Pollution Prevention/Continuous Improvement Framework

Final Report of the CASA
Pollution Prevention/Continuous Improvement Project Team

June 2002

CASA
Clean Air Strategic Alliance

Contents

1 Executive Summary

The overriding goal of preventing pollution is to eliminate the causes rather than having to correct the problems that pollution creates. Pollution prevention means avoiding or minimizing the use of toxic chemicals, improving efficiency, and reducing waste and emissions by changing processes, practices and materials. Instead of cleaning up or collecting emissions and wastes after they've been produced, we simply don't generate them in the first place.

The notion of continuous improvement recognizes that ongoing adjustments will be needed to protect the environment and take advantage of innovative and creative solutions. By twinning pollution prevention and continuous improvement, we can take a more integrated approach and apply a broader range of environmental protection tools.

The CASA board acknowledged in its strategic planning framework that a pollution prevention/continuous improvement (P2/CI) approach has potential to produce desirable environmental outcomes beyond what can be achieved through regulation. P2/CI can protect and enhance air quality (and the environment in general), help reduce operating costs, improve operating efficiencies, decrease health and environmental risks, and limit associated liabilities.

Regulation will remain a key component of Alberta's air quality management system, but innovative pollution prevention and continuous improvement strategies can complement or provide an alternative to the command and control approach. Although the primary focus for CASA, and thus the P2/CI team, is the medium of air, preventing air pollution should not result in contamination of other media; in other words, clean air should not be attained at the expense of land or water.

The framework proposed by the P2/CI Project Team includes recommendations that can be implemented by most of the major industrial sectors in Alberta and by government. It acknowledges that realizing the CASA vision for clean air will require serious and cooperative commitment by all stakeholders and that pollution prevention/continuous improvement can play a key role. The framework includes a particular focus on education and outreach activities because the project team recognized that a sound foundation of knowledge is the first step in overcoming barriers to implementing P2/CI programs.

With the submission of this final report to the CASA board, the P2/CI team has completed its mandate. The team believes there is considerable potential for Albertans to play a much more active role in preventing pollution, although they may not use those words when they begin to practise the concept. With the goal of engaging Albertans across all sectors, the Pollution Prevention/Continuous Improvement Project Team makes the following recommendations.

1.1 Recommendations

The Pollution Prevention/Continuous Improvement Project Team recommends that:

Pollution Prevention/Continuous Improvement Planning

1. CASA stakeholders adopt and implement this pollution prevention/continuous improvement framework.

2. Airshed management zones consider developing pollution prevention/continuous improvement plans.

3. Alberta Environment adopt and implement a framework based on the draft *Approach to Pollution Prevention Initiatives* framework, developed with input from the P2/CI team.

Industrial Ecology

4. The Alberta government promote and advance industrial ecology as the new mode of industrial development in the province by supporting and/or participating in a world summit on industrial ecology in Alberta.

5. CASA members support and participate in a world summit related to industrial ecology in Alberta.

Education and Outreach

6. Alberta Environment incorporate pollution prevention/continuous improvement messages into materials it updates and into new environmental education documents.

7. Alberta Environment encourage and assist others to incorporate pollution prevention/ continuous improvement messages into their materials.

8. Alberta Environment initiate a pollution prevention/continuous improvement outreach program to industry, with particular emphasis on small and medium-sized enterprises.

9. Utilities take advantage of opportunities for public education and outreach by including a pollution prevention/continuous improvement message with their bills.

10. The CASA secretariat and Alberta Environment seek opportunities to disseminate pollution prevention/continuous improvement messages through their print and electronic communications vehicles. They should start by posting the Pollution Prevention Education and Outreach Inventory prepared for the P2/CI Project Team on their websites and establishing links to pollution prevention award websites.

Hospitals

11. Alberta hospitals consider developing and implementing pollution prevention and continuous improvement programs as part of their environmental management systems.

Renewable Energy

12. CASA's Electricity Project Team address renewable energy as part of its task to identify, assess and develop emissions management options and mixtures of options.

Electric Power Generation

13. CASA's Electricity Project Team consider P2/CI in the development of its management approach for that sector.

Co-generation

14. CASA's Electricity Project Team consider opportunities for co-generation as part of its overall approach to managing emissions from the electricity sector.

