience with Economic Incentives for Protecting the Environment. EPA-240-R-01-001. January 2001.

higher than 90%[91], there appears to be reason to believe that these batteries can be recovered through wide-spread voluntary recycling programs.

Other batteries: Several other types of batteries (alkaline, zinc-carbon, silver oxide, mercuric oxide, lithium, and nickel-cadmium) are also potential targets for deposit/refund programs. Ecology's Hazardous Waste and Toxics Reduction Program has aptly described the hazardous contents and disposal options for these batteries.[92] Further information on the extent to which these batteries are used, recycled, and illegally or improperly disposed of is needed in order to evaluate whether expanded recycling programs and/or deposit/refund programs would be desirable. Program options that are specific to mercury-containing batteries are discussed below.

Pesticide Containers: Maine instituted a pesticide container deposit/refund program after discovering 400 illegal disposal sites in the state. Deposits ($5 for containers with less than a 30-gallon capacity and $10 for larger containers) are required for all limited-use and restricted-use pesticides sold in glass, metal, or plastic containers.[93] How widespread illegal dumping of pesticide containers is in Washington State is unclear. The Washington State Department of Agriculture (Agriculture) is responsible for ensuring the safe disposal of pesticides.[94] Agriculture has worked with Ecology, the Washington Pest Consultants Association (WPCA), county solid waste program, Washington State University, and others to educate pesticide users about proper disposal and recycling opportunities.[95] WPCA runs a state-wide program for recycling plastic containers. In addition, companies such as Northwest Ag Plastics collects, granulates, and recycles plastic pesticide containers for the agricultural industry at no charge.[96] If illegal dumping of pesticide containers is a problem in Washington State, it is possible that an expansion of these types of outreach efforts and recycling opportunities could help to reduce the problem without introducing a deposit/refund program.

[91] Smith, Bucklin, and Associates, Inc. 1994 *National Recycling Rate Study*. Prepared for the Battery Council International, November 1995. as reprinted in U.S. Environmental Protection Agency, National Center for Environmental Economics. *The United States Experience with Economic Incentives for Protecting the Environment*. EPA-240-R-01-001. January 2001.

[92] Washington State Department of Ecology Hazardous Waste & Toxics Reduction Program. "Demolition Debris Resources: Batteries." http://www.ecy.wa.gov/programs/hwtr/demodebris/pages2/demobatteries.html

[93] U.S. Environmental Protection Agency, National Center for Environmental Economics. *The United States Experience with Economic Incentives for Protecting the Environment*. EPA-240-R-01-001. January 2001.

[94] "Welcome to the Department of Agriculture." http://www.wa.gov/agr/default.htm

[95] See Washington State University Cooperative Extension. "Pesticide Container Cleaning and Disposal." Http://pep.wsu.edu/waste/disp.html

[96] See Northwest Ag Plastics, Recyclers. "Who Are We?" http://www.nwagplastics.com/agriculture_recycling.htm

Highlight 4-5.
Typical products containing Mercury

Fluorescent HID Lamps
Metal Switches
Thermocouples
Mercury Batteries
Thermostats
Manometers
PC Boards
Dental Amalgams
Mercury Spill Kits
Calcium Phosphate
Mercury Relays
Ignitronic Tubes
Telephone Switches
Thermometers
Rectifiers
Glass Switches
Activated Carbon
Mercury Contaminated Soil

Source: Mercury Waste Solutions, Inc.
http://www.mercurywastesolutions.com

Products containing mercury: The harmful effects of mercury are well documented and well known. Mercury is present in many materials (see Highlight 4-5) that are used by most people at some point in their lives. It is also a byproduct of fossil fuel production and a byproduct of some manufacturing processes and mining operations. In August 2002, Ecology and the Washington State Department of Health (Health) issued a draft Washington State Mercury Chemical Action Plan that recommended several actions for use of products containing mercury.[97] The recommendations centered around encouraging voluntary replacement of mercury products, expanding outreach, increasing the collection capacity of local governments, and relying on the existing regulations under the Universal Waste Rule.[98] It does not appear as if price signals (probably a deposit/refund) were seriously considered. Although many agencies across the country are actively working to safely manage and eventually reduce the use of materials containing mercury, it does not appear as if price signals – specifically deposit/refunds – are being used to these ends. A more common means is to ban the sale of certain products (namely mercury thermometers) and introduce voluntary take-back programs.[99] However, opportunities are still likely to exist for introducing deposit/refund programs for particular products.

Tires: The United States generated approximately 273 million scrap tires in 2001.[100] According the EPA, the market for these scrap tires has grown substantially, from 17% in 1990 to 76% in 2002.[101] However, illegal dumping and stockpiling are still a problem. In California alone an estimated 9.9 million tires are illegally dumped or stockpiled each year.[102] Rhode Island appears to be the only state that has implemented a deposit/refund program for vehicle tires. Customers pay a $5 deposit for each replacement tire and have can receive their refund by returning old tires within two

[97] Washington State Department of Ecology and Washington State Department of Health. *Washington State Mercury Chemical Action Plan (Draft for Public Comment)*. August 2002.
[98] Ibid.
[99] Ten states have already done so and the U.S. Senate has introduced bills to do the same on the national level.
[100] U.S. Environmental Protection Agency. "Municipal Solid Waste: Tires." http://www.epa.gov/epaoswer/non-hw/muncpl/tires.htm
[101] Ibid.
[102] California Integrated Waste Management Board. "Waste Board Helps Pay for Tire Cleanup Efforts." http://www.ciwmb.ca.gov/PressRoom/2002/April/025.htm

weeks of the replacement tire purchase date.[103] In Washington State, more than five million tires are discarded each year.[104] It is unclear whether a realistic estimate of the number of stockpiled and illegally dumped tires is available. Although in recent years tire recycling opportunities have increased in Washington State[105], a deposit/refund program for scrap tires could potentially have positive results.

Cathode Ray Tubes: In the spring of 2002, Ecology issued an Interim Enforcement Policy that excludes CRTs from the Dangerous Waste Regulations if they are properly recycled.[106] This Interim Policy is essentially a price signal because it encourages recycling in order to be relieved of both the "burden" and the fees associated with the Dangerous Waste Regulations. Many other agencies are also taking action to reduce electronics waste. Washington State can decide whether a program that complements the Interim Enforcement Policy for CRTs (e.g., a deposit/refund for all purchases of CRTs) or programs aimed at other electronic products would be worth pursuing.

Discussion: Washington State would be breaking new ground if it were to implement deposit/refund programs for any of these materials that had the explicit intent of significantly deterring the purchase/use of these products in addition to encouraging reuse/recycling and proper disposal. As illustrated by the discussions above on each potential target material, the potential for a successful deposit/refund program to be enacted will depend entirely on the specific circumstances for each material. As with the feebate discussion above, additional case-by-case research and assessment (akin to Ecology and Health's work on that produced the draft Mercury Action Plan) is needed to determine the best opportunities and pros and cons of implementing a deposit refund program for these or other suitable substances.

Political Feasibility: The political feasibility of enacting deposit/refund programs will vary substantially from substance to substance and also according to the size of the deposit/refund (smaller deposits are more likely to be politically feasible than larger deposits).

Practical Feasibility: The practical feasibility of implementing successful deposit/refund programs is low. Establishing and funding the needed depositories, inspections (e.g., for pesticide containers), transportation, and administrative functions is likely to be difficult, time consuming, and costly. As discussed previously, the resulting the transaction costs could be high relative to the benefits of the program. A few large states came to this conclusion when they considered implementing a pesticide container deposit/refund program: they determined that they would not be able to inspect the expected number of containers.

Cost Considerations: The costs of designing and implementing deposit/refund programs is likely to be high because of infrastructure and administrative requirements (see practical feasibility) and because program revenues would have to come from

[103] U.S. Environmental Protection Agency, National Center for Environmental Economics. *The United States Experience with Economic Incentives for Protecting the Environment*. EPA-240-R-01-001. January 2001.
[104] King County News Release: "Washington State's largest scrap tire recycler joins King County's LinkUp program." July 19, 2002. http://www.metrokc.gov/dnradmin/press/2002/0719lu.htm
[105] Ibid.
[106] Washington State Department of Ecology Policy Notice. "Interim Enforcement Policy Conditional Exclusion for Cathode Ray Tubes and Related Electronic Wastes." April 2002. Publication number 02-04-017. http://www.ecy.wa.gov/biblio/0204017.html

sources other than the deposits (assuming that the refund amounts would be equal to the deposit amounts). This is particularly for abundant materials such as tires.

Projected Outcomes: Projected outcomes will only become clear once detailed assessments have been conducted for each material/program option. In terms of the outcomes of existing beverage container programs, anecdotal evidence suggests that these programs have significantly reduced the amount of solid waste in those states with such program.[107] Maine's pesticide container program also appears to have significantly helped to reduce the frequency of improper container disposal in the state.[108]

Key Challenges: The key challenges are likely to be identifying programs with the highest success potential, raising the revenue needed to develop and run the programs, ensuring that the transaction costs stay sufficiently low, and measuring program results.

Tool 5 – "Bottom Line" Assessment: This tool has moderate potential for use in advancing toward the Beyond Waste Vision. This tool is particularly relevant for improving the collection and recovery of specific products at the end of their useful life to ensure proper reuse, recycling, or disposal. The costs and benefits of instituting a deposit/refund program for a specific product would need to be evaluated.

TOOL #6: HAZARDOUS PRODUCT TAX (TAX ON PRODUCTS WITH HAZARDOUS CONTENT)

As noted in the Introduction, the average quantity of toxic chemicals incorporated into products at industrial facilities is 10 to 20 times greater than the amount generated as waste.[109] Furthermore, a majority of the products that contain hazardous substances are not manufactured in Washington State, even if they are purchased, used, and disposed of in Washington State. Achieving the Beyond Waste Vision may ultimately entail taking measures to a) keep products that contain hazardous substances from being imported and b) prevent the manufacturing of products with hazardous content.

Other states have pondered the same idea. The Tellus Institute and Environmental League of Massachusetts have recommended that Massachusetts enact a (revenue neutral) tax on toxic chemicals aimed at a combination of manufacturers of products with toxic content, industrial users of products containing toxics, and/or consumer products with toxic content.[110] To date, it does not appear as if Massachusetts has followed-up on this recommendation.

It is worth noting that this kind of program would affect far more than the industrial sector stakeholders.

Political Feasibility: Although there would be different fee options that could target the same issues, let us assume that a fee on the sale of products with hazardous components would be implemented. The political feasibility of enacting this kind of fee

[107] However, it does not appear as if an assessment has been conducted on the effects of the increase in pesticides in the water system as a result of properly rinsing out the pesticide containers. See U.S. Environmental Protection Agency, National Center for Environmental Economics. *The United States Experience with Economic Incentives for Protecting the Environment*. EPA-240-R-01-001. January 2001.
[108] Ibid.
[109] INFORM, Inc. "Tracking Chemicals and Human Health: The Community's Right to Know More." 2002.
[110] Tellus Institute and Environmental League of Massachusetts, Environmental Tax Shifting in Massachusetts: Taxes that Work for Our Environment and the Economy, August 2001. http://www.environmentalleague.org/primer.pdf

would be low. It would be equivalent to implementing a broad sin tax like those in place today on "bad" products such as alcohol and tobacco. There would undoubtedly be a large backlash from both anti-tax crusaders as well as from the industries that would be most seriously affected (e.g., pesticide retailers). Even if a measure along these lines were to pass, people may go out of state to purchase the same materials for a lower cost or seek products through grey markets (e.g., Internet sales) that have developed to avoid paying taxes for other highly-taxed products.

Practical Feasibility: The practical feasibility of instituting a blanket fee on products with hazardous content is low. First, it is unclear how much information is available about the hazardous content of even the most common materials.[111] (It appears as if this is one reason why Massachusetts has not followed-up on the recommendation to pursue this kind of program.[112]) A substantial amount of research and verification would be needed before even a hazardous content baseline could be established for fee purposes. Given that thousands of products could qualify for such a fee, and assessing and implementing the fee for all such products would be infeasible, a process would have to be established to determine what materials would apply. This process would have to be updated periodically as new products were introduced and older products revised. In general, this kind of a program would be much more complicated than the existing fees on particular, easily-identifiable products like cigarettes.

Cost Considerations: A fee of this sort would be very expensive.

Projected Outcomes: The outcomes of this program would depend on the elasticities of each material that would be taxed. The price elasticities for some materials are likely to be much higher than for others. Therefore, the purchases of some materials would most likely be reduced whereas others would remain unaffected. Overall purchase (and use) rates could reasonably be expected to decline.

Key Challenges: The key challenges would be to research and develop an effective program (because the availability of the needed data is likely to be extremely limited), garnering sufficient political support, and raising the needed funds.

Tool 6 – "Bottom Line" Assessment: This tool has moderate potential for use in advancing toward the Beyond Waste Vision, particularly in the mid to long-term. This tool could be used to target specific products that contain hazardous substances which have been targeted for elimination (e.g., PBTs). In each situation, this tool should be compared with other tools that can be used to eliminate (or create incentives to eliminate) hazardous substances from products, such as bans/mandated phase-outs, take-back programs, labeling and product certification programs, and other tools.

TOOL #7: FEE ON WASTE DISPOSAL (INCINERATION/LANDFILLING)

The most common price signals geared toward hazardous waste have been fees on disposal, specifically per ton fees on incineration and land disposal. In the late 1980s, over 30 states imposed fees on one or both of these types of disposal.[113] These fees

[111] It appears as if the recommendation to pursue this program was not made based on the knowledge or availability of the kinds of data that would be needed for implementation. (Personal communications with Steve Bernow, Tellus Institute and Nancy Goodman, Environmental League of Massachusetts, December 2002.)

[113] Sigman, Hilary. "The effects of hazardous waste taxes on waste generation and disposal." Journal of Environmental Economics and Management. 30, Article No. 0014, 1996.

ranged dramatically from $.30 ton to $171 per ton. Due to the abundance and relative lifespan of these disposal fee programs, more studies have been conducted on the effectiveness of these types of price signals than on any other. Research indicates that disposal fees influence the amount of hazardous waste generated, disposed of, and shipped all in the desired direction for achieving the Beyond Waste Vision (see "Expected Results," below). Even fees on the order of $12 per ton (1998 dollars) can be expected to achieve positive results.

Political Feasibility: The political feasibility of instituting a disposal fee in Washington State is moderate. The feasibility will depend on the size of the fee, the impacts the fee would have on key stakeholders (starting with waste handlers and disposal facilities), and the cumulative effects of this fee with other fees (and costs) along the waste life cycle. Given that disposal fees have been implemented so widely nationally, it is likely that a feasible option could be managed in Washington State, though the program may have to start small and ramp up, or just stay relatively small given that other fees may ratchet up.

Practical Feasibility: The practical feasibility is medium. It is likely that the data needed to implement a fee program (e.g., amount of waste disposed, method of disposal, disposal facility, etc.) this program is available. Implementation would, however, require assembling new administration and start-up program funds.

Cost Considerations: The costs of a disposal fee program are likely to be moderate and mostly geared toward program start up and administration.

Projected Outcomes: More studies have been conducted on disposal fees than on any other type of environmental price signal. Even so, the empirical evidence is somewhat limited. In general, the evidence suggests that price signals can be expected to change behavior if they are carefully designed and implemented. Economic studies indicate that the generation of chlorinated solvent waste is highly elastic[114] with respect to in-state incineration taxes. These results suggest that the generation of chlorinated solvent waste is sensitive to waste management costs and that taxes on disposal reduce reliance on disposal relative to treatment of wastes. Using these results, Sigman calculated that, in the absence of the 1998 incineration taxes (which averaged $12/ton[115] in those states with incineration taxes[116]), chlorinated solvent waste generation in 1998 might have been higher by 5-12 percent. However, despite the evidence showing

[114] Point estimates ranged from -7 to -22. This means that, for every one percent increase in the in-state incineration taxes, a corresponding decrease in generation could be expected on the order of -7 to -22 percent. (When out-of-state taxes on generation were considered, the elasticity was -3.9.) Sigman specifically researched the impact of state taxes on chlorinate solvent waste from metal cleaning, though her results appear to be consistent with the results of three previous studies (two published in 1985 by the Congressional Business Office and one published by EPA in 1984) that focused hazardous waste in general. However, an earlier study by Wolf and Camm (1987) concluded that demand for chlorinated solvent waste management was inelastic. According to Sigman, the Wolf and Camm study may have had different results because Wolf and Camm developed a model of demand for solvents based on older (1984) data and their own very rough estimates for the relevant activities (Sigman 1996). Alberini and Frost's working paper on economic incentives and the fate of hazardous waste (1999) also concluded that waste generators respond to disposal costs.

[115] Other reports (e.g., Levinson 1999) suggest that the average tax was slightly different.

[116] A 1988 EPA study found that for all states, including those with no tax, the mean tax level on land disposal of (all) hazardous waste was $21 per ton.

reduced hazardous waste generation in response to disposal costs, both Sigman and EPA (2001) caution against interpreting the results of Sigman's 1996 study too broadly, as incineration and other disposal taxes are small relative to other waste management costs, and the behavior of waste generators is likely to be influenced more by other cost factors.

Studies (including the same study by Sigman) have also found that incineration costs (which were increased due to incineration fees) were likely to have an influence on the amount of chlorinated solvent waste disposed of.[117] In terms of waste shipments and disposal fees, the evidence shows that states with higher disposal taxes experienced a decrease in hazardous waste shipments: a $1 dollar increase in local disposal taxes increases the proportion of waste that shipped by 5 percent, while a $1 increase in destination disposal taxes decreases the proportion shipped interstate by .6 percent.[118] [119] Finally, research indicates that the effects of disposal fees are likely to have small effects on employment growth and opportunities.[120]

According to EPA, Vermont and California currently have the highest taxes on land disposal of hazardous waste with some rates in California reaching $220/ton.[121] If the elasticity predictions were true, one would expect the generation and disposal (namely incineration) rates in these states to have decreased substantially. However, it does not appear as if studies have not been conducted to test the prediction. In California, the amount of hazardous waste disposed of in landfills *has* decreased, however, it is difficult to determine whether this decrease is due to the taxes, because many other factors could have influenced the generation and disposal practices.[122]

Key Challenges: The key challenges would be designing a fee program that would be high enough to discourage waste generation without making the program politically infeasible. Also, studies would likely be needed to assuage concerns that the program would have negative impacts on employment of particular industries and industry partners (e.g., shipping companies). Another challenge will be convincing people that

[117] In the absence of the 1998 incineration taxes, approximately 19% more solvent waste may have been disposed of. Sigman's results and engineering literature suggest that treatment options may be relatively simple process alternatives to disposal and that treatment and disposal appear to be perfect substitutes (Sigman 1999). However, the same caution against over-interpretation of these results as regards the generation results above applies to these disposal results as well.

[118] Levinson, Arik. "The missing pollution haven effect." Environmental and Resource Economics Vol. 15. 2000.

[119] A second study by Alberini and Frost (1999) on economic incentives and the fate of hazardous waste also found that waste generators respond to disposal costs and that shipments slated for incineration are particularly sensitive. This study focused on halogenated solvent waste, but the conclusions were generalized to apply to all hazardous waste. Alberini and Frost note that one consequence of these findings may be that states with higher disposal taxes may simply be shipping more of their waste out-of-state (to states where disposal costs less), which would lesson the effects of the tax on overall waste generation. Sigman's results, discussed previously in regards to waste generation, also suggest that disposal taxes will cause hazardous waste generators to ship more of their waste out-of-state for disposal.

[120] Arik Levinson's study called "The Missing Pollution Haven Effect" (2000) found that disposal taxes modestly affected employment growth in some industries, but that "the effects are economically quite small and the relative size of the effects across industries does not correspond to the relative pollution-intensity of those industries."

[121] U.S. Environmental Protection Agency, National Center for Environmental Economics. *The United States Experience with Economic Incentives for Protecting the Environment*. EPA-240-R-01-001. January 2001.

[122] Ibid.

such an "end-of-pipe" program is worthwhile during a shift in focus to other points on the hazardous substance life cycle.

Tool 7 – "Bottom Line" Assessment: This tool has moderate potential for use in advancing toward the Beyond Waste Vision. This tool has one of the strongest track records among price signal tools for fostering waste reduction.

CONCLUSION

Price signals hold some promise for affecting change in the industrial sector in Washington State in the long-term. However, most of the price signals that have been implemented to date have focused on raising revenue (versus influencing industrial actors to change) and on waste versus hazardous substance use. There is therefore a gap between price signal experience and the new ambitious price signals that could, in theory, take Washington State closer to the Beyond Waste Vision. This gap is further exacerbated by a lack of substantiated information about the expected outcomes of bold new price signals, such as high fees on waste generation and toxics or ambitious feebates on particular emissions.

Other agencies that have confronted these questions have typically commissioned groups to conduct detailed evaluations of a handful of the most promising programmatic options. For example, Rhode Island's current evaluation of a possible feebate (on automobile purchases) involves a working group comprised of private interest groups, academics, and agency staff; a contracted economic analysis and assessment team; and a professional facilitator. Their assessment involves careful analysis of data gathered from several agencies and economic modeling of projected outcomes. Coming to a decision on whether to pursue the program will take months, if not years. A similar example in Washington State was work that went into the development of the recommended actions in the Washington State Mercury Chemical Action Plan, which involved an Advisory Committee of approximately 20 stakeholders, significant involvement from two state agencies, and the careful analysis of over two dozen actions. While there are undoubtedly lessons learned from this process, the general approach is sound and effective.