Transportation

15. The CASA Vehicle Emissions Team include P2/CI in its future activities.

Residential Wood Combustion

16. Alberta Environment and Environment Canada work with Natural Resources Canada to promote Natural Resources Canada's residential wood combustion initiatives.

Oil Sands and Heavy Oil

17. The Cumulative Effects Management Association (CEMA) incorporate P2/CI actions and strategies into their emissions management framework.

Upstream Oil and Gas

18. The Canadian Association of Petroleum Producers (CAPP) and the Small Explorers and Producers Association of Canada (SEPAC) develop and promote P2/CI programs.

Downstream Oil and Gas and Petrochemicals

19. The Canadian Petroleum Products Institute (CPPI) and the Canadian Chemical Producers Association (CCPA) develop and promote P2/CI programs that will reduce emissions.

Implementation

20. The CASA board review and report on progress on implementation of these recommendations by June 2004.

2 Introduction

The modern world has benefited from many positive developments in the last two centuries, but we have also become aware of the impact of human activities on the biosphere. With the rise of an industrialized economy and rapid population growth, people around the world are exposed to a multiplicity of environmental toxins in their food, air, water, soil and manufactured consumer products. In the pursuit of affluence and material gain many societies have forgotten or become complacent about the fact that all human activities depend on the health of the biosphere. Climate change, ozone depletion, species extinction, deforestation, desertification and other forms of ecotoxicity are altering the balance and integrity of our planet's natural systems. These natural systems are inextricably linked to our basic life support systems and mechanisms, and we ignore damage to these systems at our peril.

The concept of pollution prevention is not a new approach to protecting the environment. It is logical that preventing pollution in the first place will reduce environmental damage and reduce the cost of "end-of-pipe" approaches to pollution control. The overriding goal of preventing pollution is to eliminate the causes rather than having to "cure" the problems it creates. It means avoiding or minimizing the use of toxic chemicals, improving efficiency, and reducing waste and emissions by changing processes, practices and materials. Instead of cleaning up or collecting emissions and wastes after they've been produced, we simply don't generate them in the first place.

The notion of continuous improvement recognizes that ongoing adjustments will be needed to protect the environment and take advantage of innovative and creative solutions. Admittedly, incorporating a pollution prevention approach into the planning and design phases of a project or process is generally easier and less costly than making changes at a later date. By twinning pollution prevention and continuous improvement, we can take a more integrated approach and apply a broader range of tools.

Pollution prevention and continuous improvement are approaches that anyone can use – from large industries to municipalities and public institutions to individual consumers. CASA identified pollution prevention and continuous improvement as one of four key focus areas in its strategic planning framework (see Appendix A). The goals for this key focus area are:

- A working environment in which pollution prevention /continuous improvement (P2/CI) is used to protect air quality, and
- The public contributes to pollution prevention by making clean air friendly choices.

Pollution prevention and continuous improvement are consistent with the CASA vision that: *the air will be odourless, tasteless, look clear and have no measurable short- or long-term adverse effects on animals, people and the environment.* Pollution prevention plans often incorporate stakeholder collaboration, a characteristic that is central to how CASA operates. Pollution prevention/continuous improvement can be used to implement various elements of CASA's strategic framework and is consistent with CASA's other key focus areas, such as ecological health, socio-economic integration, and human and animal health.

At its November 1999 meeting, the CASA board directed a working group to develop terms of reference for a CASA P2/CI project team. The working group proposed that the P2/CI project team also take on an objective previously agreed to by the board as part of the terms

of reference of the Acidifying Emissions Management Implementation Team to "Develop plans for voluntary initiatives for enhanced performance." The working group prepared terms of reference with nine objectives for achieving the two goals noted above. At its March 2000 meeting, the CASA board accepted these terms of reference and the P2/CI project team was formed. The members of the project team are listed in Appendix B and the team's terms of reference can be found in Appendix C.

The P2/CI team recognized that a number of CASA project teams are already doing a great deal of good work on pollution prevention and continuous improvement. For example, "source reduction" describes the results of the Flaring and Venting team. The Vehicle Emissions team is implementing actions that are consistent with pollution prevention/ continuous improvement practices. The Particulate Matter and Ozone team and the Electricity team also have opportunities to incorporate components of P2/CI into their recommendations. We commend and support this work and did not want to duplicate what had already been done.

The terms of reference gave the P2/CI team a broad mandate to identify and recommend P2/CI strategies that other CASA project teams and stakeholders could use to reduce pollution at its source. The terms of reference specifically included reference to a sectoral approach and linkages to other CASA activities. The team's proposed framework includes a particular focus on education and outreach activities because the project team recognized that a sound foundation of knowledge is the first step in overcoming barriers to implementing P2/CI programs.

3 What is Pollution Prevention and Continuous Improvement?

3.1 Definitions

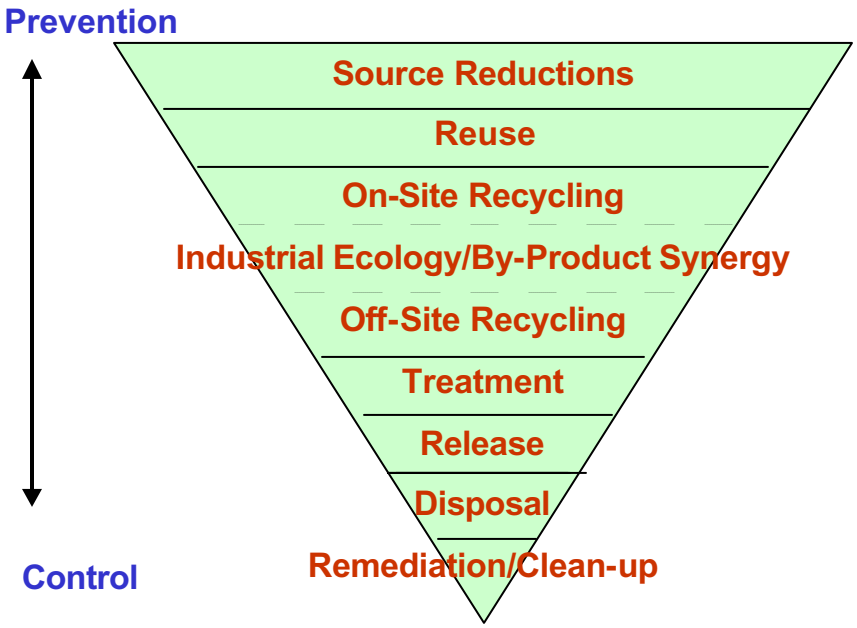
Pollution prevention is generally defined as "the use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants or wastes at the source."[1]

The CASA strategic planning framework identifies an opportunity to "continuously improve air quality by minimizing the use of polluting processes, practices, materials and products,"[2] which is the broad definition used by the project team in its work.

Pollution prevention approaches generally focus on the upper half of the environmental management hierarchy illustrated below in Figure 1. The focus shifts from prevention to control with movement down the pyramid.

[1] Canadian Council of Ministers of the Environment. *A Strategy to Fulfil the CCME Commitment to Pollution Prevention*. Pollution Prevention Task Group. May 1996.
[2] See Appendix A.

Figure 1. Pollution Prevention Environmental Management Hierarchy



Pollution prevention techniques and practices focus on:

- Substances of concern
- Materials and feedstock substitution
- Operating efficiencies
- On-site reuse and recycling
- Training
- Purchasing practices
- Product design
- Equipment modifications
- Product reformulation
- Process changes
- Clean production
- Avoidance of cross-media transfer of pollutants or waste
- Life-cycle assessment

Many factors contribute to successful P2/CI initiatives. Some of these success factors are noted in Appendix D.