Ecology will not want to move ahead with any price signal programs before conducting similar types of detailed assessments of each option and then weighing the relative pros and cons of all options in order to end up with a strong "suite" of price signal tools. It will not be possible to enact all of the desirable programs, especially given that price signals are only one of several strong-potential tools that Ecology can use to move toward the Beyond Waste Vision. With careful planning and targeting, however, price signal can play an increasingly important role in a broader set of policy tools aligned to support continued progress toward the Beyond Waste Vision.

Five- and ten-year goals and corresponding action steps, which the consultant team believes to be aggressive but realistic and consistent with the Beyond Waste Vision, are provided in Chapter 6.

5. Industry Sector Profiles: Electronics and Chemicals

Chapter 5 examines two industrial sectors in Washington to illustrate the type of sector-based analyses that would be helpful for understanding potential approaches to moving beyond "stuck" (see Chapter 2). Such sector analyses also illuminate potential areas to focus government engagement with the sector, as well as the potential effectiveness of various policy tool options. This section also discusses some of the factors that affect waste generation in these sectors, as well as background information that affects the social, economic, and regulatory "licenses to operate" commonly faced by facilities in this sector.

ELECTRONICS INDUSTRY SECTOR

The Electrical and Printed Circuit Boards industry sector, SIC 36, encompasses a large spectrum of manufacturers producing a multitude of electronics products, such as computer chips and components, batteries, televisions, and household appliances. In 2000 this industry sector was responsible for 0.58% of Washington's Gross State Product (GSP), for a total of $2.583 billion. Current employment is estimated at just over 20,000 individuals. In 2000 this industry sector reported 1,256 tons of recurrent dangerous waste generation, or 1.27% of the State's reported total. Waste projections indicate that reported recurrent dangerous waste generation will grow to 1,353 tons in 2005 (1.51%) and 2,059.36 tons in 2010 (2.11%).[123]

INDUSTRIAL HAZARDOUS WASTE & TOXIC RELEASE PROFILE

Approximately 69% of the dangerous waste generated by this industry sector in 2000 in Washington State can be attributed to the manufacture of printed circuit board (PCBs) and semiconductors. The remaining 31% comes directly from other products, including electronic capacitors, audio/visual equipment, electronic assemblies, and radio/TV/wireless communications equipment. PCBs are the physical structures on which electronic components, such as semiconductors and capacitors, are mounted to form an electronic assembly. The communications, computer, and automotive industries are the three largest customers for manufactured PCBs. Semiconductors, often associated with computers, are now found in most electronic products. They are used for data storage, information processing, display purposes, power handling, signal conditioning, and conversion between light and electrical energy sources.[124] Although these commodity products account for only a small portion of total electronics/computer industry sales, they are the linchpin to all electronic products and a driver of the U.S. economy.[125]

[123] Current waste generation and future projections taken from HWIMsy work completed under Task 1 of the Beyond Waste project.
[124] http://www.csa.com/routenet/epan/elecmpsnIIb.html
[125] http://www.csa.com/routenet/epan/elecmpsnIIb.html

In 2000, 32 electrical and electronics component manufacturing facilities in Washington reported generating recurrent dangerous waste. Dangerous waste from this industry is relatively concentrated with 7 individual facilities responsible for 80.1% of the reported waste generation.[126] Most of the facilities are located along the I-5 corridor, with the two largest generators in Vancouver (AVX) and Burlington (TTM Technologies).

2000 Reported Recurrent Dangerous Waste Generation

Facility/Company Name	Tons	% of Total	Cumulative % of Total
AVX Vancouver Corp	257.45	20.5%	20.5%
TTM Technologies Inc Burlington	246.03	19.6%	40.1%
Circuit Services World Wide LLC	157.64	12.5%	52.6%
SEH America Inc	129.14	10.3%	62.9%
Circuits Engineering Inc	91.78	7.3%	70.2%
TTM Technologies Redmond	85.54	6.8%	77.0%
Enigma Interconnect Inc	38.13	3.0%	80.1%
Others	250.40	19.9%	100.0%
Total	1256.10		

Contamination during the manufacturing process is the predominant cause of semiconductor or PCB failure. Manufactures take great care to reduce the risk of contamination, leaving production environments highly controlled. Most chemical releases reported under the Toxics Release Inventory (TRI) are controlled, captured, and shipped off-site for treatment. The TRI indicates that only 8 electronics facilities reported emissions in 2000. The concentration of reported emissions in the TRI is significantly higher, with 2 facilities, AVX and Circuit Services responsible for over 95% of the total on- and off-site releases.

TRI Reported Emissions (lbs.)				
Facility	**Total Air Emissions**	**Total Off-site Releases**	**Total On- and Off-site Releases**	**% of Total TRI Emissions**
AVX Vancouver Corp	8,193	301,500	309,693	55.0%
Circuit Services World Wide LLC	-	225,503	225,503	40.1%
Circuits Engineering Inc	23,369	255	23,624	4.2%
Cutler-Hammer	167	2,092	2,259	0.4%
Dyno Battery Inc	2	1,100	1,102	0.2%
Linear Tech Corp	250	250	500	
Matsushita Kotobuki Industries	67	-	67	
Solectron Washington	-	9	9	
Telect Inc	-	-	-	
TTM Technologies Redmond	-	-	-	
TTM Technologies Burlington				
Wafertech LLC	-	-	-	
Total	**32,048**	**530,709**	**562,756**	

[126] Based on analysis of HWIMsy waste generation and associated NAICS codes under Task 1.

WHAT ARE THE PROCESS-LEVEL SOURCES OF HAZARDOUS WASTE?

Eighty percent of PCB manufacturing employs a subtractive process in which conducting material, usually copper, is bonded onto an epoxy of resin and fiberglass to form a copper-clad laminate. The other 20% of PCBs are manufactured using expensive additive or semi-additive processes in which limited amounts of conductive material is used and etching does not play a major role.

During the subtractive process, after drilling holes through the laminate and making those holes conductive, unwanted copper is etched off, leaving copper patterns that form the electric circuits that conduct electricity. The following processes represent the major steps, in order, often used during subtractive production that may lead to waste generation:

- Lamination
- Drilling
- Cleaning
- Electroless plating
- Photolithography or stencil printing
- Etching
- Electroplating
- Rinsing
- Soldering

As mentioned earlier, contamination can be the leading cause of semiconductor failure, making a clean manufacturing environment a vital factor to a production facility's success. Wet processing, during which a semiconductor is repeatedly dipped, immersed, or sprayed with solutions is commonly used to minimize the risk of contamination.[127] Semiconductor production is a complex process that may require the repetition of several manufacturing steps. The following processes represent likely producers of dangerous waste or emissions reported under TRI:

- Diffusion
- Rinsing
- Grinding
- Etching
- Oxidation
- Photolithography printing
- Sputtering or high vacuum evaporation

A direct translation from these industrial processes into reported waste generation is unavailable. HWIMsy does indicate that wastewater treatment is the dominant process leading to dangerous waste that the electrical and electronics industry sector is currently managing.

[127] http://www.csa.com/routenet/epan/elecmpsnIIb.html

2000 Reported Recurrent Dangerous Waste Generation

Dangerous Waste Generation Process*	Tons	% of Total
Wastewater treatment	590.38	47.0%
Etching	156.29	12.4%
Sludge dewatering	131.85	10.5%
Laboratory wastes	116.32	9.3%
Other	261.26	20.8%
Total	1256.10	

*As defined by HWIMsy Source Code

TYPES OF WASTE

Semiconductor and PCB manufacturing requires a variety of chemical inputs. According to Microelectronic and Computer Technology Corporation's *Environmental Consciousness: A Strategic Competitiveness Issue for the Electronics and Computer Industry,* PCB manufacturing is the most chemical intensive process in the building of a computer work station. As PCB and semiconductors are incorporated into new, non-traditional products, these products will likely require greater chemical use for their manufacturing and possibly generate larger volumes of hazardous waste. Unfortunately HWIMSY provides a very muddy characterization of the types of wastes coming from this industry sector, with almost 24% of responses citing "Other waste inorganic solids" as the Form Code.

2000 Reported Recurrent Dangerous Waste Generation

Dangerous Waste Form*	Tons	% of Total
Other waste inorganic solids	298.42	23.8%
Spent acids and metals	171.60	13.7%
Other wastewater treatment sludge (Not toxic organics)	159.93	12.7%
Lime sludge with metals/metal hydroxide sludge	134.72	10.7%
"Dry" lime or metal hydroxide solids not "fixed"	110.42	8.8%
Solid resins or polymerized organics	96.90	7.7%
Oily sludge	43.54	3.5%
Other inorganic liquids	39.62	3.2%
Other organic liquids	27.31	2.2%
Metal scale, filings, scrap	20.50	1.6%
Concentrated aqueous solution of other organics	18.45	1.5%
Other	134.68	10.7%
Total	1256.10	

* As defined by HWIMsy Form Code

TRI, requiring CAS identification, gives a more complete picture of the chemicals emitted by these facilities. Two types of compounds, N-Methyl-2-pyrrolidone and barium, comprise almost 94% of reported emissions.

2000 TRI Reported Emissions (lbs.)

Chemical	Total Air Emissions	Total Off-site Releases	Total On- and Off-site Releases	% of Total
N-Methyl-2-pyrrolidone (list 1995)	1,499.00	301,500.00	302,999.00	53.8%
Barium compounds	-	225,503.00	225,503.00	40.1%
Formaldehyde	14,290.00	-	14,290.00	2.5%
Ammonia (includes anhydrous forms and 10% of aqueous forms since 1994)	11,861.00	-	11,861.00	2.1%
Ozone (list 1995)	1,905.00	-	1,905.00	0.3%
Lead	10.00	1,847.00	1,857.00	0.3%
Hydrogen fluoride	1,318.00	250.00	1,568.00	0.3%
Copper	1.00	1,359.00	1,360.00	0.2%
Catechol	650.00	-	650.00	0.1%
Nitric acid	451.00	-	451.00	0.1%
Copper compounds	-	250.00	250.00	
Sulfuric acid (acid aerosol forms only since 1994)	57.00	-	57.00	
Nitrate compounds (list 1995)	6.00	-	6.00	
Antimony compounds	-	-	-	
Decabromodiphenyl oxide	-	-	-	
Diisocyanates (list 1995)	-	-	-	
Lead compounds	-	-	-	
Total	32,048	530,709	562,756	

TRENDS AFFECTING THE ELECTRICAL AND ELECTRONICS INDUSTRY SECTOR WASTE GENERATION

Earlier sections of this report highlighted several powerful factors that are driving reductions in waste generation, material use, and environmental risk in key economic actor sectors. While many of these factors focus on improvements in efficiency and resource productivity, others involve the emergence of non-traditional business practices that seek to redefine various economic actor sectors' relationship with material use and wastes, significantly reducing their ecological footprint. Several trends related to these factors are likely to have direct or indirect impacts on the Electrical and PCB Industry Sector in Washington State.

Trend	Potential Impact on Risk & Volume of SIC 36 Hazardous Waste Streams
Resource Productivity Improvements/Lean Manufacturing	↓
Nanotechnology	Unknown
Churn	↑
Extended Producer Responsibility	↓
Proudcts of Service	↓
Public Awareness & Empowerment	↓

Resource Productivity Improvements

Increasing global integration, capital mobility, and overseas industrial development are forcing the electronics industry, like many other U.S. industries, to aggressively improve their customer responsiveness, product quality, and cost-competitiveness to secure market share and remain profitable. The hazardous waste generators in Washington State's Electrical and Electronics industry sector predominantly produce commodity components incorporated into other products. The majority of Washington semiconductor and PCB manufacturers likely face highly competitive markets that require consistent:

- Management or reduction of business risk.
- Human and material resources productivity improvement.
- Optimized utilization of production assets (e.g., plants, equipment).
- Elimination of all non-value adding activities (e.g., waste).
- Use of materials that minimize overall life cycle costs of final products.

To enhance resource productivity, optimize asset utilization, and eliminate waste, electronic component manufacturers are increasingly adopting advanced, or "lean", manufacturing systems.[128] Case studies demonstrate that these operations-based, continual improvement systems hold significant promise for reducing solid and hazardous wastes stemming from packaging, defective parts and products, overproduction, and raw material and component damage and spoilage.[129] Washington manufacturers may increasingly need to satisfy markets in foreign countries where there are mandated quotas on the percentage of material that must be recovered from electronics equipment.

[128] Common lean manufacturing systems include just-in-time production, cellular/one-piece flow manufacturing, total productive maintenance, 5S, kaizen/rapid improvement processes, and Six Sigma (see http://www.productivityinc.com for additional information and resources on lean methods.

[129] For information on the links between lean manufacturing and waste elimination in the electronics industry see "Six Sigma Programs Yield Dramatic Improvement Through Application of LEAN Manufacturing Methods in the Printed Circuit board Industry" *SAE Technical Paper Series 2001-01-0337*.

Nanotechnology

Technology trends are also spurring resource productivity improvements through the miniaturization and dematerialization of many products. Some of the most promising innovations will likely arise in computer technology. As the potential physical limits of Moore's Law have emerged in current silicon semiconductor production, manufacturers have been seeking new methods to increase computing power. Faced with the challenge of creating more and more switches in a smaller and smaller volume of material, micro- and nanotechnology could perpetuate this trend of increased power per unit of material or take it to a new level.[130] However, this trend may also expand the presence of minute amount of hazardous substances in a vast array of products. Maintaining vigilant management over these increasingly diffuse and ever smaller products could prove difficult.

Churn

While emerging trends attempt to decouple material consumption from economic growth, powerful pressures remain focused on moving more goods faster through the economy (also referred to as "churn"). For many companies and industry sectors, profitability is a product of how many material goods are sold in a given time frame. Sophisticated marketing techniques are used to build consumer demand for new products. In diverse industries such as electronics, automobiles, and apparel, new products are continually introduced and entire product lines turn over in less than two years. In the electronics industry several factors will contribute to the churn of products and their components, increasing the demand for electronic assemblies and other industry sector products manufactured in Washington State. These factors include:

- The advent of new technologies (including digital television programming, flat screen televisions, video games, and smaller, faster personal/laptop computers).
- The incorporation of electronic assemblies into non-traditional products.
- The rapid evolution and greater affordability of widely-used technologies.
- A strong reliance on electronic products for business and personal entertainment and communications.

Extended Producer Responsibility

Increased attention to product lifecycle impacts and "extended producer responsibility" (EPR) are compelling an increasing number of companies to examine "what they make", and not just "how they make it". For example, the EPA and electronics industry teamed up to evaluate the life-cycle environmental impacts, performance, and cost of technologies used in desktop computer monitors—namely, cathode ray tubes (CRT) and liquid crystal displays (LCD)[131]. Data from the study assists original equipment manufacturers (OEMs) and suppliers in the electronics field in incorporating environmental considerations into their decision-making processes and identify areas for improvement.

[130] Massachusetts Institute of Technology. "The State of Innovation." *Technology Review*. June 2002, pp. 55-63.
[131] http://www.epa.gov/dfe/projects/computer/index.htm

Several stakeholders groups have been convened at the regional and national level to discuss the implications of EPR and how it relates to the electronics sector. These include the National Electronics Product Stewardship Initiative (NEPSI), the Western Electronics Product Stewardship Initiative (WEPSI), and the Northwest Product Stewardship Council. In addition other governments, particularly in Europe, are taking aggressive action to help ensure responsible manufacturing of electronic equipment. All are concerned with the short product lifespan, large volumes of waste, toxic components, and the economics of recovering and managing the waste streams.

Products of Service

One growing trend has been towards developing "products of service", where a company retains ownership of the actual physical product and leases its services to the customer. Such an approach can align eco-effectiveness goals with business goals, as the business incentives favor products that are durable, long lasting, and easy to reuse or recycle.[132] As consumers attempt to avoid owning products that have ever-shorter useful lives, accelerated obsolescence may increase demand for electronic product services. A handful of companies have been successful in creating new business models for advanced electronics products like copiers. It is unclear how this trend will influence the production of electronic components. Several factors, including the possible low cost-effectiveness of reusing composite materials in electronic components, represent barriers requiring high levels of innovation and creativity for this trend to have a significant direct effect on semiconductor or PCB production.

Public Awareness and Empowerment

In certain instances, churn and accelerated obsolescence in the electronics industry may intersect with other trends to provide net environmental benefits. For example, public awareness and interest in environmental quality, health, and well-being have been steadily increasing and becoming more sophisticated over the past 30 years. There is increasing evidence that the growing public environmental awareness is – and has significant potential to – shift consumption patterns and political activism to address more environmentally sustainable practices. As consumers become dissatisfied with their "obsolete" computer and return to the market for new electronic products, the volume of information provided by increasing transparency and public awareness may lead to the selection of a specific "green" product.

There are also signals of increasing community empowerment around environmental issues, as evidenced by the rapid proliferation of local, regional, national, and international non-governmental organizations (NGOs) focused on environmental issues. Spurred by access to information and organizing capabilities using electronic mail and the Internet, groups are able to quickly mobilize to push for environmental improvements by industry and government. In this case, the electronics industry may be manufacturing the infrastructure used to demand radical change in its industrial practices.

[132] Examples of the "products of service" concept are discussed in *Natural Capitalism* by Paul Hawken, Amory Lovins, and L. Hunter Lovins (New York: Little, Brown and Company, 1999).

CRITICAL CUSTOMERS

Buyers

As most of the electronics products manufactured in this state that generate waste are assembled into other products, buyers are likely to be Original Equipment Manufacturers (OEMS). It appears that many large waste generators manufacture specialty products for many different customers based on their dynamic needs. Interviews with several PCB and semiconductor manufacturers reveal a range of buyers including:

- Aerospace & Defense
- Wireless Communications
- Computer Peripherals
- Networking Equipment
- Industrial Automation
- Home Audio Equipment

Many times orders are placed for relatively small quantities for research and development needs (R&D) or to scale up production of other end products. Large volume orders may be driven by external regulations. For instance, sometimes defense contractors are restricted from using PCBs or semiconductors manufactured off-shore and foreign buyers may specify ingredients that will satisfy their regulations for material recovery.

Industry associations

The Electronics industry has several national industry associations representing its diverse composition. It does not appear that any single association dominates in terms of Washington State industry penetration, environmental goals, or engagement in environmental issues. Some of the larger national associations are:

The **Electronic Industries Alliance (EIA)** is a national trade organization that includes the full spectrum of U.S. manufacturers, representing more than 80% of the $550 billion electronics industry. The Alliance is a partnership of electronic and high-tech associations and companies whose mission is promoting the market development and competitiveness of the U.S. high-tech industry through domestic and international policy efforts.[133]

The **Electronic Components, Assemblies, & Materials Association (ECA)** represents the electronics industry sector comprised of manufacturers and suppliers of passive and active electronic components, component arrays and assemblies, and commercial and industrial electronic equipment and supplies.[134] ECA is closely aligned with EIA.

The **Semiconductor Industry Association (SIA)** is a trade association representing the U.S. microchip industry. SIA member companies comprise 90 percent of U.S. semiconductor production and employ domestic workforce of more than 284,000. The

[133] http://www.eia.org/about/
[134] http://www.ec-central.org/abouteca/index.htm

SIA provides a forum for domestic semiconductor companies to work collectively to advance the competitiveness of the $102 billion U.S. chip industry.[135]

IPC is a United States-based trade association dedicated to furthering the competitive excellence and financial success of its members worldwide, who are participants in the electronic interconnect industry. The association represents OEMs, board manufacturers, electronics manufacturing services companies and their suppliers.[136]

A regional association, **Electronics Manufacturers Association (EMA)**, was founded in 1974 and has been active in the region for over 25 years. EMA has evolved along with technology to meet the developing needs of the electronics manufacturing community by promoting the exchange of ideas within the electronics manufacturing arena. Seattle chapter members include individuals from engineering and technology disciplines, purchasing, as well as sales and production management.[137]

CURRENT INDUSTRY ENVIRONMENTAL STATUS AND KEY INITIATIVES

ISO Certification and EMS

The implementation of environmental management systems (EMS) may be growing among electronics companies seeking to improve the effectiveness and consistency of their environmental management and risk reduction activities within a continual improvement framework. Many facilities in the electronics industry are ISO 9001 certified, as quality expectations and commodification create external pressures for product standards. There is also evidence that some companies are beginning to maintain ISO 14001 and EMS standards, illustrating possible increased attention to risk reduction and resource productivity.[138] One industry association survey completed recently found that 14.2% of respondents were ISO 14001 and 9.9% had implemented an equivalent EMS. When asked if they were considering 14001 certification, the following answers were received:

IPC Study: Status of ISO 14001 Certification

Considerng ISO 14001 Certification	Number of Compnaies	Percent
No plans to update company registration	67	42.1%
Gathering Information	34	21.4%
Not Aware of the Need	31	19.5%
Actively Pursuing	19	11.9%
Don't Know	8	5.0%
Total	159	

The current recession has taken its toll on PCB and semiconductor manufacturers, likely leading to weakening interest in EMS implementation from companies struggling to remain in business. The cost is simply too large for marginal manufacturers. However, new incentives to certify are emerging, as customers work to "green" their supply chain. Notably, Ford Motor Company has required their Tier I and Tier II suppliers to be ISO

[135] http://www.semichips.org/about.cfm
[136] http://www.ipc.org/html/fsabout.htm
[137] http://www.ema-wa.org/index.html
[138] Phone interview with Fern Abrams, Director of Environmental Policy IPC

14001 certified by July 1, 2003.[139] Continued industry troubles will likely mean that external pressures from customers will be a prevailing force for certification.