3.2 Examples of Pollution Prevention Techniques and Practices[3]

Materials and feedstock substitution is a method of source elimination. Polluting materials in a production process or embedded in a product are replaced with less polluting or non-polluting substances. Opportunities for materials and feedstock substitution include:

- Painting applications
- Parts cleaning
- Metal finishing
- Printing operations
- Building and grounds maintenance

Operating efficiencies and training are examples of how normal parts of good operation can provide effective ways to prevent pollution. Examples include:

- Changing production schedules to minimize equipment and feedstock changeovers
- Improving maintenance schedules
- Segregating by-products at the source
- Training staff to improve material handling and recognize P2 opportunities

Product design and reformulation includes methods for preventing pollution associated with the entire life cycle. Addressing environmental concerns at an early stage can avoid environmental impacts throughout the product life cycle in a cost-effective manner. Results of redesigning or reformulating a product include:

- Reducing toxicity of a product
- Reducing waste material
- Extending the life of a product
- Extending the life of the materials used
- Reducing energy and material intensity needed to produce, use and dispose of the product

Equipment modifications and process changes involve new technologies or approaches to existing operating systems processes and practices to improve production efficiencies and reduce pollution and waste. An example is mechanical stripping instead of using solvents to remove paint and varnish.

The Value of Waste

Waste can also be viewed as a loss of valuable process materials that could have economic and environmental benefits if reused or recycled. The following approaches reflect this perspective on the value of waste.

On-site reuse and recycling is considered pollution prevention because it occurs at the same place as the original activity.[4] **Reuse** means using materials again in their original form or in new applications. **Recycling** extends the effective life of resources. Environmentally sound recycling is usually preferable to end-of-pipe solutions. Raw materials, chemicals and treated

[3] Environment Canada, *Pollution Prevention Planning Handbook,* 2001

[4] Off-site reuse or recycling is also an environmentally friendly activity but is not considered pollution prevention because it deals with pollution or wastes after they have been created.

and untreated wastewater are examples of materials that could be reused or recycled. Some examples of reuse and recycling are:

- Recovering metals by ion exchange or reverse osmosis
- Recycling cooling water
- Reusing trim and cuttings from plastic moulding in on-site production rather than taking them for off-site disposal

3.3 Tools and Information Sources

Manuals, decision trees and other tools are useful in step-by-step implementation of pollution prevention activities. The sources listed below provide guidance, and the inventory of pollution prevention education and outreach initiatives in Alberta, compiled for the P2/CI team, contains additional information.[5]

- Environment Canada http://www.ec.gc.ca/nopp/english/index.cfm
- U.S. Environmental Protection Agency http://www.epa.gov/p2
- Pollution Prevention Resource Exchange http://p2rx.org
- Canadian Centre for Pollution Prevention www.c2p2online.com

The EPA site contains a section of "Sector Notebooks,"[6] which provide detailed descriptions of industry activities, pollution and pollution prevention opportunities, and they include a section on compliance. Although directed at U.S. industry, many of the notebooks are also relevant to the Canadian situation. A number of P2/CI initiatives have been undertaken in the U.S. and some of these are summarized in Appendix E. The Pollution Prevention Resource Exchange is a national network of regional centres dedicated to improving the dissemination of pollution prevention information, and it provides seamless access to high quality, synthesized, peer-reviewed P2 information and expertise.

Additional actions that can promote P2/CI are sharing of success stories and sharing information about factors that lead to P2 success. Government outreach programs and information dissemination by industry associations have been effective ways of doing this in other jurisdictions.

The Pollution Prevention/Continuous Improvement Project Team identified a number of tools and strategies to promote and implement P2/CI; these are noted in Appendix F.

[5] The Inventory is available online through the CASA website at http://www.casahome.org/uploads/PPCI_inventoryofP2CIprogramsinABMAR-2002.pdf

[6] http://es.epa.gov/oeca/sector/index.html

4 Success Stories

Success stories can encourage companies and organizations to develop and implement their own P2/CI practices and there is no shortage of pollution prevention success stories. An Internet search using the phrase "pollution prevention success stories" yields 300 to 400 matches.

Awards and recognition programs are one way of delivering success stories and the Pollution Prevention Awards given out each year by the Canadian Council of Ministers of the Environment are a good example.[7]

Industry associations can do much to inform their members through newsletters, conferences and other means, and businesses themselves have been a key source of pollution prevention success stories. Several examples have been selected and are summarized below.