THE BIGGER PICTURE: WHAT ARE THE ISSUES? WHAT IS BEING DONE ABOUT THEM?

The Issues

The hazardous substances associated with electronics include waste (e.g., regulated hazardous waste and other waste that often ends up as municipal solid waste), toxics (TRI releases and other toxics that are not tracked through TRI), large-scale industrial equipment, and electronic consumer products (see Highlight 5-1). The industrial sector profile provided earlier in this chapter provides data on only one contributor (the Electronics and Printed Circuit Board sector) to this electronics hazardous substance world. In order to achieve the Beyond Waste Vision, each of these electronics hazardous substance "contributors" will need to be addressed.

Highlight 5-1
Consumer electronics products

TVs and monitors
Computers
Audio/stereo equipment
VCRs
DVD players
Video Cameras
Telephones (land line and mobile)
Fax and copying machines
Wireless devices
Video game consoles

Source: U.S. Environmental Protection Agency, Office of Solid Waste. Electronics: A New Opportunity for Waste Prevention, Reuse, and Recycling. EPA-53-F-01-006. June 2001.

Electronics products have been a large focus area for waste reduction. This is largely due to both the rapid growth and the rapid changes in the electronics products markets – growth that has resulted in a tremendous increase in the amount of electronics product waste. In 1988 alone, over 20 million personal computers became obsolete.[140] Only 13 percent of these computers were recycled.[141] During the same year, over 35 million personal computers were sold.[142] In 2000, the lifespan of computers was estimated to be 3-5 years and shrinking. 2000 estimates predicted that in 2005, more than 63 million personal computers would be retired. These staggering trends represent one of the larger product-based challenges related to electronics waste: increases in the waste associated with other products such as mobile phones and personal digital assistants, are also dramatic. For example, by 2005, approximately 130 million cell phones annually will join existing electronic waste.[143]

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139 http://www.ford.com/en/ourCompany/environmentalInitiatives/cleanerManufacturing/supplierCertification.htm

140 U.S. Environmental Protection Agency, Office of Solid Waste. *WasteWise Update: Electronics Reuse and Recycling*. EPA-53-N-00-007. October 2000; U.S. Environmental Protection Agency, Office of Solid Waste. *Electronics: A New Opportunity for Waste Prevention, Reuse, and Recycling*. EPA-53-F-01-006. June 2001.

141 Ibid.

142 Minnesota Office of Environmental Assistance. "Fact Sheet: Waste Electronic and Electrical Products." [No date] www.moea.state.mn.us/plugin/factsheet.cfm

143 INFORM

Thankfully, a lag time between when many of these products become obsolete (and are no longer used) and when they are being discarded[144] may allow for programs and markets to respond to the increasing need to manage the electronics that are no longer used.

Computers are an area of concern because they typically contain hazardous materials such as lead, mercury, and hexavalent chromium (materials commonly found in Cathode Ray Tubes (CRTs), circuit boards, and batteries). Electronics also are made with valuable materials such as steel, and precious metals. Other electronic devices also contain hazardous materials that give cause for concern. Persistent Bioaccumulative Toxics (PBTs) such as arsenic, antimony, beryllium, cadmium, copper, lead, nickel and zinc, are found in several common portable electronic devices, such as cell phones, mp3 players, personal digital assistants and pagers.Additional issues include the energy used by these products as well as the packaging, shipping, and marketing of these products: each of these activities and materials contributes in some way to the overall amount of waste and/or toxics associated with these products.

Finally, as explained earlier in the chapter, the manufacturing of computer components typically results in a substantial amount of hazardous waste generation and toxic releases. Manufacturing of semiconductors, printed circuit boards (PCBs), and (to a lesser degree) other components results in toxic air emissions and effluents (releases to land and water), and the generation of solid hazardous (and non-hazardous waste).[145]

What is being done

For several years, government agencies, interest groups, manufacturers, and others have been exploring waste reduction and pollution prevention options. The largest focus areas have been 1) product recycling and disposal, and 2) pollution prevention during the manufacturing process.

The largest focus areas have aimed at particular products, namely cathode ray tubes (CRTs), versus particular industrial sectors or the manufacturing of electronics equipment in general. The types of activities range from streamlining regulatory status of CRTs bound for recycling, banning disposal of CRTs, developing guidelines for electronic equipment management, setting up local collection sites, charging a recycling fee at point of sale, labeling products containing hazardous substances, investigating extended product responsibility providing technical assistance, and developing multifaceted programs to encourage recycling, re-use, and ultimately reduced generation of new electronics equipment.[146]

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[144] According the Institute for Local Self-Reliance, approximately 75 percent of obsolete electronics are being stored or warehoused until acceptable management options are available. U.S. Environmental Protection Agency, Office of Solid Waste. *WasteWise Update: Electronics Reuse and Recycling*. EPA-53-N-00-007.

[145] World Bank. Electronics Manufacturing.

[146] U.S. Environmental Protection Agency, Office of Solid Waste. *WasteWise Update: Electronics Reuse and Recycling*. EPA-53-N-00-007. October 2000. and also: U.S. Environmental Protection Agency, Office of Solid Waste. *Electronics: A New Opportunity for Waste Prevention, Reuse, and Recycling.* EPA-53-F-01-006. June 2001; Commission of the European Communities, Proposal for a Directive of the European Parliament and of the Council on waste electrical and electronic equipment and Proposal for a Directive of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment. Brussels, June 2000 http://europa.eu.int/eur-lex/en/com/pdf/2000/en_500PC0347_02.pdf

At the federal level, EPA is encouraging reuse, recycling, and proper disposal of CRTs.[147] EPA's economic analysis of its proposed CRT rule concluded that if the rules were implemented with full RCRA Subtitle C compliance, 2,900 establishments in 66 different two-digit SIC codes would be affected and approximately $4.8 million total savings would be realized (for current generators that elect not to send their discarded CRTs for disposal). Under current CRT disposal practices, the study found that the proposed rule would results in approximately $0.1 million in total savings.[148][149] Most of the costs savings would result from reduced administrative and transportation costs.

Minnesota has streamlined its regulatory structure to promote recycling of waste electronics by Minnesota businesses and institutions, and has passed regulations require businesses and institutions to manage electronic devices and components in a manner consistent with state and federal law.[150] The state has also implemented a large-scale, multi-stakeholder effort to remove used electronic products from municipal solid waste.[151]

At least a few other states have implemented programs aimed specifically at reducing the hazardous waste from CRTs. Massachusetts has banned disposal of CRTs in its municipal waste landfills. The state's Waste Specific Restrictions (Section 310 CMR 19.017(3)) restrict the disposal of CRTs at landfills, transfer facilities, and combustion facilities; and the Waste Restriction Plan Submissions (Section 310 CMR 19.017(5)) require that a plan describing the actions to be taken to comply with the CRT disposal restrictions be submitted.

California has banned the disposal of CRTs in municipal landfills and is considering new regulatory structures for waste CRTS. The state is also working toward creating a broad CRT recycling program. (The politics behind this proposal have involved the opposition and subsequent reversal of this opposition from Hewlett Packers, the largest manufacturer of personal computers in the world.[152]) In the meantime, California's Integrated Waste Management Board (CIWMB) has developed draft Guidelines for Procurement, Use, and End-of-Life Management of Electronic Equipment for use by state agencies and other interested parties.[153]

The Commission of European Communities is working on a combination of approaches that aim to prevent electronics waste; re-use, recycle, and otherwise recover electronics waste; and minimize the risks and impacts to the environment from the treatment and disposal of electronics waste. The proposal has a four-part implementation: 1) Producers

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[147] U.S. Environmental Protection Agency. *More recycling and reuse proposed for electronic wastes and mercury-containing equipment*. EPA530-F-02-018 April 2002.

[148] The EPA analysis built upon an alternative 1998 proposal from the CSI Computers and Electronics Sector Subcommittee that encourages recycling CRT glass back into new CRT glass. The recommendations included extended storage limits, no manifesting, reduced recordkeeping requirements, and no biennial reporting. A separate economic analysis was conducted for the CSI proposal alone, the results of which are provided in EPA's study (see EPA 2000).

[149] Minnesota Office of Environmental Assistance. *Recycling Used Electronics: Report on Minnesota's Demonstration Project.* July 2002.

[150] See http://www.state.ma.us/dep/recycle/crt/crthome.htm

[151] Minnesota Office of Environmental Assistance. *2002 Pollution Prevention Evaluation Report.* February 2002. www.moea.state.mn.us/berc/p2evaluation2002.cfm

[152] Davis, Grey. SB1523 Veto message. Sept. 2002a http://www.dtsc.ca.gov/HazardousWaste/CRTs/; Schoenberger, Karl. "In switch, HP announces support for e-waste bill." *Mercury News*. December 3, 2002.

[153] California Environmental Protection Agency, Integrated Waste Management Board, Guidelines for the Procurement, Use, and End-of-Life Management of Electronic Equipment. November 2002. www.ciwmb.ca.gov/Electronics/Procurement/PUEOL/default.htm

responsibility for certain phases of the waste management of their products, 2) Separate collection of electronics waste, Producer-designed treatment and re-use/recycling systems, and 4) informing the users of electrical and electronics equipment of these programs.[154]

Action is also being taken here in Washington State. For example:

- In the spring of 2002, Ecology issued an Interim Enforcement Policy that excludes CRTs from the Dangerous Waste Regulations if they are properly recycled.[155] This Interim Policy is essentially a price signal because it encourages recycling in order to be relieved of both the "burden" and the fees associated with the Dangerous Waste Regulations.
- In 2000, King County established a Computer Recovery Project to collect, among other things, computer central processing units, monitors, keyboards, and mice from county residents and small- to medium-sized businesses. Local computer repair/resale vendors and non-profit organizations collection the materials and decide whether they can be repaired and resold or recycled.[156]
- In 1995, Pacific Northwest Pollution Prevention Resource Center developed "environmental accounting profile" on a Lynnwood, WA company called Precision Circuits, Inc. which manufactures circuit boards.[157] In 1994, Precision Circuits initiated two changes with positive environmental impacts: (1) they purchased new plastic coated racks, eliminating nitric acid, and (2) put into place a new waste water treatment process that produced less waste water sludge and fewer waste streams. The study evaluated the savings realized from these investments which were determined to have a combined 5-year net present value of approximately $66,000 (1995 dollars) with pay-back periods of under one year. (PNPPRC 1995) This evaluation used a Total Cost Analysis approach used "to demonstrate its value as an effective decision-making tool for small firms evaluating the costs and benefits of pollution prevention opportunities."

Programs that are aimed largely at industrial pollution prevention are also popular.

These numerous examples illustrate not only that product-based programs are being taken seriously be numerous government agencies, but also that many programs combine many approaches (e.g., pollution prevention, recycling options, and disposal requirements) all at once.

Price signals geared toward the electronics sector and electronics equipment in general are relatively few.

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[154] Commission of the European Communities, Proposal for a Directive of the European Parliament and of the Council on waste electrical and electronic equipment, and Proposal for a Directive of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment. Brussels, June 2000. http://europa.eu.int/eur-lex/en/com/pdf/2000/en_500PC0347_02.pdf

[155] Washington State Department of Ecology Policy Notice. "Interim Enforcement Policy Conditional Exclusion for Cathode Ray Tubes and Related Electronic Wastes." April 2002. Publication number 02-04-017.

[156] U.S. Environmental Protection Agency, Office of Solid Waste. WasteWise Update: Electronics Reuse and Recycling. EPA-53-N-00-007.

[157] Pacific Northwest Pollution Prevention Resource Center, Analysis of Pollution Prevention and Waste Management Minimization Opportunities Using Total Cost Assessment: A Case Study in the Electronics Industry. September 1995 www.p2pays.org/ref/02/01321.htm

Opportunities for change within the Electronics Industry

A substantial amount of information is available on pollution prevention technologies that are available for use by electronics industries, including manufacturers of PCBs[158]. Studies have at times involved cost-benefit evaluations that have been too case-specific to apply directly to Washington's situation, but could helpful references for program evaluation in Washington.[159] For example, one study focused on the costs and benefits of using an ammoniacal etchant recovery system, which are popular in Europe and Asia where etchant costs are much higher than they are in the U.S. This study concluded that companies that use sufficient etchant (generate more than 20,000 lbs of ammonia waste per year) could install one of the available etchant recovery systems with a payback time period of three years of less. Waste reduction estimates are 80% for facility copper wastes and 90% for facility ammonia wastes.[160]

Two compounds, N-Methyl-2-pyrrolidone (NMP) and barium, account for nearly 94% of all reported TRI releases. NMP, a solvent with broad solubility that is known for its low toxicity,[161] is the leading substitute for methylene chloride in paint strippers, graffiti removers, and other products for consumer and industrial cleanup. Several pollution prevention programs have advocated the use of NMP as a substitute for other solvents.[162] Even though NMP is a cleaner alternative to other solvents, several options appear to be available to reduce or eliminate the amount of NMP used by the Electronics Sector, including recycling of NMP on-site, using an ultrasonic DI (De-Ionized) water system for Water Cleaning; and improving NMP filtration.[163] Some of these options have helped facilities to reduce their overall costs associated with the solvents and related processes.[164]

CHEMICAL INDUSTRY

Chemicals and Allied Products, SIC 28, consists of facilities classified as industrial organic chemical manufacturers under the three-digit SIC code 286. This includes gum and wood chemicals, cyclic crudes and intermediates, and industrial organic chemicals not elsewhere classified. The last category is by far the largest and most diverse of the three; however, its size distribution and industry structure are similar to those of the

[158] See previous references and Kerr, Greiner, Anderson, and April, Inc. *Pollution Prevention Technologies* Written for the Minnesota Office of Environmental Assistance. http://www.moea.state.mn.us/berc/bestpractices.cfm
[159] Ibid.
[160] Ibid.
[161] It is not on the Hazardous Air Pollutants (HAPs) list of the U.S. 1990 Clean Air Act Amendments.
[162] See Colorado Department of Public Health and Environment. "Chemical Manufacturing. Chemicals and Allied Products: Switch to Less Hazardous Cleaning Agents." http://www.coloradop2.org/cdphe_16.htm; New Jersey Technical Assistance Program, "Pollution Prevention Case Study -- Constant Services: Using alternative solvents in the gravure pressroom." http://www.cees.njit.edu/njtap/constant.htm; Pacific Pacific Northwest Pollution Prevention Resource Center, "Reducing Use of Fast-Evaporating Solvents in Paint and Coating Equipment." http://www.pprc.org/pprc/rpd/statefnd/minn_oea/reducin2.html; U.S. EPA EnviroSense's Integrated Solvent Substitution Data System (ISSDS) (Search on NMP to see a list of documents related to P2 and NMP): http://es.epa.gov/issds/.
[163] Kerr, Greiner, Anderson, and April, Inc. Pollution Prevention Technologies Written for the Minnesota Office of Environmental Assistance, 2000 See http://www.moea.state.mn.us/berc/bestpractices.cfm
[164] See the Minnesota Office of Environmental Assistance Pollution Prevention Profile for SIC 3572, http://www.moea.state.mn.us/publications/SIC3572.pdf.

cyclic crudes and intermediates because both use primarily petroleum and coal derived feedstocks.[165] In addition to industrial organic chemicals, seven separate types of product groups are identified under SIC 28:

- Inorganic Chemicals
- Plastics Materials and Synthetics
- Drugs
- Soaps, Cleaners, and Toilet Goods
- Agricultural Chemicals
- Miscellaneous Chemicals

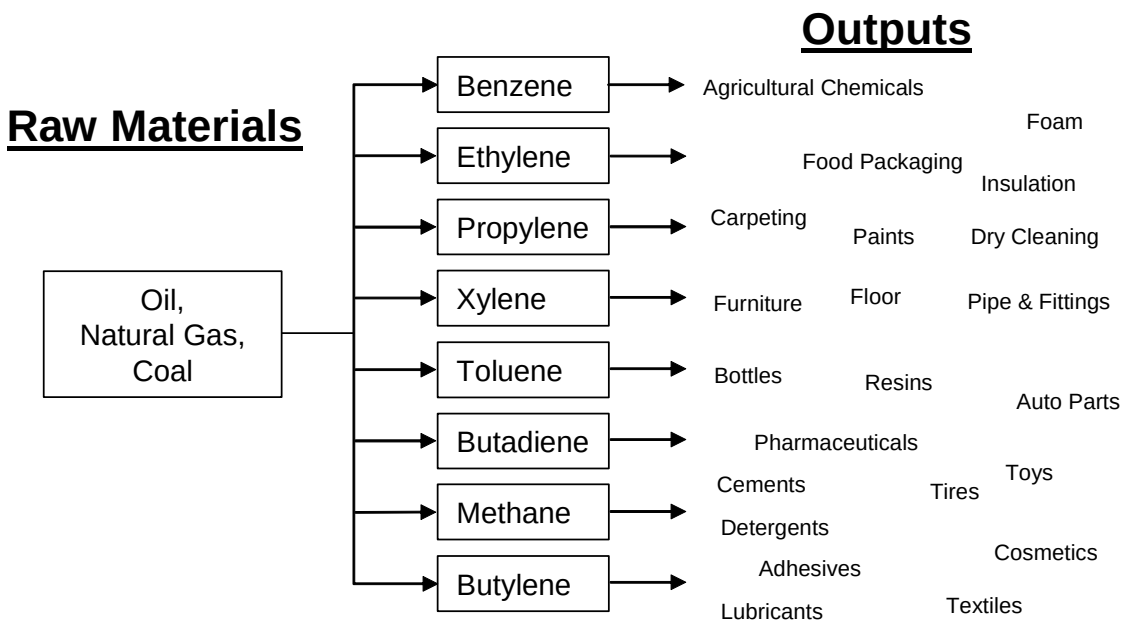
Many of these sub-sectors are downstream users of the products manufactured by the industrial organic chemical industry. Others, such as the inorganic chemical sector, utilize unrelated feedstocks.[166]

In 2000 this industry sector was responsible for 0.33% of Washington's Gross State Product (GSP), for a total of $1.472 billion. Current employment is estimated at just over 6,000 individuals. According to *The EPA Organic Chemical Industry Notebook*:

- Relatively few organic chemical manufacturing facilities are single product/process plants.
- Many facilities are designed so production levels of related products can vary over wide ranges to accommodate variations in feedstock and product prices.
- Short-term market fluctuations (12 months and less) can lead facilities to alter production rates and production processes.

The following flow diagram depicts the primary organic chemical building blocks, a key subset of large volume secondary building blocks, and a set of large volume tertiary building blocks.[167]

[165] http://www.csa.com/routenet/epan/organicIIb.html
[166] http://www.csa.com/routenet/epan/organicIIb.html
[167] http://www.csa.com/routenet/epan/organicIIb.html



INDUSTRIAL HAZARDOUS WASTE & TOXIC RELEASE PROFILE

In 2000 this industry sector reported 17,162 tons of recurrent dangerous waste generation, or 17.5% of the State's reported total. Waste projections indicate that reported recurrent dangerous waste generation will grow to 21,587 tons in 2005 (24.1%) and 24,683 tons in 2010 (25.2%).[168] Almost 97% of the dangerous waste generated by this industry sector in 2000 in Washington State can be attributed to cyclic crudes and intermediate manufacturing of organic chemicals. An additional 2% comes from fertilizer and pharmaceutical production.

In 2000, 28 chemicals and allied products facilities reported generating recurrent dangerous waste. Dangerous waste from this industry is concentrated, with a single facility—Noveon Kalama—responsible for 96.9% of the reported generation. Approximately 175,000 tons of chemical products are shipped from this one facility each year for use in the production of food preservatives and vitamins, fragrances and perfumes, photographic chemicals, adhesives, resins, coatings, dyes, detergents, sun screens and solvents.[169] The facility manages most of its dangerous waste on-site, incinerating its distillation and reaction bottoms, as well as other wastes, to recover energy. This management system requires an air permit issued by the local air quality agency and is considered highly regulated. One boiler is used to burn hazardous wastes and it requires a federal RCRA permit.

[168] Current waste generation and future projections taken from HWIMsy work completed under Task 1 of the Beyond Waste project.
[169] www.noveoninc.com

2000 Reported Recurrent Dangerous Waste Generation		
Facility/Company Name	**Tons**	**% of Total**
Noveon Kalama	16,632.16	96.9%
RSA Microtech	295.48	1.7%
Hollister Stier Laboratories LLC	39.85	0.2%
Inflation Systems Inc 9138	36.45	0.2%
Kemira Chemicals Inc Washougal Plant	31.03	0.2%
Others	127.25	0.7%
Total	17,162.22	

The TRI indicates that 29 facilities reported emissions in 2000. The concentration of reported emissions in the TRI is lower compared to HWIMsy, with 6 facilities responsible for 89.9% of the total on- and off-site releases. Noveon Kalama's permitted practice of incinerating its wastes results in 161,271 lbs. of reported air emissions, 9.1% of all TRI reported emissions for this industry sector.