Dow Chemical[8]

Few organizations have achieved as much success in preventing pollution as Dow Chemical. Although some critics may claim there are a limited number of P2 and Energy Efficiency (E2) opportunities, Dow has proved otherwise. In 1981, Dow's Louisiana Division, in the face of rising energy costs, held a contest to reduce energy use with projects that provided a minimum 100 percent return on investment (ROI). In the first year, 27 out of 39 proposed projects survived the review process and were instituted. They cost $1.7-million to implement and delivered a 173 percent ROI.

This impressive result left employees feeling that all opportunities had been tapped. However, the following year the contest yielded 32 projects costing a total of $2.2-million and yielding an ROI of 340 percent. In the third year, the program was expanded to include waste reduction; 38 projects were selected with an implementation cost of $4-million and a 208 percent ROI. This contest was eventually formalized as "WRAP" – Waste Reduction Always Pays. Over a 12-year period, Dow implemented 936 projects with ROIs averaging between 97 and 470 percent. Of these, 575 projects were audited, verifying savings of more than $110-million per year and an average ROI of 204 percent. Dow attributed the success of the WRAP program to creating an environment of teamwork and cooperation among plants, which continually built momentum toward bigger and better projects with higher ROIs.

More recently, Dow's Midland, Michigan chemical manufacturing facility initiated a project to reduce toxic wastes and emissions using only P2 techniques.[9] Partners included the Natural Resources Defense Council, Greenpeace, and other community activist groups and individuals. Through the implementation of 17 projects, this initiative reduced facility emissions by 43 percent, from one million pounds to 593,000 pounds per year. Similarly, facility wastes were reduced by 37 percent, from 17.5 million pounds to 11 million pounds per year. These reductions exceeded the goal of a 35-percent reduction, with a total capital

[7] See the CCME website at www.ccme.ca/5e_othertopics/5ed_pollution/5ed1.html.
[8] Kenneth E. Nelson, "Are There Any Energy Savings Left?" *Chemical Processing*, January 1989; and Kenneth Nelson, "Dow's Energy/WRAP Contest – A 12-Year Energy and Waste Reduction Success Story," in Proceedings of the Fifteenth National Industrial Energy Technology Conference. March 1993, Houston, Texas.
[9] Linda E. Greer, "Anatomy of a Successful Project," *Environmental Science & Technology*, June 1, 2000.

investment of $3.1-million. Dow estimates the initiative will save the company $5.4-million annually through raw material cost savings and reduced waste treatment costs, for an overall annual rate of return of 180 percent.

The success of Dow at Midland showed that:

- The common belief that cost-effective waste and emission reduction projects did not exist proved false.
- A key barrier to implementing P2 projects is prioritization from engineering and R&D personnel.
- Many P2 projects, while small in terms of capital, have a large impact on waste and emissions and are often overlooked in the capital authorization process.
- Dow engineers were not well recognized for working on small projects.

Closer to home, Dow Chemical Canada has reduced emissions and energy consumption at its Fort Saskatchewan, Alberta facility by eliminating a chlorine liquefaction process.[10] This P2 success story involved making process modifications to allow the chlor-alkali plant to feed its chlorine product directly into the vinyl chloride monomer plant without any intermediate processing. Historically, the chlorine was liquefied and purified prior to use. By eliminating this intermediate step, 1,300 tonnes of liquid chlorine inventory were removed, the source of 10 tonnes per year of fugitive chlorofluorocarbon (CFC) emissions was eliminated, and 29,700 tonnes of CO_2 emissions were avoided due to reduced energy consumption.

3M Company

The 3M company has also had success with pollution prevention. From 1975 to 1999, 3M's 3P—Pollution Prevention Pays—program has prevented 807,000 tons of pollutants and saved the company $827-million.[11] The 3P program depends directly on the voluntary participation of 3M employees. Innovative projects are recognized with 3P awards. A 3P coordinating committee representing the engineering, manufacturing, and laboratory functions, along with the Environment, Health and Safety group, administers the program.

General Industry

In a 1998 paper, Miriam Pye presents 15 case studies across a wide range of industries that have successfully combined P2/E2 technologies and strategies to enhance the environment, productivity, and the bottom line.[12] Improvements were seen through reduced energy and material costs, lower disposal costs, reduced liability, increased sales, improved product quality, and improved working conditions. Cumulatively, these benefits translate into increased shareholder value.