TRI Reported Emissions (lbs.)						
Facility	**Total Air Emissions**	**Surface Water Discharges**	**Releases to Land**	**Total Off-site Releases**	**Total On- and Off-site Releases**	**% of Total TRI Emissions**
Agrium Kennewick	762,145	9,785	78,805	148,230	998,965	50.7%
Bay Zinc Co. Inc.	2,337	-	-	232,024	234,361	11.9%
RSA Microtech	1,500	-	-	208,485	209,985	10.7%
Noveon Kalama	161,271	885	1,403	15,447	179,006	9.1%
Morton Intl. Inc.	82,314	-	-	500	82,814	4.2%
Agrium Kennewick Area	30,230	2,180	33,245	-	65,655	3.3%
Rudd Co. Inc.	31,797	-	.	-	31,797	1.6%
Pace Intl. LLC	.	-	30,674	-	30,674	1.6%
Praxair Inc.	26,820	-	-	-	26,820	1.4%
Columbia Paint & Coatings	22,555	-	-	-	22,555	1.1%
Vinning Ind. Inc.	15,370	54	-	9	15,433	0.8%
General Chemical	14,862	-	17	17	14,896	0.8%
Wasser High-Tech Coatings	11,200	-	-	3,050	14,250	0.7%
Pioneer Americas Inc.	11,402	-	-	-	11,402	0.6%
Others	32,428	-	-	595	33,023	1.7%
Total	1,206,231	12,904	144,144	608,357	1,971,636	

What are the Process-Level Sources of Hazardous Waste?

The process employed to manufacture a given chemical is driven by the intended product. Polymerization, oxidation, and addition are commonly used to produce organic chemicals.[170] Polymerization is a chemical reaction usually carried out with a catalyst, heat or light (often under high pressure) in which a large number of relatively simple molecules combine to form a chain-like macromolecule.[171] Oxidation means combining oxygen chemically with another substance. In certain cases the name is also applied to reactions where electrons are transferred.[172] Addition covers a wide range of reactions where a double or triple bond is broken and a component added to the structure.[173]

At Noveon Kalama, a two-step toluene oxidation process is employed to create phenol and other specialty chemicals.[174] The process likely consists of oxidizing toluene to

[170] http://www.csa.com/routenet/epan/organicIIIa.html
[171] http://www.csa.com/routenet/epan/organicIIIa.html
[172] http://www.csa.com/routenet/epan/organicIIIa.html
[173] http://www.csa.com/routenet/epan/organicIIIa.html
[174] www.noveoninc.com

produce benzoic acid, which is chemically separated and then catalytically converted to phenol.[175] The products of the oxidation process are then used to produce a range of chemical products, including: benzaldehyde, benzyl alcohol, benzyl amine, sodium and potassium benzoate, K-Flex® dibenzoate plasticizers, nonyl phenol, benzyl benzoate, cinnamic aldehydes, dibenzyl amine, benzyl acetate, benzyl salicylate, and cinnamic alcohol.[176]

The production process used at the Noveon Kalama facility and its large production volume translates into 96% of recurrent dangerous waste in the Washington State Chemicals industry sector being generated during product distillation. 2.1% is generated when off-spec product is discarded, 0.5% when spent process liquids are removed, and 0.3% are laboratory wastes.[177]

2000 Reported Recurrent Dangerous Waste Generation		
Dangerous Waste Generation Process*	Tons	% of Total
Product distillation	16,474.49	96.0%
Discrading off-spec material	365.99	2.1%
Spent process liquids removal	91.58	0.5%
Laboratory wastes	56.88	0.3%
Other	173.28	1.0%
Total	17,162.21	
*As defined by HWIMsy Source Code		

Types of Waste

Distillation and reaction bottoms streams have varied compositions. In general, these streams are diverse mixtures of polymerized or high molecular weight products that are the result of high heat involved in the reaction or separation processes.[178] The exact composition of the streams depends on process parameters. For example, the bottoms streams from the benzoic acid and phenol processes represent the largest volume of hazardous waste generated at the Noveon Kalama plant. This type of waste is listed as "tar" in the HWIMSy reporting system and represents 91% of the total hazardous waste generated by the Chemicals & Allied Products industry sector in Washington State. No other facility reported generating this type of waste in 2000.

[175] http://www.epa.gov/ttn/chief/le/benzene/benz_c5e.pdf p 5-47
[176] www.noveoninc.com
[177] As defined by HWIMsy form source code
[178] Email from Bob Goldberg, Washington State Department of Ecology.

2000 Reported Recurrent Dangerous Waste Generation		
Dangerous Waste Form*	Tons	% of Total
Resins, tar, or tarry sludge	15,612.38	91.0%
Other organic liquids (Specify in comments)	869.30	5.1%
Other metal salts/chemicals	292.87	1.7%
Other inorganic liquids	86.56	0.5%
Nonhalogenated solvent	65.25	0.4%
Concentrated aqueous solution of other organics	59.24	0.3%
Other waste inorganic solids (Specify in comments)	31.03	0.2%
Other	145.59	0.8%
Total	17,162.21	
* As defined by HWIMsy Form Code		

TRI, requiring CAS identification, gives a more complete picture of the chemicals emitted by these facilities. Three types of compounds, Ammonia, Zinc, and Nitrates comprise over 70% of reported emissions. Most of Noveon Kalama's emissions are toluene moving through boiler stacks. In 2000 this facility reportedly emitted 95,639 lbs of toluene to the air, only 4.9% of all reported TRI emissions for this industry sector.

2000 TRI Reported Emissions (lbs.)							
Chemical	Total Air Emissions	Surface Water Discharges	Releases to Land	Total On-site Releases	Total Off-site Releases	Total On- and Off-site Releases	% of Total
Ammonia (includes anhydrous forms and 10% of aqueous forms since 1994)	829,288	4,233	3,631	837,152	5,146	842,298	42.7%
Zinc compounds	2,837	0	0	2,837	281,780	284,617	14.4%
Nitrate compounds (list 1995)	255	8,510	109,805	118,570	143,700	262,270	13.3%
Methanol	113,133	0	0	113,133	500	113,633	5.8%
Toluene	110,438	0	0	110,438	0	110,438	5.6%
Lead compounds	1	0	0	1	109,264	109,265	5.5%
Copper compounds	1,187	19	6	1,212	45,547	46,759	2.4%
Manganese compounds	506	0	30,424	30,930	11,960	42,890	2.2%
Benzene	30,487	0	0	30,487	0	30,487	1.5%
Xylene (mixed isomers)	25,677	0	0	25,677	0	25,677	1.3%
Other	92,422	142	278	92,842	10,460	103,302	5.2%
Total	1,206,231	12,904	144,144	1,363,279	608,357	1,971,636	

TRENDS AFFECTING THE CHEMICAL & ALLIED PRODUCTS INDUSTRY SECTOR WASTE GENERATION

The consultant team's trends memo highlighted several powerful trends that are driving reductions in waste generation, material use, and environmental risk in key economic actor sectors. While many of these trends focus on improvements in efficiency and resource productivity, others involve the emergence of non-traditional business practices that seek to redefine various economic actor sectors' relationship with material use and wastes, significantly reducing their ecological footprint. Unlike other industries, the resource productivity trends are likely to have a limited direct or indirect impact on the

major hazardous waste generators in the Chemicals & Allied products sector in Washington State. Other factors are likely to play a more substantial role in this sector.

Resource Productivity Improvements

Increasing global integration, capital mobility, and overseas industrial development are forcing U.S. industries to aggressively improve their customer responsiveness, product quality, and cost-competitiveness to secure market share and remain profitable. The hazardous waste generators in Washington State's Chemical & Allied Products industry sector predominantly produce commodity inputs used to create other products. The majority of Washington chemical manufacturers likely face highly competitive markets that require consistent:

- Management or reduction of business risk.
- Human and material resources productivity improvement.
- Optimized utilization of production assets (e.g., plants, equipment).
- Elimination of all non-value adding activities (e.g., waste).

Churn

While emerging trends attempt to decouple material consumption from economic growth, powerful pressures remain focused on moving more goods faster through the economy (also referred to as "churn"). For many companies and industry sectors, profitability is a product of how many material goods are sold in a given time frame. Sophisticated marketing techniques are used to build consumer demand for new products. In diverse industries such as electronics, automobiles, and apparel, new products are continually introduced and entire product lines turn over in less than two years. The Chemicals sector experiences this factor to the extent that the chemicals they create are later used to manufacture these end products.

Public Awareness and Empowerment

Public awareness and interest in environmental quality, health, and well-being have been steadily increasing and becoming more sophisticated over the past 30 years. There is increasing evidence that the growing public environmental awareness is – and has significant potential to – shift consumption patterns and political activism to address more environmentally sustainable practices. The chemical industry has experienced public pressures for several decades, and has developed the Responsible Care program to create standards for industry performance around environment, health, and safety programs and community relations.

There are also signals of increasing community empowerment around environmental issues, as evidenced by the rapid proliferation of local, regional, national, and international non-governmental organizations (NGOs) focused on environmental issues. Spurred by access to information and organizing capabilities using electronic mail and the Internet, groups are able to quickly mobilize to push for environmental improvements by industry and government.

CRITICAL CUSTOMERS

Buyers

As mentioned above, the pervasive presence of organic chemicals in multiple goods means the spectrum of companies buying this industry's products is quite large. Efforts to alter behavior "downstream" would require narrow targeting and would likely have little effect on hazardous waste generation in Washington State.

Suppliers

Approximately 90% of the feedstocks in the industrial organic chemical industry are derived from petroleum and natural gas. As it is difficult to differentiate feedstocks, suppliers are likely to compete on price and earn profits based on volume. Efforts to alter behavior "upstream" would likely be difficult.

Industry associations

The Chemicals industry has several industry associates representing its diverse product line. The American Chemistry Council is a dominant force at the national and international level. Facilities are likely to be a member of this association as well as smaller groups catering to the needs and goals of its market niche.

The **American Chemistry Council (ACC)** represents companies engaged in the business of chemistry. Members "apply the science of chemistry to make innovative products and services that make people's lives better, healthier and safer."[179] The Council markets itself as committed to improved environmental, health and safety performance through industry sponsored certifications, advocacy, and health and environmental research and product testing. The "business of chemistry" is a $450 billion enterprise and "a key element of the nation's economy and as the nation's largest exporter, accounts for ten cents out of every dollar in U.S. exports."[180]

The **Synthetic Organic Chemical Manufacturers Association (SOCMA)** is the largest trade association serving the specialty-batch and custom chemical industry. Its more than 320 member companies have more than 2,000 manufacturing sites and 100,000 employees. SOCMA members encompass every segment of the industry—from small specialty producers to large multinational corporations—and manufacture 50,000 products annually that are valued at $60 billion dollars.

CURRENT INDUSTRY ENVIRONMENTAL STATUS AND KEY INITIATIVES

Responsible Care®

In 1988, the American Chemistry Council (ACC) launched Responsible Care® to respond to environmental and public health concerns associated with the manufacture and use of chemicals. Responsible Care® is an industry association continual improvement program that aims to support responsible chemical production and use.[181]

[179] http://www.americanchemistry.com
[180] http://www.americanchemistry.com
[181] http://www.americanchemistry.com/rc.nsf/secondaryprofilesid/lsgs-4dnmdz?opendocument

Responsible Care® is an obligation of membership in the American Chemistry Council, and requires member companies to:

- Continually improve their health, safety and environmental performance.
- Listen and respond to public concerns.
- Assist each other to achieve optimum performance.
- Report their goals and progress to the public.[182]

Responsible Care 14001

Responding to the rise of ISO 14001 standards and its requirement throughout the supply chain by some industries, ACC has also created a Responsible Care 14001 certification. It is marketed as "an option for companies that may be required by customers or other parties to gain ISO 14001 certification, but want to also gain credit for their existing Responsible Care activities that go beyond the scope of an environmental management system such as occupational health and safety, product stewardship, community outreach and ISO rules, requiring registrars transportation safety activities."[183] The Responsible Care 14001 certification process operates within existing (and their auditors) to meet both Registrar Accreditation Board (RAB) and ACC requirements.

The chemical industry has complex regulatory, social, and economic license to operate pressures. There are likely to be further opportunities for pollution prevention and continuous improvement, as well as opportunities for implementing and strengthening facility environmental management systems. It is likely, however, that significant long-term progress toward the Beyond Waste Vision in this sector will require research and development, technological change, and infrastructure investment that is beyond the means of individual companies. Strategic intra-industry and government-industry partnerships will likely be needed to address long-term transition needs to reach the Beyond Waste Vision.

Establishing a Beyond Waste Partnership (see Goal #2 in Chapter 6) with the chemical sector should be a useful means for identifying opportunities and constraints within the sector for reaching the Beyond Waste Vision.

[182] http://www.americanchemistry.com/rc.nsf/secondaryprofilesid/lsgs-4dnmdz?opendocument
[183] http://www.americanchemistry.com/rc.nsf/unid/lgrs-5fur2a?opendocument

6. Goals and Action Steps

This section outlines a set of potential goals for Ecology to pursue as it works with the industrial sector to achieve the Beyond Waste Vision. The goals are organized around two timeframes: five years into the future, and ten years into the future. These milestones are meant to provide Ecology with aggressive but achievable goals that are consistent with the bold Beyond Waste Vision. Under many of the goals, we present action steps that we believe Ecology would need to take to achieve these goals. Under each goal, there is discussion about why the consultant team selected this goal and the associated action steps. The goals and action steps for achieving Ecology's Beyond Waste Vision are drawn from the best professional judgment of the consultant team, based upon our experience in this field, the research undertaken for this study, and the assessment of regulatory responsiveness program and price signal tools that are presented in Chapters 3 and 4.

Numerous other policy tools can be used to achieve the Beyond Waste Vision over time in the industrial sector, such as government procurement incorporating environmental criteria, technical assistance, information reporting and communication, regulated phase-out of certain substances, and education and awareness-raising. While we mention a few of these other tools throughout this report, this section primarily focuses on recommended goals and actions related to the tools examined in this report – regulatory responsiveness programs and price signals. Consistent with our discussion in Chapter 2 about the benefit of aligning multiple tools and signals to achieving the Beyond Waste Vision, we encourage Ecology to supplement the goals and action steps described in this section with additional tools and action steps that reinforce and facilitate the behavior change and performance outcomes that the Beyond Waste Vision implies from the industrial sector.

As mentioned in Chapter 2, there are several key observations from our research that have shaped the potential goals and action steps. For example, in areas where the political will for bursts of bold change is not present, we suggest that Ecology focus on sustaining progress and momentum through steps that encourage continual incremental improvement. The long-term, cumulative and compounded impacts of sustained incremental improvements can be profound.

We have outlined five-year goals that we believe to be consistent with Ecology's desire for aggressive but achievable goals toward achieving the Beyond Waste Vision. The action steps reflect the actions that the consultant team believes Ecology would need to pursue to achieve these goals. In developing the potential goals for Ecology, we have tried to emphasize bold actions, while taking into account the current political, economic, and budgetary climate in Washington.[184] In light of such constraints, we believe that short-term actions that focus on improving the resource efficiency of industrial sector actors represent a key opportunity. Such actions directly benefit business profitability while reducing the materials, energy, and waste associated with each unit of production. Over time, shifting economic, social, and regulatory licenses to operate will increasingly supplement "eco-efficiency" gains by raising attentiveness to risk in product and process design, material selection, and product lifecycles.

[184] For example, see Robert McClure and Lisa Stiffler. "Environmental Programs Continue to Slide", *Seattle Post-Intelligencer*. December 18, 2002. (http://seattlepi.nwsource.com/local/100412_enviro18.shtml)

FIVE-YEAR GOALS (2008)

The goals listed below constitute a set of goals that the consultant team believes to be consistent with progressing aggressively toward the Beyond Waste Vision. The action steps seek to leverage current trends that are compatible with the Beyond Waste Vision, while building a stronger foundation for future action.

OVERALL GOALS

Goal #1: The public in Washington is aware of the Beyond Waste Vision, as well as its expected benefits for the State.

The more effective Ecology is at articulating the Beyond Waste Vision – and the "business case" for achieving it – to the public and various economic actor sectors, the more latitude the Agency is likely to have in implementing policy tools that leverage "beyond compliance" environmental behavior and performance. We believe that a considerate, thoughtful roll-out that addresses the following considerations is important to avoiding immediate alienation of key stakeholders and economic actor sectors:

- Stakeholders will want to know what benefits – public health, economic, environmental, etc. – the State anticipates from pursuing and achieving the Beyond Waste Vision.
- Stakeholders may be concerned about the economic dislocation that they expect could result from pursuing the Beyond Waste Vision, particularly if actions or costs are mandated in a manner and timeframe that does not enable them to satisfy their "economic license to operate".
- Stakeholders may not be able to see the connection between the Beyond Waste Vision and what it means that they will need to do differently.

Ecology should consider the following messages in its public articulation and communication of the Beyond Waste Vision:

- *"There is a powerful economic business case for moving toward the Beyond Waste Vision."* While broad consensus on the need for State action may emerge periodically in response to strong evidence of adverse impacts to human orecological health, the "business case" for sustained, incremental action toward the Beyond Waste Vision can also be linked to the economic and competitiveness benefits of reducing the underlying need for vigilance related to hazardous substance use and waste management in the State. While the prospect of driving the risks and costs of managing, using, and disposing hazardous substances and wastes from the economy may seem remote to

many, significant literature on eco-efficiency has shown that there can be tangible benefits along the way.[185]

- "We recognize that there are economic and technological constraints that limit our collective ability to realize the Vision in the short to medium-term, and we respect those constraints."
- "At the same time, there is significant opportunity for sustained, continual improvement toward the Vision that can result in strong public health, economic and competitiveness, and environmental quality benefits along the way. The cumulative, long-term impact of continued steps in the same direction can be monumental." Focus on efficiency improvements – less waste (broadly defined) per unit of production – makes a lot of sense from an environmental and business perspective over the next 5 years, supplemented by gradually increasing focus on risk reduction and "eco-effectiveness".
- "It is likely that reaching the Beyond Waste Vision will require significant culture change in all of our organizations, including the Department of Ecology. We recognize that organizational change is not easy, but that our long-term success depends on it."

ACTION STEPS:

1. Clearly define the Beyond Waste Vision, its implications for the industrial sector (in terms of desired behavior change and performance outcomes), and the business case for achieving it. Identify key messages that need to accompany this information to address concerns that are likely to come from industrial sector actors and their critical customers.
2. Develop a communications strategy that aims to actively define and raise awareness of the Beyond Waste Vision throughout the state before the vision and its implications are defined for Ecology.
3. Conduct Vision roll-out and "listening" meetings with key constituencies, including various industrial sector groups, to discuss the vision and to listen to comments and concerns from these constituencies. Concerns and constraints (e.g., economic and technological) should be acknowledged.
4. Enlist key "allies" within the agency and elsewhere that may be effective at articulating the Beyond Waste Vision and the business case for achieving it. Involve these allies in various roll-out and listening events. Consider forming a Beyond Waste Advisory Board, composed of business representatives, academics, and other experts who can both advise Ecology on implementation strategies, and who can assist with communicating to various constituencies about the Beyond Waste Vision.

[185] The World Business Council for Sustainable Development (WBCSD) and the Global Environmental Management Initiative (GEMI) have documented numerous examples of the strong economic business case that can frequently be made for improving environmental performance. See http://www.wbcsd.org and http://www.gemi.org for publications documenting specific examples. Also see Dennis A. Rondinelli. November 2000. *Rethinking U.S. Environmental Protection Policy: Management Challenges for a New Administration*. Pricewaterhouse Endowment for the Business of Government, pp. 15-23. and GEMI. 1998. *Environment: Value to Business*. Washington, DC: GEMI. for examples of business benefits from beyond compliance environmental performance.

REGULATORY RESPONSIVENESS RELATED GOALS

Goal #2: Ecology is actively collaborating with at least 10 industrial sectors to develop sector-specific strategies for progressing toward the Beyond Waste Vision.

We believe that Ecology should pursue collaborative partnerships with selected industry sectors in Washington over the next 5 years. We encourage this for several reasons. First, collaborative partnerships are needed to supplement regulatory approaches to environmental improvement. Second, such partnerships would enable Ecology to better understand the "licenses to operate" that affect various industry sectors in Washington, enabling the agency to better target key leverage points with policy tools. And third, Ecology can receive input from industry on ways government can to alter its behavior to facilitate industrial environmental performance improvement.

The proposed action steps below reflect several of the attributes of the voluntary regulatory responsiveness programs discussed in Chapter 3. Based on our evaluation in Chapter 3, however, we do not recommend that Ecology develop a formal regulatory responsiveness program, or "green tier" program, at this time.[186] We believe that a more sector-based approach, one that draws from experiences with the Cleaner Production Challenge in Washington as well as other jurisdictions' lessons with responsiveness programs, will be most resource-effective for Ecology to pursue in the coming 5 years.

ACTION STEPS:

1. Identify 5-10 specific industry sectors active in Washington with which Ecology is interested to develop a collaborative relationship for addressing the Beyond Waste Vision. We suggest that sectors exhibiting one or more of the following characteristics be considered in the identification of target industry sectors:

- Sectors responsible for significant waste generation and/or hazardous material use, or in which significant increases are projected;
- Sectors where there are likely to be short-term environmental improvement opportunities that do not require major capital investment;
- Sectors experiencing trends (e.g., lean manufacturing, dematerialization) that are at least partially compatible with the Beyond Waste Vision; and
- Sectors containing companies that are likely to be receptive to exploring partnership opportunities with Ecology.

Based on a review of Washington industry sectors and the sector selection criteria in Chapter 2, we suggest that the following sectors be considered for recruitment into sector-focused Beyond Waste Partnerships:

- Electrical and Electronic Equipment (particularly printed circuit board manufacturing)

[186] For examples of formal regulatory responsiveness or "green tier" programs, see the descriptions of the National Performance Track program, the Wisconsin Green Tier program, and other programs see Appendix B.

- Chemicals and Appied Products (particularly manufactured inorganic chemicals; manufactured pesticides and fertilizers)
- Aerospace / Aircraft Manufacturing
- National Security / Military (particularly supply and maintenance depot operations)
- Fabricated Metal Products
- Ship Building and Repair
- Hospitals
- Universities and Vocational Schools
- General Government
- Printing and Publishing

2. Recruit company representatives from 2-3 industry sectors each year (10 over 5 years) to join Ecology in "Beyond Waste Partnerships" that aim to create a constructive dialogue regarding opportunities and challenges for progressing toward the Beyond Waste Vision. The partnerships should be framed to explore the behavior changes and performance outcomes that are needed in the particular industrial sector as well as those needed from State government to facilitate progress.
3. Conduct modest independent analyses of each target sector and prepare brief profiles which assess what "high performance" currently means in the sector and where opportunities and constraints related to environmental improvement are likely to lie. The objective should be to provide a foundation for discussion in step 4.
4. Conduct a series of half-day focus groups with representatives from each sector. The objective should be to develop shared understanding of desired behavior changes and performance outcomes (from the sector and from Ecology), and to identify opportunities and constraints for realizing them.
5. Establish 5-year "Beyond Waste Challenges" with each of the participating industry sectors that is modeled on the approach used in Ecology's "Cleaner Production Challenge". The specific content of each challenge would be determined in through the partnerships' interactions in step 4.
6. Consider granting companies participating in and/or successfully completing the challenges a variety of incentives that demonstrate government responsiveness to desired behavior change and performance outcomes. (see Goal 3 for more discussion)

Goal #3: Ecology is leveraging and linking with external voluntary initiatives to encourage and facilitate beyond waste behaviors and performance outcomes.

We encourage Ecology to examine ways in which the State of Washington can alter the way it "touches" industrial actors to lessen constraints on "Beyond Waste" behaviors and to be responsive to industry efforts to go beyond compliance. Ecology should seek strategic opportunities to link with or leverage initiatives and programs sponsored by

other organizations that are consistent with the Beyond Waste Vision. Ecology can do so through endorsements, promotional efforts, or the provision of participation incentives. This approach can lessen the need for Ecology to develop its own independent "voluntary, regulatory responsiveness programs" at this time, while enabling the state to benefit from and learn from the implementation of these programs in other jurisdictions.

Possible initiatives to leverage include the following.

- EPA's National Performance Track Program
- EPA's National Waste Minimization Partnership and WasteWise Partnership
- National Biosolids Partnership's EMS for Biosolids Program
- Envirostars Program (in several Washington counties)
- ACC's Responsible Care Program (efforts are underway to update the program)
- Global Reporting Initiative / CERES
- Forest Stewardship Council

There are other third party certification initiatives that are focused on environmental improvement in specific commercial and industry sectors, from the hotel industry to the fishing industry. Ecology should examine ways to encourage (or be responsive to) greater participation in such initiatives within Washington State.

In addition to initiatives that are compatible with the Beyond Waste Vision, there are certain trends which are highly complementary to the vision. Ecology should seek opportunities to leverage such trends, which often have powerful drivers. For example, we see lean manufacturing as a key trend driving waste elimination as well as increased economic competitiveness. Ecology can support and leverage this trend by (1) identifying and removing potential obstacles to lean implementation, and (2) taking steps to increase the attentiveness of lean implementers to risk and lifecycle considerations.

A realistic goal for the 5 year timeframe is for Ecology to identify, develop, and test a collection of incentives that can be used to encourage and facilitate Beyond Waste behaviors among industrial actors. During the implementation of the "Beyond Waste Partnerships" with industrial actors, Ecology should look for places where it can offer support, incentives, or strategic facilitation to encourage participation in sector-based "Beyond Waste Challenges".

ACTION STEPS:

1. Identify specific incentives that Ecology and other government agencies could provide as an incentive to Beyond Compliance behaviors and performance.
2. Pilot specific incentives, which could be used for companies participating in the Beyond Waste Partnerships or could be made more broadly available. Ecology should consider piloting or expanding use of the following incentives:
    - Flexible air permitting, particularly focused on removing obstacles to lean manufacturing implementation;
    - Revising government procurement guidelines to increase consideration of environmental factors; and

- Expanded use of Ecology's EMS alternative.

Ecology should seek EPA Innovations Grants to support one or more activities.

3. Explore the use of incentives to encourage and reward participation in Ecology's "Beyond Waste Challenges" and/or in external programs such as EPA's National Performance Track Program. For example, hazardous waste fees could remain capped for facilities that become members of EPA's Performance Track Program or that implement the Washington EMS Alternative.[187]
4. Identify and begin removing obstacles to trends moving in the right direction. For example, conduct a pilot project with a company or industry sector in Washington that is implementing lean manufacturing practices to understand environmental performance improvements associated with lean implementation and to identify and remove potential barriers to lean implementation. As discussed in Chapter 3, Ecology could likely find an interested partner in EPA, as well as possible funding support through EPA's Innovations Grants program. Potential pilot project candidates include organizations in the electronics, aerospace, equipment manufacturing, hospitals, and military (e.g., Air Force) sectors.

Goal #4: At least 50% of industrial actors in Washington have implemented some form of continuous improvement-focused environmental management system.

Achieving the Beyond Waste Vision in the industrial sector will require organizational management systems that ensure all environmental impacts and risks are identified and managed. In addition, continual improvement processes, supplemented by routine scanning for emerging environmental issues, are necessary to achieving sustained progress toward the vision. While they do not guarantee environmental performance improvements, Environmental Management Systems (EMSs) typically provide a foundation from which such improvements can be made.

We encourage the Department of Ecology to continue its efforts to encourage industrial actors to implement and improve EMSs. We also encourage Ecology to broaden its partnerships for encouraging EMS implementation and for studying their prevalence and effectiveness in Washington. Once Ecology has a better understanding of the prevalence of EMS implementation in Washington, it may be appropriate to adjust the

[187] EPA coordinates periodic conferences to bring states together with EPA to discuss the future of regulatory responsiveness programs in the U.S. Ecology might want to consider sending a representative to future meetings. Tamara Bedford, EPA Region 8 (Denver), at (303) 312-6189, is a key EPA contact for keeping abreast of developments in the Performance Track Program and various states programs that have relationships to Performance Track.

"percentage adoption" goal.[188] The 50% adoption target is likely to be a bold reach within 5 years.

ACTION STEPS:

1. Continue implementation of the EMS Alternative as an option for compliance with the State Pollution Prevention Planning requirements.
2. Identify and implement other incentives that could be used to encourage EMS implementation among industrial sector actors. For example, EMS implementation requirements could be used more to offset non-compliance penalties, or as part of Supplemental Environmental Projects (SEPs). As another example, Ecology could provide an Advanced EMS Track if the agency decides to remove the hazardous waste fee cap. Under such an approach, the waste fee cap would remain in effect for those industrial actors that agree to implement an EMS. Additionally, State efforts to support or encourage external EMS initiatives could be used to increase EMS adoption rates in Washington. For example, initiatives such as the National Biosolids Partnership's EMS for Biosolids program and EPA's Performance Track program have EMS implementation and certification requirements. (See the consultant team's Issue Paper titled, *Potential Enhancements to Ecology's Pollution Prevention Planning Program*, for suggestions for altering the current EMS Alternative.)
3. Conduct some baseline research about the prevalence and effectiveness of EMS implementation among industrial actors in Washington. This research could also seek to identify obstacles to effective EMS implementation, as well as conditions and incentives that could encourage EMS implementation. Consider including EMS-related questions in the upcoming Beyond Waste survey. Enlist support from local universities in studying the prevalence and effectiveness of EMS among various industry sectors in Washington.
4. Consider forming a working group with interested academic researchers from local universities that could be tasked with identifying future Beyond Waste and EMS research avenues that could inform Ecology's policy-making activities.

PRICE SIGNAL RELATED GOALS

Goal #5: Washington has a revamped Hazardous Waste Planning Fee that is aligned with the Beyond Waste Vision and that has stronger incentives for reducing hazardous wastes and toxic releases.

Well-aligned price signals can complement a broader set of policy tools aimed to guide industrial actors toward Beyond Waste behaviors and performance outcomes. As discussed in Chapter 4, the State of Washington already employs some fees associated with waste generation and hazardous substance purchases. If the Beyond Waste

[188] A national survey of more than 580 manufacturing facilities found that approximately 24% of manufacturing plants with more than 50 employees have adopted an EMS, 28% have adopted a formal P2 program, and 18% have adopted both an EMS and a P2 program. See Richard Florida and Derek Davison, "Why Do Firms Adopt Advanced Environmental Practices?" in Cary Coglianese and Jennifer Nash. 2001. *Regulating from the Inside: Can Environmental Management Systems Achieve Policy Goals?* Washington, DC: Resources for the Future. In addition, approximately 30 to 40% of U.S. manufacturing firms are, to some degree, implementing lean manufacturing-based continual improvement programs.

strategic planning process results in the State deciding to strengthen the use of price signal tools, then we suggest that Ecology consider the steps below during the coming 5 years in conjunction with efforts to conduct more detailed evaluations of bolder, specific price signal tool designs. These steps will likely constitute bold action in the 5 year time frame.

The approach suggested below reflects the very real and potent economic and political constraints that limit government's ability to drive significant behavior change using fees, as discussed in Chapter 4. While this approach would have longer-term effects, it is realistic to expect that it could be implemented in the short-term (5 year time frame). One key challenge is the variable impact that fee and tax increases can have on different companies and industry sectors due to factors such as the availability of alternative substances or process techniques. For example, a modest fee increase could have a disproportionately large economic impact on some actors, who may have few options for changing behavior, while the fee increase scarcely registers with other actors. For this reason, broadly-targeted fee and tax increases can be blunt instruments, with the resulting behavior change varying greatly by numerous factors confronting specific actors and industry sectors. Two strategies can be employed to shift tax and fee increases from "punishing certain industry sectors" to "discouraging certain behaviors and/or substances".

- Gradually phase in changes to price signals over a longer time horizon so as to provide industrial actors time to adapt or to bring alternative technologies or practices on line.
- Offset the increased tax or fee burden with rebates or other economic instruments (e.g., tax credits, subsidies) so that the overall economic burden on the industry does not increase significantly, but so that there is a stronger economic incentive for pursuing Beyond Waste behaviors.

In light of this discussion, Ecology can take several steps to improve the alignment and strength of its existing waste and toxic release-related fee to create stronger incentives for Beyond Waste behaviors. Revamping the Hazardous Waste Planning Fee can provide a stronger monetary incentive to industrial facilities to reduce their dangerous waste generation and toxic releases.

ACTION STEPS:

1. Determine a target fee rate that starts small and slowly ramps up every year (or two) for ten years. (Options to consider and avoid are provided in the Tools section of the price signals chapter.) Considerations would include the impacts of this fee on particular industries and companies. Slowly but predictably increase the per pound fee (or alternative unit of measure) periodically (on an established schedule) to increase the incentive for industrial behavior change while providing program certainty. The rate and frequency of the increase would be reevaluated after ten years and changed if necessary.
2. Remove the current per facility fee cap ($13,706 in 2002), but not without introducing a new fee structure (because simply removing the cap would be infeasible as discussed in Chapter 4). Consider alternative approaches, including:
    a. A 2-part, regressive fee structure (Option B in Chapter 4) that would modestly increase the fee for the facilities that contribute a substantial

amount of fee pounds.[189] The modest increase would be less for the larger contributors than if the cap were simply removed and the same (current) per pound fee rate were charged, which would result in very large fee increases for many facilities (see Chapter 4 for discussion).

b. A multi-tiered progressive fee structure (Option C in Chapter 4).

c. An EMS Alternative that enables facilities to maintain the current cap levels provided that they implement and maintain EMSs with a P2 program component. Facility participation in a selected external regulatory responsiveness program, such as EPA's Performance Track Program could also be considered as an alternative track for facilities to maintain the current cap levels.

3. Eliminate the current $50 fee cap for facilities that generate between 2,640 and 4,000 pounds of dangerous waste.

4. Eliminate the current total program revenue cap of $1 million plus inflation.

5. Explore options for developing a rebate component (10% tax refund for a 10% reduction in releases/waste) for facilities that make improvements from year to year. For example, some level of tax refund could be provided for a 10% reduction in releases/waste. This will work best once the general revenues have increased beyond a minimum program-funding point.

6. Phase-out or eliminate the Education Fee Program over the next few years when the revenue from the increased Planning Fee will compensate for the Education Fee revenues.

Goal #6: The State has determined whether it wants to be a leader in using price signals to achieve the Beyond Waste Vision, and has identified specific opportunities to use targeted price signals in its substance and sector-focused integrated strategies.

It is likely that for broad-based price signal adjustments to have a significant impact on industrial sector behaviors, the adjustments would need to be relatively significant. Significant adjustments to fees or taxes, however, would have highly differential impacts across industry sectors. The relative impacts would depend on multiple factors, such as the ability of companies to substitute more environmentally friendly alternatives to practices, production processes or materials. Designing an approach that can encourage broad-based behavior change without creating significant economic and social impacts in certain industrial sectors is unrealistic without a careful analysis of the impacts of such changes to specific industry sectors and companies.

It is our assessment that the political, practical, and economic feasibility of implementing bold new price signals is extremely low in the next five years. However, the longer-term prospects may be brighter. In addition, targeted tools – such as feebates, deposit/refunds, and taxes on specific products – could be used to address specific needs and leverage points identified in the PBT Chemical Action Plans and through the sector-based Beyond Waste Partnerships.

[189] Measured by a combined total of pound of TRI releases, pounds of dangerous waste, and pounds of extremely hazardous waste times ten.

There is growing support in the environmental policy literature for increasing the use of fees to complement other environmental policy tools.[190] Proponents argue that the use of economic instruments can increase industries' flexibility in meeting environmental improvement goals, while providing incentives for those actors that make progress toward the goals. Furthermore, carefully-targeted price signals, even if not sufficient to drive significant behavior change in isolation, could be aligned to complement and reinforce other policy tools, such as regulatory and reporting requirements, voluntary initiatives, or bans or phase-outs.

To achieve this goal, we believe that Ecology would need to undertake the steps listed below.

ACTION STEPS:

1. Use the next year, during Ecology's Beyond Waste strategic planning process to answer the following questions: "Does the State of Washington want to push forward in this area in light of its other needs, priorities, and opportunities?" and "If so, how much of a leader is the State interested to be in pushing for bolder price signal actions?"
2. If the answer to the first question is "no", then no further steps are appropriate other than to monitor environmental, scientific, and policy trends in Washington and elsewhere for significant changes that might warrant reconsideration of price signal tools.
3. If the answer to the first questions is "yes", then establish a program to (1) conduct more detailed evaluations of price signal options and their expected industry impacts, and (2) build support in the State for taking bolder action with the use of price signals. To inform this evaluation program, Ecology could draw on experiences working with specific industry sectors through activities such as the TREE program, the Cleaner Production Challenge, and the proposed Beyond Waste Challenge. It also could be useful to collaborative with other State that have demonstrated some interest or activity in implementing more ambitious price signal programs (e.g., New Jersey, Massachusetts, Louisiana, Minnesota, California). The State may also be able to tap support and/or resources from EPA's National Center for Environmental Economics or one of the EPA policy innovations grants programs.

   In such a research program, Ecology should consider the following topics, among others.

   a. Evaluate the use of "carrot/stick" price signal approaches, such as feebates and deposit/refunds. Feebates can help target price signals to focus on specific substances or behaviors, providing a stronger economic reward for desired behaviors. Deposit/refund tools could be particularly relevant for increasing the recycling or safe disposal of particular products or materials.

   b. Evaluate the role that price signals can play in addressing specific PBT reduction goals adopted by the State. While take-back programs or

[190] For example, see Dennis Rondinelli. November 2000. *Rethinking U.S. Environmental Policy: Management Challenges for a New Administration*. Arlington, VA: PricewaterhouseCoopers Endowment for the Business of Government, p. 27.

phase-outs/bans might be appropriate for reducing specific PBTs or other hazardous substance in specific products, price signals might also be appropriate to leverage changes. Data about the materials in products can be limited, but sufficient information can typically be collected about "high profile" substances. If deposit/refund options are not suitable for ensuring the safe collection and management of these materials, Ecology could consider take-back programs, or product or substance bans. Much of this evaluation could be done in coordination with Ecology's PBT Task Forces.

c. Monitor the progress of programs that report on hazardous substance use (e.g., materials accounting programs in Massachusetts and New Jersey) as well as new programs that are established in this area. Material accounting approaches offer options to measure efficiency of material use, but as discussed in Chapter 4, it does not appear at this time that the benefits of implementing such a system would outweigh the significant costs to both the State and to industry.

d. Assess the desirability and feasibility of introducing a waste disposal fee. Disposal fees should not be discarded simply because they are "end-of-pipe." These fees are the most "tried and true" price signal in the waste arena, and the only price signal for which there is empirical data: disposal fees can be expected to influence waste generation, shipping, and disposal.

e. Evaluate (and implement, if feasible and desirable) a refocused Hazardous Substance Use Fee that modestly increases the fee rate for non-petroleum substances. (See Chapter 4 for a more detailed discussion of this option.)

f. Consider the equity of fee impacts. Ecology has identified the fee distribution and equity criteria as an evaluation of whether the fee amount is proportional to the environmental impacts of toxics/wastes generated.[191]

[191] Generally speaking, questions of equity related to price signals focus on two subject areas. First, there is reason to believe that flat taxes tend to hurt poorer people and possibly poorer business. However, because the types of flat taxes that could reasonably be imposed under a new price signal program in Washington State are unlikely to be flat taxes that are passed on to all consumers, this issue is likely to be less significant. However, some industries and companies may have a greater ability to invest in cleaner production or management or to incur increased costs until alternative technologies are available. If the industries pass on the price of the fees/taxes to the general consumer, the costs will be incurred by both industrial sector actors and consumers. The good news is that there are mechanisms such as fee caps, exemptions, and refunds, for addressing inequities should they exist.

The second equity issue concerns balancing the burden of the tax "costs". According to the polluter pays principle, polluters (rather than the public) should bear the pay up front for the costs they are imposing. Environmental taxes have the potential to pose a much greater burden on a small number of pollution or natural resource intensive industries (Hoerner 1998). These industries may claim that a tax that has a greater impact on them is inequitable and renders them uncompetitive. One could argue that it is acceptable for industries to no longer be competitive as a result of a tax that internalizes environmental externality, but taking this position could be extremely politically risky, and also undermine (at least in the short-term) other goals that society values (e.g., employment, availability of affordable energy). Instead, options are available such as using some of the revenue to reduce other

g. Plan for implementation, monitoring, program evaluation, and enforcement of any price signal tools being seriously considered. Effective tracking, evaluation, and enforcement (where applicable) are important success factors. First, there is evidence that information alone, regardless of a specific price signal program, is a powerful instrument for change. The Toxic Release Inventory program, for example, has been credited with a role in driving significant toxic release reductions by making information on toxic releases publicly available. Second, many believe that "what gets measured gets done." Third, adequate evaluation will enable Ecology to identify program results, identify issues, and adapt future policy efforts to address identified needs.

h. Consider options for gradual phase-ins of various price signal options.

i. Based on the results of the evaluation program discussed above, any price signal tool approaches that appear promising for achieving the Beyond Waste Vision, and realistic in terms of political feasibility and implementation feasibility should be flushed out in a more detailed proposal or plan.

4. If the State decides to move forward with examining bolder price signal actions, it does not need to wait until the end of the evaluation program to begin modest action to improve the alignment of existing price signal tools toward the Beyond Waste Vision. See Chapter 4 for a discussion of various options and Goal #6 below for a suggested path to consider.

5. Within 5 years, we believe it is possible for the State to determine whether bold use of price signal tools makes sense as a key policy ingredient for progressing toward the Beyond Waste Vision. Within this timeframe, it is also possible to have selected preferred price signal design approaches and to have made progress building and communicating a clear "business case" for pursuing the use of bolder price signals. It may be helpful to enlist the support of a Beyond Waste Advisory Committee (see action steps under Goal #1) to inform this decision and to assist with building and communicating the business case if action is desired. Stakeholder meetings could also be conducted around various options to solicit input and to communicate the business case for action.

TEN-YEAR GOALS (2013)

The goals listed below constitute a set of goals that the consultant team believes to be consistent with progressing aggressively toward the Beyond Waste Vision. For the most part, these goals build upon the five-year goals, and the learning and evaluation results that emerge from the first five-year period. Specific action steps are not listed separately in this section. In several cases, action steps involve a continuation of actions discussed in the five-year goal section. In other cases, action areas are discussed in the description of the goals.

taxes, introducing tax incentives for investments in energy efficiency and renewable energy technologies, and simply choosing a different price signal program altogether (Hoerner 1998).

REGULATORY RESPONSIVENESS RELATED GOALS

Goal #7: Ecology is actively collaborating with 15-20 industry sectors in the State to develop, implement, and adapt sector-specific strategies for progressing toward the Beyond Waste Vision.

This goal represents a continuation of efforts discussed under Goal #2 to pursue collaborative partnerships for making progress toward the Beyond Waste Vision with industry sectors in Washington. In the five to ten year time frame, there are several areas in which Ecology attention would likely be beneficial:

- Evaluate the results of the Beyond Waste Partnerships and the Beyond Waste Challenges (and/or the Cleaner Production Challenge if it remains in operation by this name) implemented to date, and identify lessons learned;
- Evaluate the experience with various government incentives and responsiveness activities experimented with during the first five year period (see Identify opportunities to expand the use of effective incentives in conjunction with industrial actor participation in (1) the Beyond Waste Partnerships and Challenges, (2) third party voluntary programs (e.g., Performance Track), and/or (3) a new, more formal regulatory responsiveness program in Washington State (see below).
- Evaluate current trends that are affecting industrial actors in Washington related to the Beyond Waste Vision and goals, and identify opportunities to leverage these trends to achieve the Beyond Waste Vision faster;
- Recruit broader participation in the Beyond Waste Partnerships and the Beyond Waste Challenges;
- Expand the number of industry sectors that Ecology is engaging through the Beyond Waste Partnerships; and
- Review the effectiveness of regulatory responsiveness programs, as well as specific program attributes (e.g., effectiveness of various incentives), being piloted in other jurisdictions (e.g., Wisconsin's Green Tier Program, EPA's Performance Track) and assess the value to Washington developing a more formal regulatory responsiveness program, modeled on one or more of these other programs.

Goal #8: 70% of industrial actors in Washington have implemented some form of continuous improvement-focused environmental management system.

This goal represents a continuation of efforts discussed under Goal #4 to foster continual improvement-based waste elimination cultures among industrial actors. A ten-year, 70% target is likely to be highly aggressive. Ecology may need to adjust this goal in five years, based on more accurate estimate of the actual prevalence and effectiveness of EMS implementation in Washington. Ecology should continue to monitor EMS implementation and effectiveness in the State, and to adjust its policies and program activities based on lessons learned to leverage greater EMS and continual improvement program adoption and effectiveness.

PRICE SIGNAL RELATED GOALS

Goal #9: The State has successfully implemented price signal tools identified during the five-year evaluation program.

The specific focus of Ecology activity during the five to ten year planning horizon should reflect the direction that Ecology charted during the first five year period (see Goals #5 and 6). If Ecology decides not to pursue price signal tools in any significant way during this first five year period, then the focus in years five through ten should be on scanning for circumstances and "windows of opportunity" where price signal tools may become more appropriate for one or more reasons. Reasons could include that:

- There is increased evidence that specific price signal tools can be used effectively to alter behaviors that Ecology is interested to target;
- There is growing support in the State for the need to apply additional policy tools to speed progress toward the Beyond Waste Vision or to address increased perceptions of risk; or
- Other states are moving to implement price signals to target specific products, substances, or behaviors.

If Ecology did opt to pursue the bolder use of price signal tools during the first five year period, then the five to ten year time horizon should largely be focused on implementing the selected options from the evaluation program discussed in Goal #5. Efforts should also focus on evaluating the actual results and impacts of any price signal modifications implemented during the first five year period (see Goal #6). At the ten year point under this path, Ecology should aim for the following:

- Implementation of the selected price signal tools is complete. Plans are established for any phased increases in price signal tools for the next five to ten year planning horizon, providing industrial actors with increased certainty about the future directions of government action around price signals.
- An effective monitoring program has been established to track the results of price signal implementation. Key questions include: What affect are the tools having on waste, substance use, or the desired behavior change? What are the economic impacts of the price signal on various sectors? What constraints, if any, are inhibiting certain sectors from changing behavior in response to the price signals?

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8. Glossary

Following are definitions of some key terms that may need clarification.

Biological material. A biodegradable material posing no immediate or eventual hazard to living systems that can be used for human purposes and can safely return to the environment to feed environmental processes. They can be safely be returned to the soil and consumed by organisms.

Biologically Active Compound. A material that has direct physiological effect on a plant, animal, or microorganism. Examples of biologically active compounds include antibiotics, hormones, endocrine disruptors. Most such compounds enter the environment as pharmaceuticals or personal care products.

Composites. Materials or products made of combinations of biological, technical, and/or "unmarketable" materials.

Economic actor sector. A broad group of organizations and/or individuals whose similar actions or decisions related to the use, consumption, or exchange of goods and services have a large impact on material and waste flows within the state. Examples of key economic actor sectors in Washington include residential, agriculture, and primary metals.

Extraction Wastes are wastes generated at the point of original extraction or harvest of a material. Examples include mining overburden and tailings, forestry slash, and crop residues.

Indicator. A measurement that reflects the status of a system. Examples include the Dow Jones Industrial average, the oil pressure of an engine, or the "ecological footprint" of an individual or community. This report proposes several new indicators to assess progress towards the Beyond Waste Vision.

Kaizen. Lean production is founded on the idea of kaizen, or continual improvement. This philosophy implies that small, incremental changes routinely applied and sustained over a long period result in significant improvements. Kaizen, or rapid improvement processes, often are considered to be the 'building block" of all lean production methods, as it is a key method used to foster a culture of continual improvement and waste elimination. Kaizen focuses on eliminating waste in the targeted systems and processes of an organization, improving productivity, and achieving sustained continual improvement. The kaizen strategy aims to involve workers from multiple functions and levels in the organization in working together to address a problem or improve a particular process. The team uses analytical techniques, such as Value Stream Mapping, to quickly identify opportunities to eliminate waste in a targeted process. The team works to rapidly implement chosen improvements (often within 72 hours of initiating the kaizen event), typically focusing on ways that do not involve large capital outlays. Periodic follow-up events aim to ensure that the improvements from the kaizen "blitz" are sustained over time. Kaizen can be used as an implementation tool for most of the other lean methods.

Persistent Bioaccumulative Toxics (PBTs) are highly toxic, long-lasting substances that can build up in the food chain to levels that are harmful to human and ecosystem

health. Examples of PBTs include heavy metals (like mercury), dioxins, and Polychlorinated Biphenyls (PCBs).

Polychlorinated Biphenyls (PCBs) are human-made chemicals that occur as oily liquids or solids, are colorless to light yellow, and have no smell or taste. Because they do not easily burn and are good insulators, PCBs have been used widely as coolants and lubricants. There are no known natural sources of PCBs in our environment. Manufacturing of PCBs stopping in the Unites States in 1977 because they were found to build up in our environment and cause harmful effects.

Pre-Production Planning (3P). Whereas other lean manufacturing methods (e.g., kaizen) take a product and its core production process steps and techniques as given, the Production Preparation Process (3P) focuses on eliminating waste through "greenfield" product and process redesign. 3P represents a key pivot point, as organizations move beyond a focus on efficiency to incorporate effectiveness in meeting customer needs. Lean experts typically view 3P as one of the most powerful and transformative advanced manufacturing tools, and it is typically only used by organizations that have experience implementing other lean methods. 3P seeks to meet customer requirements by starting with a clean product development slate to rapidly create and test potential product and process designs that require the least time, material, and capital resources. This method typically engages a diverse group of employees (and at time product customers) in a week-long creative process to identify several alternative ways to meet the customer's needs using different product or process designs. Participants seek to identify the key activities required to produce a product (e.g., shaving wood for veneer, attaching an airplane engine to the wing), and then look for examples of how these activities are performed in nature. Promising designs are quickly "mocked up" to test their feasibility, and are evaluated on their ability to satisfy criteria along several dimensions (e.g., capital cost, production cost, quality, time). 3P typically results in products that are less complex, easier to manufacture (often referred to as "design for manufacturability"), and easier to use and maintain. 3P can also design production processes that eliminate multiple process steps and that utilize homemade, right-sized equipment that better meet production needs.

Technical material.[192] A material that remains in a closed-loop system of manufacture, reuse, and recovery (the technical metabolism), maintaining its value through many product life cycles. These valuable resources, such as plastic or metal, are typically lost when items are disposed.

Unmarketables. Materials that cannot be maintained safely in either biological or technical cycles.

[192] Definition adapted from McDonough Braungart Design Chemistry, *http://www.mbdc.com/c2c_home.htm*

Appendix A: Possible Considerations for Program Evaluation Criteria

TECHNICAL FEASIBILITY

- Are the needed technologies and tools, such as monitoring equipment, available?
- Are information systems available to implement and track the program?
- Does the program require specific expertise? Is this expertise available?
- Would the program be legal?
- Is enforcement possible?

PRACTICAL FEASIBILITY

- What will the program's staffing requirements be?
- Funding requirements?
- Will implementation be considered an "undue" burden for the agency or for the regulated community?
- Will the program add substantial coordination challenges with other agencies or jurisdictions?
- Can enforcement be implemented and effective? (Is there reason to believe it will be implemented?)

POLITICAL FEASIBILITY

- Who are the program's stakeholders?
- Are the stakeholders likely to support or oppose the program?
- What, if any, are the equity issues involved with the program?
- What incentives (preferably financial) are available to those who will be affected by the program?
- Have similar programs failed to be supported elsewhere or previously in Washington State? If so, why? Will the same issues arise again for this program?
- What can be done to avoid political pitfalls?
- What is the best communication strategy for working with stakeholders?

COST EFFECTIVENESS

- What are the expected costs of the program? Will these change over time?
- What revenues are desired from the program? Will these change over time?

- What revenues can be reasonably expected from the program? Will these change over time?
- What would happen if the revenues fall to zero over time because the Beyond Waste Vision is achieved and the program is no longer needed?
- What will the costs be to others affected by the program? Is there any way to offset these costs?
- What, if any, revenue can be shared as a "carrot" to the industries/companies that are making significant progress?

EXPECTED OUTCOMES

- Have programs like this one been implemented before?
- If so, have they been successful from a financial perspective? … from a financial perspective? ... from an administrative perspective? … from a political perspective? …and from a behavioral perspective (did the program reduce hazardous/toxic substance use, generation, disposal, etc.?)
- Is there empirical evidence to support a prediction that a particular outcome can be expected?
- If there is no information on the expected outcome, is the program worth additional research before moving ahead?

CHALLENGES AND KEY SUCCESS FACTORS

- What key challenges may arise (that are not already captured by the other criteria)? What would stop this program from being passed, implemented, or ultimately successful?
- If timing is a problem (e.g., because needed technologies are not yet available), can the program be phased-in?
- What are the critical path success factors, without which this program will fail?
- Will the program move Washington State closer to achieving the Beyond Waste Vision?

Appendix B: Examples of Regulatory Responsiveness and Covenant Programs

EPA'S PERFORMANCE TRACK PROGRAM

Initiated June 26, 2000, EPA's National Environmental Performance Track program is "designed to recognize and encourage top environmental performers – those who go beyond compliance with regulatory requirements to attain levels of environmental performance that benefit people, communities, and the environment." Participation in the program is available to facilities of any type, size, and complexity, as long as specified membership criteria are met and approved by EPA.[193]

EPA is implementing its Performance Track program at two levels. The first level, the National Environmental Achievement Track (Achievement Track), is designed to recognize facilities that consistently meet their legal requirements, achieve "beyond compliance" performance, and have implemented high-quality environmental management systems. As participants in the program, such facilities are also expected to achieve even greater environmental results by setting and aspiring to continuous improvement goals, and keeping the public involved and informed in their efforts. The second level, the National Environmental Stewardship Track (Stewardship Track), is still under development. This track will be designed to recognize and encourage even greater levels of environmental performance by focusing, in part, on a broader scope of possible measures, including improved environmental management in customer, supplier, and transporter relationships; attention to product stewardship; and even better community engagement and public outreach.

ENVIRONMENTAL BENEFITS

The primary goals of the Performance Track program is to encourage facilities to make voluntary commitments to continued improvement and "beyond-compliance" environmental performance -- efforts not encouraged by the existing regulatory system. Though beyond compliance performance cannot be mandated, many regulated entities do nonetheless voluntarily choose to attain this level of effectiveness. The premise of performance-based incentive systems is that those who do attain such a status should be recognized for their efforts at improving communities and their surrounding environments, and should also be encouraged, with a variety of incentives, to do more. Similarly, such performance incentives could serve to entice other entities to improve performance to a level acceptable for program participation, resulting in even more

[193]Smaller facilities are not asked to make as many performance commitments as larger facilities (e.g., the EMS for a small facility may be simpler than one for a larger, more complex facility).

widespread public and environmental benefits. Membership to the Performance Track program requires detailed commitments to continuous, beyond-compliance environmental performance, described in more detail below. Working within specific guidelines, each participant can choose, depending on individual circumstances (production processes, waste streams, greatest environmental concern, etc.) where to focus improvement activities.

PERFORMANCE TRACK MEMBERSHIP REQUIREMENTS

The following program criteria were designed by EPA to best ensure incremental, continuous, beyond-compliance environmental improvement by Performance Track members. While no single requirement would provide EPA with the desired level of outcomes, it is believed that an integrated effort involving adherence to all programmatic requirements will lead to desired environmental benefits.

Environmental Management System (EMS). Program participation requires each company to have implemented a mature, well-designed EMS for at least one complete cycle of implementation. The EMS provision is designed to help ensure that member facilities will continue to meet, and ideally exceed regulatory obligations. The EMS must include at least one self-or third-party audit, in addition to the following:

- **Policy.** A policy statement should include commitments to regulatory compliance, pollution prevention, continuous improvement in environmental performance, and the sharing of EMS performance information with the local community.
- **Planning.** Planning efforts should include the identification of significant environmental concerns and legal requirements at the facility, measurable objectives designed to meet legal requirements, and program commitments.
- **Implementation**. Implementation includes the development of roles and responsibilities for communicating and meeting EMS objectives, defined programs and procedures for maintaining compliance and meeting environmental performance objectives outlined in the EMS, environmental training programs for all employees, and an emergency preparedness program.
- **Checking.** This step involves development of a program for assessing performance and preventing and detecting non-conformance with legal and other requirements of the EMS.
- **Management Review.** Documented review of EMS performance by a designated manager is the final required component of the EMS.

Environmental Improvement. All applicants to the Performance Track program must demonstrate past evidence of, and future commitments to, specific, measurable, continuous environmental improvement. Facilities must present an environmental record for the previous two years of operation, and show progress *beyond* the minimum requirements over the course of these two years. More specifically, facilities must be able to identify accomplishments, in at least two[194] aspects of any of the following environmental categories: energy use, water use, materials use, air emissions, waste,

[194]One for smaller facilities.

water discharges, accidental releases, habitat preservation/restoration, and product performance. Also to qualify, a facility must commit to future improvements in four aspects of the categories listed above.[195]

Sustained Compliance. In addition to environmental improvements, all applicants must demonstrate a solid record of sustained compliance with environmental requirements (i.e., all applicable federal, state, local, and tribal environmental regulations), certification of current compliance, and commitment to maintain compliance.

Community Outreach. Generally, facilities will be expected to have already established a public outreach program (e.g., newsletters, performance reporting, etc.) prior to involvement in the Performance Track program, and these efforts must be continued under Performance Track. Such activities may vary depending on facility size and operation, but should include active identification of, and response to, the local community's environmental concerns, and a process for informing the community of important environmental matters affecting it. The annual reporting requirement, described below, is also to be made available for public review. Such public scrutiny opportunities are designed as an incentive for firms to make and achieve meaningful commitments.

Annual Performance Reporting. Performance Track members must commit to providing annual reports on the status of their efforts to achieve stated environmental commitments and overall adherence to Performance Track requirements. The annual performance report is to include: a summary of the facility's EMS assessment activities and progress towards meeting EMS objectives and targets; a brief report on progress made in meeting environmental performance commitments; a summary of public outreach activities; and a self-certification that the facility continues to meet program criteria.

PROGRAM VERIFICATION

To help evaluate the effectiveness of the Performance Track Program EPA will conduct program site visits to a limited number (up to 20 percent) of Performance Track facilities each year. The visits will assess program implementation and progress towards meeting performance commitments. [This section to be expanded.]

PARTICIPANT BENEFITS

EPA hopes that, in exchange for the commitments outlined above, facilities will have access to a variety of program benefits that will both reward them for participation and facilitate achievement of the overall program goal – greater environmental protection. Current incentives to members of the *Achievement Track* include:

- Lower priority for inspection targeting purposes.
- Discretion in penalty assessment due to clear "good faith efforts" to comply.
- Public recognition of achievements, including use of the Performance Track logo at the facility, in corporate communications, etc. Recognition also includes listing

[195] Two for smaller facilities.

in EPA's Performance Track website, and highlights in feature articles and other promotional materials.

- Participation in achievement track peer exchanges, including special conferences, workshops, and networks, where facilities can share information regarding successful environmental improvement activities.
- Meetings with senior EPA officials to communicate program lessons learned and facilitate program improvements.

Pending Incentives. In August, 2002, EPA issued a notice of proposed rulemaking for additional, more regulatory-based incentives for existing Performance Track members. EPA hopes to offer these additional incentives to members, believing that certain regulatory requirements may not be necessary for facilities who have met all Performance Track requirements and who provide a greater amount of environmental performance information to agencies and the public. These proposed incentives are listed below.

- For Performance Track facilities that emit air toxics and subject to Maximum Achievable Control Technology (MACT) standards under the Clean Air Act, EPA is hoping to offer reduced frequency of reporting to an interval of time twice that currently required of all facilities subject to MACT standards.[196] Performance Track facilities that use P2 or process changes to reduce hazardous air pollutant emissions below the MACT thresholds will also have reduced reporting requirements.
- For Publically Owned Treatment Works (POTWs) who are members of Performance Track, EPA is proposing reduced reporting costs by allowing facilities to use the Internet rather than paid newspaper notices. Incentives also include the potential for some POTWs to reduce oversight of some smaller industrial users, greater discretion in determining which users are "nonsignificant," and greater flexibility with respect to annual pretreatment reports.
- EPA is proposing that Performance Track members who are large quantity generators under the Resource Conservation Recovery Act (RCRA) have up to 180 days to accumulate hazardous waste[197] without the need to obtain a RCRA permit or interim status, provided that certain conditions are met, including implementation of pollution prevention practices.

EPA's August 2002 proposed rulemaking also includes an option to develop a pilot project designed to explore approaches for consolidating environmental reporting for Performance Track members, ultimately allowing a reduction in scope and number of reports submitted to EPA.

[196]Title V sources will still be required to submit semi-annual reports.

[197]Currently, all large quantity generators are allowed only 90 days to accumulate hazardous waste without needing to obtain a RCRA permit.

PERFORMANCE TRACK AND STATE REGULATORY RESPONSIVENESS PROGRAMS

In developing the program, EPA focused largely on different state's experiences with similar leadership programs testing voluntary performance-based approaches. Through this, EPA recognized the importance of state/EPA partnerships, largely due to the fact that in most cases, states are in fact the "service provider" to regulated companies. Since creation of the Performance Track program, EPA has been working to coordinate with the states and create joint membership incentives.

On April 24th 2002, EPA Administrator Whitman signed MOAs with several states, intended to provide a structure for developing state-specific incentives that would apply to members of both state environmental performance programs (e.g., Virginia E3, Clean Texas, etc.) and Performance Track. EPA continues to hold meetings with states to coordinate EPA's Performance Track with state environmental performance programs, and plans to continue pursuing new MOAs with states that opt to develop such programs of their own. In addition to the obvious benefit of EPA/state cooperation – the optimization of incentives and environmental benefit – such partnerships can also help streamline innovation endeavors. Regular cooperation, for example, will help ensure that mandatory elements of federally delegated programs are maintained while providing maximum incentives for beyond-compliance performance.

Currently, at least 14 states have implemented programs designed to reward environmental leadership and encourage superior environmental results. Among these programs are Colorado's Environmental Leadership Program; Michigan's Clean Corporate Citizen Program; New Jersey's Silver and Gold Track Program for Environmental Performance; and South Carolina's Environmental Excellence Program. Many of the state programs contain similarities to the National Environmental Performance Track, including the establishment of different performance "tiers," requirements for EMSs, environmental improvement, public outreach, strong compliance records, membership renewal requirements, and a combination of incentives for voluntary performance. Three additional programs, including one implemented in Washington at the county level, are briefly described below.

ENVIROSTARS PROGRAM—WASHINGTON

Initiated in King County, Washington in 1995, the EnviroStars Program is a nationally recognized incentive-based effort to certify local businesses that reduce, recycle, and properly manage hazardous wastes. Now also available in Snohomish, Kitsap, Jefferson, Pierce, and Whatcom counties, the program certifies businesses based on a two-to-five star rating, depending on the level of "proactive" hazardous waste reduction occurring at the business. The higher the star rating assigned, the more environmentally active the business is, and the more recognition it receives.

- Two stars are granted to businesses that have demonstrated proper hazardous waste management and agreed to future hazardous waste reduction goals.
- Three star businesses also involve employees in hazardous waste reduction activities and are actively involved in changing practices, processes, and/or products to further reduce hazardous waste.

- Four star businesses also incorporate waste prevention practices into all aspects of their operations.
- Five star businesses meet all prior criteria and are also considered to be waste reduction leaders in their industry, going well beyond their "peers" in committing to environmentally responsible practices.

To be eligible for membership in the EnviroStars Program, local businesses cannot generate large quantities of hazardous waste and must be proactively working to reduce hazardous waste that is produced.

Incentives for Participation. The program offers several incentives to businesses that are designed to encourage hazardous waste recycling and reduction, while also giving local consumers information on business implementing "environmentally sound" practices in the area.

- Businesses receive EnviroStars decals that can be displayed in their windows, and are also listed on the EnviroStars website and in local "Green Business" directories.
- Businesses with more than two stars are featured in the local media (e.g., radio, print advertisement).
- EnviroStar businesses may also be eligible for business honors, such as the Governor's Award.
- EnviroStars members benefit from partnering with other members and government entities to learn new ways of reducing waste, and accessing the EnviroStarts site consultant for further suggestions regarding waste reduction improvements.

Environmental Benefits. The EnviroStars program lists many environmental benefits, including reduced waste, increased reuse and recycling, decreased use of hazardous materials, and increased voluntary compliance with waste and air quality regulations.

GREEN PERMITS PROGRAM—OREGON

Launched in 1999, the Oregon Department of Environmental Quality's (DEQ) Green Environmental Management Systems (GEMS) Permits Program is designed to encourage and reward facilities to achieve environmental results beyond what is required of them by law. All participants must be involved in ongoing communication with community stakeholders, including regular reporting of environmental performance. The program then uses a tiered approach, where the level of reward given to a facility is dependent upon the level of "beyond compliance" commitment made by the facility.

- The first tier is offered to facilities which have begun to implement an Environmental Management System (EMS) designed to help meet and exceed regulatory requirements. Performance incentives in this tier include access to a single-point-of contact at Oregon DEQ, technical assistance, enforcement discretion, and public recognition.
- Facilities eligible for recognition in the second tier must have implemented a comprehensive EMS that addressing a wide range of environmental impacts, including those outside of regulatory scrutiny. In return, participants are eligible for streamlined reporting, and flexible/expedited permitting.

- Third tier participants have formal EMS's that, in addition to second tier criteria, consider product and service life-cycle impacts. Members of this tier are generally considered industry leaders in environmental performance, and are rewarded with specially tailored regulatory responsiveness that serve to improve their economic competitiveness as well as further enable superior environmental performance.

Facilities interested in participating in the Green Permits Program must submit an application that includes:

- General facility information.
- A description of environmental impacts and existing systems that address these impacts.
- Information regarding past environmental performance and future environmental goals.
- A plan for incorporating public and agency participation in reviewing environmental performance.
- Desired regulatory flexibility and/or other incentives.
- A $5,000 deposit to cover agency costs.

It was recently announced that the Oregon Green Permit Program would be terminated, for a variety to reasons including a massive state budget deficit, poor industry participation, and an inability to offer sufficient incentives to participants.

PROPOSED GREEN TIER PROGRAM—WISCONSIN

Wisconsin has attempted to be at the forefront of regulatory innovation since 1997, by creating an Environmental Cooperation Pilot Program. In 1999 the state signed an agreement under an EPA-ECOS memorandum of understanding that permitted 10 projects to move forward. Wisconsin is making efforts to expand the program beyond its current status with legislation. The current proposal was developed by the Green Tier Advisory Committee using a consensus process. 15 members from government, farm, business and the NGO communities participated in the stakeholder group. The proposal is awaiting action in the Wisconsin legislature.

The Green Tier proposal sets up a two-tier regulatory system to encourage beyond compliance behavior. All regulated entities begin in the "Control Tier." At this level, regulated entities remain subject to the existing regulatory control system and must comply with minimum environmental standards. Access to the "Green Tier" is earned by accomplishments recorded in the Control Tier.[198]

The Green Tier would be a two-level system. Level One would be an entry level. Regulated entities must meet "fact-based" criteria that bar participants with certain criminal judgments in the last five years and civil judgments in the last three years.[199] This allows entities that currently do not demonstrate superior performance an exit from

[198] Meyer, George E. "A Green Tier for Greater Environmental Behavior." Wisconsin Department of Natural Resources. June 1999. p. 8.
[199] http://www.dnr.state.wi.us/org/caer/cea/green_tier/factsheets/factsheet1.htm

the Control Tier prior to beyond compliance behavior. Requirements exist for public involvement, audits, environmental management systems and reporting.

Level Two, the Green Star level, uses contracts and requires superior environmental performance. According to the Green Tier Fact Sheets issued by the Green Tier Committee, superior environmental performance means "measurable or notable improvements in air, water, land or natural resources quality or ecosystem protection." The proposal does not define explicitly actions, but requires that they "meet the needs of multiple parties and communities" and "go beyond minimum legal standards."[200] Anticipated goals of the undefined actions include: biodiversity, reduced environmental risk, damage mitigation, biosphere protection, energy and water management, comprehensive resource management, resource conservation, technology transfer; mentoring; sustainable community development and promoting civil discourse.[201]

Wisconsin's program uses performance contracts, legal accountability, environmental management systems (EMS), and incentives to elicit and confirm the desired beyond compliance behavior. Green Tier members are regulated by performance contracts negotiated for specific local or statewide environmental goals that include remedies, facilitate sanctions via "environmental performance decrees," and may merit "due diligence" designation through a credible EMS.[202]

The main thrust of the program is to use both "pull" and "push" to move regulated entities from their original station in the Control Tier up into the Green Tier. It is anticipated that the normal regulatory system, burdensome and inflexible, is sufficient to encourage certain entities towards behavior change. Strict enforcement would be pursued to motivate others. Negotiable incentives create "pull." Green Tier's proposed incentives include: regulatory flexibility, streamlining, technical assistance, single point of DNR contact, recognition and use of Green Tier or Green Star logos for public relations and marketing purposes.[203] In addition, efforts are underway to align the program with the U.S. Environmental Protection Agency's new Performance Track.

BAVARIAN COVENANT PROGRAM - GERMANY

The Umwelt Pakt Bayern was signed on October 23, 1995. The five-year agreement between the State of Bavaria, the Federation of Bavarian Industry, the Bavarian Chambers of Commerce and Industry, and the Bavarian Crafts and Trades Congress aimed for greater protection of the environment with 180 specific commitments. In addition to the main parties, the pact identified 61 companies, chambers, associations, and organizations and their individual commitments. Included in the pact were the following commitments made by industry:

- Performance of 3,500 corporate ecological audits in compliance with the Bavarian Environmental Advisory Program;
- Increasing the internal recycling quota of Wacker-Chemie from 53% to 75%;
- Reduction of specific CO2 emission from gas consumption by 25%;
- Extension of BatWa's petrol station to include bio-diesel; and

[200] http://www.dnr.state.wi.us/org/caer/cea/green_tier/factsheets/factsheet1.htm
[201] http://www.dnr.state.wi.us/org/caer/cea/green_tier/factsheets/factsheet1.htm
[202] Meyer, p. 8.
[203] http://www.dnr.state.wi.us/org/caer/cea/green_tier/factsheets/factsheet1.htm

- Providing catalytic converters for all BMW motorcycles as standard equipment.

The State Government committed to several measures including:

- Relief for companies registered as audited locations under EMAS with respect to reporting and documentation obligations, controls, and monitoring by the supervisory authorities as well as with regard to approval procedures;
- Relief from superfluous regulations for Bavarian companies;
- Creation of a contaminated land remediation fund; and
- Participation in GAB (Company for remediation of contaminated sites in Bavaria) through 2008 and increased financial contributions.

At the end of the five-year pact, progress had been made, meriting in the signing of another five-year pact covering 2000-2005 focused on further implementation. Milestones reached by July 1999 included:

- 1035 participants
- 495 of 500 Eco-Audits performed
- 2,700 of 3,500 environmental assessments completed
- 5 of 10 environmental guidelines written and disseminated
- Individual commitments by Wacker-Chemie, BMW, Audi, and Energy Utilities implemented

DUTCH COVENANT PROGRAM - NETHERLANDS

During the 1980s, a sense of urgency developed in the Netherlands over the need to tackle environmental problems and to move towards sustainable development. Motivated by public concern and the release of the 1987 Brundtland Report (also known as Our Common Future) the government to produce the National Environmental Policy Plan (NEPP) and the NEPP Plus (published in 1989 and 1990 respectively) setting out a strategy aimed at achieving sustainable development by the year 2010.

The NEPP and NEPP Plus contain over 200 quantified goals as part of an integrated environmental policy program that employs a target-group approach to divide the responsibility between different sectors of society. The original seven target groups were: industry, agriculture, transport, consumers, the construction industry, the energy sector and refineries. Many in industry considered the goals too difficult and costly. Believing the goals were nevertheless worth attaining, the Dutch looked for alternative ways to encourage industry to take responsibility for improving the environment. In particular, the government perceived that the necessary improvements in industrial environmental performance would be more easily reached by obtaining industry's commitment to solving problems and by using their expertise.

Integrated environmental agreements, such as the Chemical Industry Declaration, were developed through negotiations between government and industry and signed with individual industry sectors. Negotiations can be time consuming. For example, the Chemicals Industry Declaration took two and a half years to negotiate through a mixture of formal meetings and informal contacts. 103 individual entities signed the Chemical Industry Declaration, with phased, quantified reduction targets set for certain substances

in the years 1994, 2000 and 2010. The targets were expressed as a percentage reduction over a baseline, usually set as 1985 and verified by integrated environmental management systems, to be implemented by 1995 as part of the agreement.

As of 1998, 50 environmental covenants had been signed by state and/or lower levels of government and industrial organizations and specific individual companies. The covenants loosely fall into three separate categories: the reduction of atmospheric emissions (10 different covenants), soil and water (15 covenants), and improving the environmental quality of products (25 covenants).

Criticisms of Covenants and Contracts. The use of contracts and covenants draws opposition from environmentalists who believe agreements may offer regulatory relief. However, these agreements work within the context of current law and regulation, often requiring parties to the agreement to move beyond compliance. The Dutch Ministry of Housing, Spatial Planning, and Environment (VROM) maintains a preference for substantive law to end environmental damage, but covenants may be appropriate (1) to benefit the environment as soon as possible or (2) if they are more likely to be effective due to ease of implementation or lower enforcement costs. Neither country relies exclusively on substantive law or covenants in one particular case, but often use written agreements to support existing legislation or regulations and long-term goals.

Additional criticism surrounding these agreements falls into three categories: (1) the legal basis of the agreements; (2) the ambiguous relationship between agreements and the traditional permitting system; and (3) the central role assigned to alternative management systems like environmental management and audit systems (EMAS) and company environmental plans (CEPs). Environmental innovations often run into difficulties when the task of permitting and inspection falls to parties that may not have been involved in crafting the agreement. The role of permitting in implementing an agreement is not stipulated in legislation, creating uncertainty among local authorities on the role they should play. In addition, if agreement provisions are viewed as too lenient on signatories, local authorities may not be willing to use all their available tools on non-signatories. Finally, translating agreements into written permits is difficult and may require more institutional capacity.

The Netherlands' and Bavaria's reliance on alternative management systems for both implementing and monitoring agreements is also controversial. In the Netherlands, companies are encouraged to develop a CEP which may be the basis of their permit conditions. These detailed plans are rewarded with an "outline" license, which is much less detailed than a traditional license. The outline license focuses on the objectives agreed to in the covenant and the CEP and may contain no more than a few dozen regulations. In addition, the Dutch government believes that the rigor of enforcement activities should correspond to the quality of the CEP. Critics contend that local permitting authorities will be required to transform their skill sets from tracking emissions to evaluating the management systems in place at each facility.

Appendix C

TOOL #1, REVISED PLANNING FEE OPTION B

Note: This is a simple assessment of one of many possible fee options. More detailed modeling would be needed to fully project revenue based on trend data, inflation, etc.

Option B involves the following:

- Elimination of the current fee exemptions and caps
- A per pound base fee ($.038) that is approximately the same as recent fees up to 350,000 pounds (which is approximately where the fee cap "kicked in" in recent years)
- For all facilities with more than 350,000 fee pounds, a lump sum (of approximately $13,300/the same amount as the existing fee cap) plus a small per pound fee (e.g., $.001/pound) for all additional pounds.
- The per pound base and overage fees could incrementally increase over time, e.g., $.001 per year.

Table XX. Option B: Lump Some Payment Plus Overage for all Fee Pound Quantities of 350,000 or more.

			Lump Sum ($13,300) Plus Overage (Per Pound Fee)		
Facility	**Fee Pounds**	**Overage (Pounds Above 350,000)**	**$ 0.001**	**$ 0.003**	**$ 0.005**
Goldendale Aluminum Co.	31,813,886	31,464	$ 44,764	$ 107,692	$ 170,619
KAISER ALUMINUM	29,667,798	29,318	$ 42,618	$ 101,253	$ 159,889
US Navy Fleet & Industrial Supply Ctr.	22,634,585	22,285	$ 35,585	$ 80,154	$ 124,723
Birmingham Steel, Seattle Division	21,149,392	20,799	$ 34,099	$ 75,698	$ 117,297
ALCOA-Wenatchee Works	14,071,568	13,722	$ 27,022	$ 54,465	$ 81,908
Boeing-Auburn	7,541,099	7,191	$ 20,491	$ 34,873	$ 49,255
INTALCO Aluminum Corporation	5,410,819	5,061	$ 18,361	$ 28,482	$ 38,604
Boeing-Fredrickson	5,123,689	4,774	$ 18,074	$ 27,621	$ 37,168
Boeing-Everett	4,760,426	4,410	$ 17,710	$ 26,531	$ 35,352
Puget Sound Naval Shipyard	4,297,020	3,947	$ 17,247	$ 25,141	$ 33,035
BOEING	4,021,712	3,672	$ 16,972	$ 24,315	$ 31,659
Georgia-Pacific West	3,085,964	2,736	$ 16,036	$ 21,508	$ 26,980
TransAlta Centralia Generation, LLC	2,813,064	2,463	$ 15,763	$ 20,689	$ 25,615
Weyerhaeuser Co.	2,661,327	2,311	$ 15,611	$ 20,234	$ 24,857

			Lump Sum ($13,300) Plus Overage (Per Pound Fee)		
Facility	**Fee Pounds**	**Overage (Pounds Above 350,000)**	**$ 0.001**	**$ 0.003**	**$ 0.005**
Toray Composites America Inc.	1,911,551	1,562	$ 14,862	$ 17,985	$ 21,108
Naval Submarine Base Bangor	1,835,626	1,486	$ 14,786	$ 17,757	$ 20,728
Fort James Camas Mill	1,797,304	1,447	$ 14,747	$ 17,642	$ 20,537
Boise Cascade Corporation	1,711,438	1,361	$ 14,661	$ 17,384	$ 20,107
Kenworth Truck Company	1,425,580	1,076	$ 14,376	$ 16,527	$ 18,678
Boeing Plant 2	1,377,586	1,028	$ 14,328	$ 16,383	$ 18,438
Total (Top 20)	**169,111,436**	**168,761**	**$ 182,061**	**$ 519,584**	**$ 857,107**
Total (Remaining facilities)	**38,802,857**	**38,453**	**$ 51,753**	**$ 128,659**	**$ 205,564**
Grand Total:	**207,914,292**	**207,214**	**$ 233,814**	**$ 648,243**	**$ 1,062,671**

Note: Longview Aluminum (formerly Reynolds Metal Company), which generated the greatest number of fee pounds in 2000, 2001, and 2002, has been removed from this table because its operations have been closed. If Longview Aluminum were to continue generating substantially more (by an order of magnitude) fee pounds than other companies, it may have to be addressed separately due to potential impacts of a per-pound fee.

APPENDIX D

TOOL #1, REVISED PLANNING FEE OPTION C

Note: This is a simple assessment of one of many possible fee options. More detailed modeling would be needed to fully project revenue based on trend data, inflation, etc.

Option C involves the following:

- Elimination of the current fee exemptions and caps
- A per pound base fee ($.038) that is approximately the same as recent fees up to 350,000 pounds (which is approximately where the fee cap "kicked in" in recent years)
- Escalating the per pound fee one penny after 350,000 fee pounds and at every additional increment of 100,000 fee pounds up to 1,150,000 total fee pounds (i.e., each fee pound between 350,000 and 450,000 would cost $.048, each fee pound between 450,000 and 550,000 would cost $.058, etc.)
- No fees would be charged on any fee pound over 750,000 pounds

Facility Name	Total Fee Pounds	Fee if all lbs. @ $0.0380/ lb.	Actual Fee Paid in 2001	First 350,000 Fee lbs. @ $0.0380/ lb. 1st Tier 350,000	Next 100,000 Fee lbs.@ $0.0480/ lb. 2nd Tier 450,000	Next 100,000 Fee lbs.@ $0.0580/ lb. 3rd Tier 550,000	Next 100,000 Fee lbs.@ $0.0680/ lb. 4th Tier 650,000	Next 100,000 Fee lbs.@ $0.0780/ lb. 5th Tier 750,000	Next 100,000 Fee lbs.@ $0.0880/ lb. 6th Tier 850,000	Next 100,000 Fee lbs.@ $0.0980/ lb. 7th Tier 950,000	Next 100,000 Fee lbs.@ $0.1080/ lb. 8th Tier 1,050,000	Next 100,000 Fee lbs.@ $0.1180/ lb. 9th Tier 1,150,000	Total Fee
Goldendale Aluminum Co.	31,813,886	$1,208,928	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Kaiser Aluminum	29,667,798	$1,127,376	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
US Navy Fleet & Industrial	22,634,585	$860,114	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**

Facility Name	Total Fee Pounds	Fee if all lbs. @ $0.0380/ lb.	Actual Fee Paid in 2001	First 350,000 Fee lbs. @ $0.0380/ lb. 1st Tier 350,000	Next 100,000 Fee lbs.@ $0.0480/ lb. 2nd Tier 450,000	Next 100,000 Fee lbs.@ $0.0580/ lb. 3rd Tier 550,000	Next 100,000 Fee lbs.@ $0.0680/ lb. 4th Tier 650,000	Next 100,000 Fee lbs.@ $0.0780/ lb. 5th Tier 750,000	Next 100,000 Fee lbs.@ $0.0880/ lb. 6th Tier 850,000	Next 100,000 Fee lbs.@ $0.0980/ lb. 7th Tier 950,000	Next 100,000 Fee lbs.@ $0.1080/ lb. 8th Tier 1,050,000	Next 100,000 Fee lbs.@ $0.1180/ lb. 9th Tier 1,150,000	Total Fee
Supply Ctr.													
Birmingham Steel, Seattle Division	21,149,392	$803,677	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Alcoa-Wenatchee Works	14,071,568	$534,720	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Boeing-Auburn	7,541,099	$286,562	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Intalco Aluminum Corporation	5,410,819	$205,611	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Boeing-Fredrickson	5,123,689	$194,700	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Boeing-Everett	4,760,426	$180,896	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Puget Sound Naval Shipyard	4,297,020	$163,287	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Boeing	4,021,712	$152,825	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Georgia-Pacific West	3,085,964	$117,267	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
TransAlta Centralia Generation, LLC	2,813,064	$106,896	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Weyerhaeuser Co.	2,661,327	$101,130	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**

Facility Name	Total Fee Pounds	Fee if all lbs. @ $0.0380/ lb.	Actual Fee Paid in 2001	First 350,000 Fee lbs. @ $0.0380/ lb. 1st Tier 350,000	Next 100,000 Fee lbs.@ $0.0480/ lb. 2nd Tier 450,000	Next 100,000 Fee lbs.@ $0.0580/ lb. 3rd Tier 550,000	Next 100,000 Fee lbs.@ $0.0680/ lb. 4th Tier 650,000	Next 100,000 Fee lbs.@ $0.0780/ lb. 5th Tier 750,000	Next 100,000 Fee lbs.@ $0.0880/ lb. 6th Tier 850,000	Next 100,000 Fee lbs.@ $0.0980/ lb. 7th Tier 950,000	Next 100,000 Fee lbs.@ $0.1080/ lb. 8th Tier 1,050,000	Next 100,000 Fee lbs.@ $0.1180/ lb. 9th Tier 1,150,000	Total Fee
Toray Composites	1,911,551	$72,639	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Naval Submarine Base Bangor	1,835,626	$69,754	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Fort James Camas Mill	1,797,304	$68,298	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Boise Cascade Corporation	1,711,438	$65,035	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Kenworth Truck Company	1,425,580	$54,172	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Boeing Plant 2	1,377,586	$52,348	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Mc Chord Air Force Base	1,352,441	$51,393	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Boeing-Harbour Pointe	1,253,714	$47,641	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
Equilon Enterprises LLC	1,203,416	$45,730	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	$11,800	**$79,700**
USN NUWC-Keyport	1,064,650	$40,457	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	$9,800	$10,800	-	**$67,900**
Simpson Tacoma Kraft Company	907,578	$34,488	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	-	-	-	**$47,300**
Tosco Corp.	872,848	$33,168	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	-	-	-	**$47,300**
Tesoro NW Company	855,707	$32,517	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	$8,800	-	-	-	**$47,300**

Facility Name	Total Fee Pounds	Fee if all lbs. @ $0.0380/ lb.	Actual Fee Paid in 2001	First 350,000 Fee lbs. @ $0.0380/ lb. 1st Tier 350,000	Next 100,000 Fee lbs.@ $0.0480/ lb. 2nd Tier 450,000	Next 100,000 Fee lbs.@ $0.0580/ lb. 3rd Tier 550,000	Next 100,000 Fee lbs.@ $0.0680/ lb. 4th Tier 650,000	Next 100,000 Fee lbs.@ $0.0780/ lb. 5th Tier 750,000	Next 100,000 Fee lbs.@ $0.0880/ lb. 6th Tier 850,000	Next 100,000 Fee lbs.@ $0.0980/ lb. 7th Tier 950,000	Next 100,000 Fee lbs.@ $0.1080/ lb. 8th Tier 1,050,000	Next 100,000 Fee lbs.@ $0.1180/ lb. 9th Tier 1,150,000	Total Fee
Wafer Tech LLC	818,254	$31,094	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	-	-	-	-	**$38,500**
ARCO Products Company	809,486	$30,760	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	-	-	-	-	**$38,500**
Agrium U.S. Inc. KFO	768,985	$29,221	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	-	-	-	-	**$38,500**
Longview Fibre Company	762,630	$28,980	$13,192	$13,300	$4,800	$5,800	$6,800	$7,800	-	-	-	-	**$38,500**
Kaiser Aluminum TR	741,172	$28,165	$13,192	$13,300	$4,800	$5,800	$6,800	-	-	-	-	-	**$30,700**
University of Washington	737,247	$28,015	$13,192	$13,300	$4,800	$5,800	$6,800	-	-	-	-	-	**$30,700**
US Army Yakima Firing Center	735,975	$27,967	$13,192	$13,300	$4,800	$5,800	$6,800	-	-	-	-	-	**$30,700**
Kimberly Clark Tissue Co.	730,877	$27,773	$13,192	$13,300	$4,800	$5,800	$6,800	-	-	-	-	-	**$30,700**
Boeing Aero & Elec	719,215	$27,330	$13,192	$13,300	$4,800	$5,800	$6,800	-	-	-	-	-	**$30,700**
NAS Whidbey Island Ault Field	616,539	$23,428	$13,192	$13,300	$4,800	$5,800	-	-	-	-	-	-	**$23,900**
AVX Vancouver Corp	577,742	$21,954	$13,192	$13,300	$4,800	$5,800	-	-	-	-	-	-	**$23,900**
BF Goodrich Kalama, Inc.	545,790	$20,740	$13,192	$13,300	$4,800	-	-	-	-	-	-	-	**$18,100**
Sandvik Special Metals Corp	527,147	$20,032	$13,192	$13,300	$4,800	-	-	-	-	-	-	-	**$18,100**

Facility Name	Total Fee Pounds	Fee if all lbs. @ $0.0380/ lb.	Actual Fee Paid in 2001	First 350,000 Fee lbs. @ $0.0380/ lb. 1st Tier 350,000	Next 100,000 Fee lbs.@ $0.0480/ lb. 2nd Tier 450,000	Next 100,000 Fee lbs.@ $0.0580/ lb. 3rd Tier 550,000	Next 100,000 Fee lbs.@ $0.0680/ lb. 4th Tier 650,000	Next 100,000 Fee lbs.@ $0.0780/ lb. 5th Tier 750,000	Next 100,000 Fee lbs.@ $0.0880/ lb. 6th Tier 850,000	Next 100,000 Fee lbs.@ $0.0980/ lb. 7th Tier 950,000	Next 100,000 Fee lbs.@ $0.1080/ lb. 8th Tier 1,050,000	Next 100,000 Fee lbs.@ $0.1180/ lb. 9th Tier 1,150,000	Total Fee
Kenworth Truck Company	523,630	$19,898	$13,192	$13,300	$4,800	-	-	-	-	-	-	-	**$18,100**
Northwest Alloys Inc.	502,905	$19,110	$13,192	$13,300	$4,800	-	-	-	-	-	-	-	**$18,100**
Lasco Bathware	498,104	$18,928	$13,192	$13,300	$4,800	-	-	-	-	-	-	-	**$18,100**
Boeing-Development Center	491,662	$18,683	$13,192	$13,300	$4,800	-	-	-	-	-	-	-	**$18,100**
Port Townsend Paper Corporation	477,630	$18,150	$13,192	$13,300	$4,800	-	-	-	-	-	-	-	**$18,100**
BF GOODRICH	468,248	$17,793	$13,192	$13,300	$4,800	-	-	-	-	-	-	-	**$18,100**
Protective Coatings Inc.	461,413	$17,534	$13,192	$13,300	$4,800	-	-	-	-	-	-	-	**$18,100**
Crown Beverage Cork and Seal	446,227	$16,957	$13,192	$13,300	-	-	-	-	-	-	-	-	**$13,300**
TOSCO NW Co. Fernadale Refinery	421,482	$16,016	$13,192	$13,300	-	-	-	-	-	-	-	-	**$13,300**
Blue Streak Finishers Ltd.	408,651	$15,529	$13,192	$13,300	-	-	-	-	-	-	-	-	**$13,300**
BHP Coated Steel Pacific NW Fac	399,142	$15,167	$13,192	$13,300	-	-	-	-	-	-	-	-	**$13,300**
Equilon Enterprises,	398,601	$15,147	$13,192	$13,300	-	-	-	-	-	-	-	-	**$13,300**

Facility Name	Total Fee Pounds	Fee if all lbs. @ $0.0380/ lb.	Actual Fee Paid in 2001	First 350,000 Fee lbs. @ $0.0380/ lb. 1st Tier 350,000	Next 100,000 Fee lbs.@ $0.0480/ lb. 2nd Tier 450,000	Next 100,000 Fee lbs.@ $0.0580/ lb. 3rd Tier 550,000	Next 100,000 Fee lbs.@ $0.0680/ lb. 4th Tier 650,000	Next 100,000 Fee lbs.@ $0.0780/ lb. 5th Tier 750,000	Next 100,000 Fee lbs.@ $0.0880/ lb. 6th Tier 850,000	Next 100,000 Fee lbs.@ $0.0980/ lb. 7th Tier 950,000	Next 100,000 Fee lbs.@ $0.1080/ lb. 8th Tier 1,050,000	Next 100,000 Fee lbs.@ $0.1180/ lb. 9th Tier 1,150,000	Total Fee
LLC													
American Millwork Inc.	359,000	$13,642	$13,192	$13,300	-	-	-	-	-	-	-	-	**$13,300**
Total (Currently Capped Facilities)	**191,569,543**	**$7,279,643**	**$699,176**										**$2,640,900**
Total (Remaining Facilities)	**16,344,749**	**$621,100**	**$613,991**										**$621,100**
Grand Total	**207,914,292**	**$7,900,743**	**$1,313,167**										**$3,262,000**
Note: Longview Aluminum (formerly Reynolds Metal Company), which generated the greatest number of fee pounds in 2000, 2001, and 2002, has been removed from this table because its operations have been closed													

Appendix E: Overview of the Minnesota Toxic Pollution Prevention Act Fee Structure

From http://www.moea.state.mn.us/berc/p2fees.cfm

The **Minnesota Toxic Pollution Prevention Act** (TPPA) requires the payment of pollution prevention fees on January 1 of each year. The fees are collected by the Minnesota Office of Environmental Assistance (OEA). The pollution prevention fees support Minnesota's pollution prevention assistance activities. Programs include the Minnesota Technical Assistance Program (MnTAP), grants, workshops, conferences and educational materials such as the Pollution Prevention Planning Guide and fact sheets.

The federal Emergency Planning and Community Right-to-Know Act requires certain facilities to report releases of listed toxic chemicals on the toxic chemical release inventory (TRI) Form R. Facilities reporting toxic chemical releases are required to pay pollution prevention fees to the OEA.

Large Quantity Generators (LQGs) of hazardous waste must pay a fee to the OEA based on hazardous waste generation only if they are not required to pay to the ERC a pollution prevention fee based on toxic chemical releases for that same year.

CALCULATING THE FEE

TRI REPORTERS

Under the TPPA, fees must be calculated in the following manner from facilities required to report toxic chemical releases.

Total pounds of toxic chemicals

- Facilities reporting releases of less than 25,000 pounds annually of toxic chemicals must pay $500.
- Facilities reporting annual releases of toxic chemicals in excess of 25,000 pounds pay a graduated fee of $0.02 per pound of toxic chemicals reported released. There is no maximum fee.

Calculating the fee

- Add together releases reported on Section 8.1 of Form R. Off-site transfers for waste treatment or disposal in Section 8.7 of Form R are also included.
- Quantities transferred off-site for recycling and energy recovery as reported on Section 8 of Form R are <u>not</u> assessed the pollution prevention fee.

Total number of toxic chemicals

A fee of $150 is assessed for each toxic chemical reported released.

LARGE QUANTITY GENERATORS (LQGS)

The TPPA requires that LQGs of hazardous waste—those not required to pay pollution prevention fees based on toxic chemical releases—must pay an annual pollution prevention fee of $500. Minnesota Rules, Chapter 7045, set guidelines for identifying and regulating generators of hazardous waste. Plants and facilities that generate more than 1,000 kilograms of hazardous waste per month are regulated as Large Quantity Generators. The Minnesota Pollution Control Agency (MPCA) and metropolitan county hazardous waste offices supply the OEA with a list of facilities identified as LQGs for billing purposes.

Appendix F: Overviews of the Materials Accounting Programs in Massachusetts and New Jersey

The Massachusetts and New Jersey programs both set waste reduction goals of 50 percent over ten years, with 1987 as a baseline.

MASSACHUSETTS TOXICS USE REDUCTION ACT

The passage of the Massachusetts Toxics Use Reduction Act (TURA) in 1989 was the first attempt by any state to achieve pollution prevention through (1) mandatory annual reporting of companies' chemical use; (2) biannual planning by companies of ways to reduce their use of toxics; and (3) annual fees paid by companies based on the number of chemicals they use in large quantities (over 10,000 pounds per year per chemical) and how many workers they employ (Tellus Institute and Environmental League of Massachusetts 2001). To implement this program, the Massachusetts Department of Environmental Protection instituted a materials accounting[204] program, which is described in a separate document [name]. The TURA program was not instituted as a price signal per say, but rather as a multifaceted program that uses the annual fee as one of several pollution prevention instruments.

RESULTS

A report published in August 2001 by the Tellus Institute and the Environmental League of Massachusetts indicates that a core group of companies that have reported since 1990 have showed a 33% decrease in their use of toxics between 1990 and 1998. (Tellus from report "1998 Toxics Use Reduction Release" MDEP). However, because the TURA fees are based on the number of chemicals a firm uses instead of the weight of the chemicals used, it is unlikely that the TURA fees themselves have caused the reductions. According to EPA's 2001 report, *The U.S. Experience with Economic Incentives for Protecting the Environment*, the information collected through TURA has helped facilities to identify possible improvements in process efficiencies and cost-cutting by having an improved understanding of the quantities of toxics used during production, released to the environment, and transformed into products.

NEW JERSEY WORKER AND COMMUNITY RIGHT TO KNOW ACT

The New Jersey materials accounting experience developed from the 1984 New Jersey Worker and Community Right to Know Act, the first law to require industrial facilities to publicly report quantities of toxic chemicals: transported in or out of facilities as (or in) products, chemically converted in production processes, stored on site, and generated

[204] Also known under more general titles, such as "chemical reporting programs" (EPA 2001) and materials flow accounting.

as waste and subsequently released to the environment or transferred of site for recycling, treatment, and disposal (INFORM 1997). Like Massachusetts, New Jersey instituted a materials accounting tracking and reporting program. The only fee associated with this program is a fee on the number of employees at a facility.

A discussion about materials accounting-based programs that focuses only on the experiences in Massachusetts and New Jersey would be misleading, because measures to institute similar programs have failed in at least eight other states: California, Colorado, Florida, Hawaii, Maryland, Michigan, New York, and Oregon) (GAO, 1997; Fairley 1998). The experiences of these states may be equally valuable to Ecology given simply the experience-based odds of passing materials accounting legislation.

RESULTS

INFORM's 1997 research on New Jersey's materials accounting data indicated that, between 1991 and 1994, the use of toxic chemicals in New Jersey increased 633 million pounds (approximately 5 percent) to 13.3 billion pounds. However the use of chemical class of special concern, such as PBTs and ozone depleters, decreased.[205] Between 1991 and 1994, non-product output increased, but facilities reported the highest level of source reduction in 1993 (INFORM 1997). These findings were not accepted as "truth" by all stakeholders. The Chemicals Manufacturers Association (CMA), for example, claimed that this and other materials accounting reports falsely attributed reductions in the use of TRI-listed chemicals to materials accounting, when in fact it was a combination of process shutdowns and plant closings that caused the use reduction (Fairly 1998).

Two separate reports on the New Jersey program, one by EPA (2001) and one by the National Pollution Prevention Roundtable and Kerr, Greiner, Anderson, and April Inc. (2000) indicate that the program's reporting requirements have been beneficial to companies because the data helps them assess their options to minimize waste and enact pollution prevention measures.

As mentioned previously, the only price signal instrument used in this program is a fee of $2 per employee for the regulated facilities. Although research has not been done to determine whether this fee has influenced the overall results of the program, it is unlikely to have done so for two reasons. First, there is not reason to believe that the number of employees is associated (much less indicative of a cause-and-effect relationship) with the amounts of chemicals used or released. Second, the influence of the fee, if any, could be undesirable because there is reason to believe that a higher number (relative to production) of employees leads to safer and more efficient operations. Therefore, a fee on employees that is high enough to influence industrial hiring practices could theoretically lead to a decrease in on-site safety (and therefore more chemical spills/accidents) and less than desirable management practices.

[205] The amounts of the decreases were as follows: bioaccumulators, 33 percent; carcinogens, 5 percent; chloroorganics, 14 percent; haloorganics, 16 percent; heavy metals, 18 percent; and ozone depleters, 64 percent. Source: INFORM, Inc. 1997.

Appendix G: Overview of Sweden's NOx Feebate Program

AN OVERVIEW

Combustion plants produce energy — electricity and heat — by burning different kinds of fuel. But during combustion, air-polluting compounds such as nitrogen oxide (NO) and nitrogen dioxide (NO2), collectively termed nitrogen oxides (NOx), and sulphur dioxide (SO2) are released. Since January 1, 1992, large combustion plants have paid an environmental charge on NOx emissions. 'Large' plants are defined as having a capacity of 10 MW or more and an annual energy production exceeding 50 GWh. Smaller combustion plants are not liable because of the higher relative cost of continuously measuring the emissions. The charge of SEK 40 (US $4.80) per kilogram of NOx is not a tax. Instead it is redistributed among liable plants in proportion to their energy production. As a result, plants which produce much energy relative to their total emissions benefit, while those with a low ratio of energy to emissions lose. Some plants earn money from this system while others underwrite it.

Most of the liable combustion plants are found in energy production, that is, heating and power plants. The pulp and paper industry, the chemical industry and the metal industry also have combustion plants for energy production. Waste incineration plants producing energy are similarly liable for the charge. There is a wide variation in net payment (charge minus refund) within the industries, as Figure 1 shows. For example, energy production plants range from making a net payment of SEK 10m ($1.2m) to receiving a net income of SEK14m ($1.7m). In 1992, approximately SEK 100m ($12m) was redistributed.

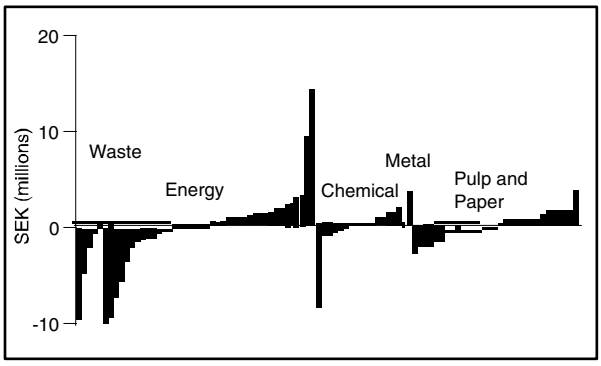

Figure 1. The net NO_x charge payment per liable plant and industry (Source: SNV PM 930430)

The refund system was necessary in order to achieve a fair system. The competition between small (non-liable) and large (liable) combustion plants would have been distorted if the charge was not refunded to the liable plants. The fact that the charge is refunded and thereby only has an environmental purpose has facilitated acceptance of the charge. A positive side effect is that less polluting plants are favoured economically

and thus given a competitive advantage. The refund system has contributed to the considerable success of the charge.

Policy History at a Glance

1990	1992	
Parliamentary decision	Implementation of Swedish NO_x charge on large combustion plants	Best expectations of the policy exceeded

Many companies started NOx-reducing projects as soon as a parliamentary decision was taken in 1990, in order to have as low emissions as possible when the charge came into force in January, 1992. The management and the operators at the plants have become more focused on reducing NOx. At one plant the operators are given a salary bonus if NOx emissions are low.

Though the combustion plants are given an economic incentive to reduce their emissions, they are not forced to do so by regulation. It is up to the individual plant to decide. Companies can choose whether to reduce their NOx emissions or pay the charge. Generally speaking, the liable plants have a greater incentive to seek ways to reduce emissions than any government body. It is therefore much more efficient to leave it to the liable group to formulate individual responses to the charges.

POLICY ISSUES

The Swedish NOx charge system seems suitable for reducing emissions from combustion plants for energy production in other countries. The system has proved to be very successful. It is regarded as a fair system. Considerable cost-effective reductions in emissions have been achieved at the liable plants.

SOME FURTHER READING

Swedish Ministry of the Environment (1991). *Economic Instruments in Sweden with Emphasis on the Energy Sector*, Stockholm.

Results:

- NO_x emissions were 35% lower in 1992 than in 1990. By 1993, total reductions rose to 44% of 1990 levels.
- The number of combustion plants with NO_x -reducing technologies increased by a factor of about 16 between 1982 and 1994, and further installations are planned. Figure 2 provides a more detailed picture.

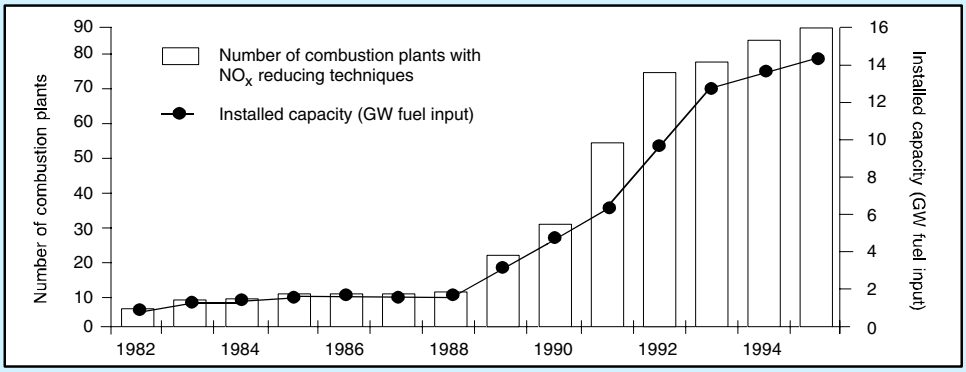

Figure 2. Present and planned installations of NO_x reducing techniques (Source: SNV Report 4152)

- NO_x emissions have decreased much more rapidly than expected. Thus the target for 199 of a 35% reduction from 1990 levels was already achieved in 1993.
- Emissions reductions have been achieved in a cost-effective manner for both individuals and society.
- The average cost to reduce one kilogram of NO_x is SEK 10 ($1.2). Thus the charge of SEK/kg-NO_x has provided a substantial economic inducement to reduce emissions. For many plants, installing NO_x -reducing technologies has proved profitable.
- Though the overall effect of the policy on society is difficult to estimate, the Swedish Environmental Protection Agency has estimated the net benefit to be on the order of at least 250 million ($30 million).

Lessons:

- Budget-neutral economic instruments can be used to reduce pollution without harming industrial competitiveness or raising industry opposition.
- Political acceptability of an otherwise unacceptably high charge can be achieved if the income from the charge is rebated to relevant parties.

Appendix H: Getting the Taxes Right

According to EPA (2001), "To date, the theoretically ideal product charge has not been imposed. Although some product charges may be large enough to have a significant effect on behavior, most of them are intended primarily to raise revenue."

Evidence does suggest that it is possible to set taxes at a level high enough. The general consensus is that it is very difficult to set the tax at exactly the "right" level (Tellus Institute 2001). If the tax level is set too low, there is unlikely to be any behavioral change. However, assessing the correct tax level is difficult for several reasons. First, one needs reliable information about the tax level that will influence behavior. As previously discussed in the context of the empirical evidence, there is some information on this topic as it relates to disposal taxes (especially incineration taxes). Second, truly enacting the polluter pays principle by making the polluting facility pay for the social/external cost of the material usage, generation, or disposal would require determining what the social/external cost is. But the true social cost is extremely difficult to measure as it depends on the type and inherent hazard of the waste or hazardous/toxic substance, the method of treatment and disposal, the geographic location, etc. (EPA 2001, Gottinger 1997). Third, given that relatively few agencies have explicitly geared their price signal programs to influence behavior (even if a behavioral change was an outcome) or to truly internalize the social/external costs, there are few real-life programs to follow and learn from.

Highlight B
Do environmental taxes affect all industries equally?

In Redefining Progress' report *Burdens and Benefits of Environmental Tax Reform: An Analysis of Distribution by Industry*, Andrew Hoerner examined the impacts on industry (498 sectors of the U.S. economy) if revenues from an energy tax (on carbon) were used to reduce payroll taxes or corporate income taxes. The results of his study are that 73-80% of all industries (by value of output), employing 78-92% of U.S. workers, would benefits from such programs. However, "a small but important group of industries, mostly in mining and the production of bulk metals, chemicals, and ceramics, might suffer substantial price increases. The global competitiveness of these industries could be significantly harmed unless special policies were adopted to lessen their burden."

Source: Hoerner 2000

Perhaps the most troubling potential impact of not setting the tax right is that, if the taxes are set too high, parties are likely to seek out alternative means to do the same activity, such as illegal dumping/disposal (a small amount of which could result in more environmental damage than would have been incurred without the tax) (EPA 2001), relocating operations to other states where the regulations are less costly/stringent (Alberini and Frost, 1999), or falsifying the data in their reports. .