Small Business

Pollution prevention also offers business development opportunities to small business. Amici Enterprises Inc. of Calgary received a 1998 Canadian Council of Ministers of the Environment Pollution Prevention Award for its innovative invention – the Envirowrapper, a reusable, lightweight pallet wrapper. Made of durable polypropylene or polyethylene and fitted with special straps and easy-release buckles, each Envirowrapper can be reused to wrap

[10] Personal communication with Ken Tsang, Dow Chemical Canada Inc., Fort Saskatchewan.
[11] http://www.3m.com/about3m/environment/policies_about3P.jhtml
[12] Miriam Pye, "Case Studies: P2 and E2," *Pollution Prevention Review*, Summer 1998.

pallets for three to five years. In most applications, the wrappers pay for themselves in less than a year. Currently one of the most popular methods of transporting products is by putting them on pallets and then applying plastic stretch wrap to the load to reduce shifting or toppling. The plastic can be used only once; new plastic wrap must be applied each time a pallet is reloaded. When a shipment reaches its destination, the used plastic wrapper is disposed of as waste, or recycled where programs exist. The reusable Envirowrapper provides an effective, reliable and environmentally friendly alternative to stretch wrap for stabilizing and protecting pallet loads. Using the Envirowrapper reduces the amount of plastic stretch wrap being used and disposed of in landfills, or through recycling programs.

Amici also received an Emerald Award for Small Business. The Emerald award is given for demonstrated commitment and/or introduction of products and services to the environment.

Alberta Environment

Governments also have success stories to share. For example, in July 2001, Alberta Environment published a report that summarized some of the key steps that have been taken to reduce pollution from pulp mills and oil sands operations in northern Alberta where industries and municipalities have already implemented a range of pollution prevention initiatives.[13]

4.1 Common Components of Pollution Prevention Plans

Individual P2/CI initiatives vary according to the facility and problem being addressed. Nevertheless, most successful P2/CI initiatives have several common features, such as:

- Commitment from the top of the organization
- Baseline review (review of the current situation)
- Identifying P2 opportunities
- Choosing the most appropriate opportunities
- Setting targets
- Implementation
- Monitoring and review

Appendix D lists a number of the essential and desirable elements of successful P2/CI plans.

[13] See *Pollution Prevention and Control; Industrial Initiatives in Northern Alberta*, available online at http://www3.gov.ab.ca/env/water/nrei/Pollution_Prevention.pdf. This document was published as part of the Northern Rivers Ecosystem Initiative.

5 Proposed Framework for P2/CI

5.1 Role of CASA

Successful implementation of P2/CI is easier to achieve when all potential players agree that P2/CI practices are desirable and try to develop and implement P2/CI initiatives. This section of the report proposes a framework and recommendations for CASA stakeholders to consider on their own and in partnership with others. Pollution prevention and continuous improvement are key elements of CASA's business plan. P2/CI is an opportunity for CASA stakeholders to show leadership on this issue and thus,

1. **The P2/CI Project Team recommends that CASA stakeholders adopt and implement this pollution prevention/continuous improvement framework.**

The CASA structure offers advantages to developing practical P2 /CI initiatives. Project teams can play a role in promoting, developing and implementing P2/CI. Some have already incorporated the concept of pollution prevention/continuous improvement into their work. The Flaring and Venting team and the Vehicle Emissions team are examples. The Particulate Matter and Ozone team advocates P2 with its "Keeping Clean Areas Clean" component. The Electricity project team may also have opportunities to incorporate components of P2/CI into its framework and recommendations.

CASA's airsheds can incorporate P2/CI into their activities too. They often deal with region-specific issues that use a collaborative process. It may be appropriate for them to consider P2 activities as a way of implementing some of their initiatives. Therefore,

2. **The P2/CI Project Team recommends that airshed management zones consider developing pollution prevention/continuous improvement plans.**

5.2 Role of Alberta Environment

Alberta Environment also developed a draft pollution prevention program framework document for implementing a P2 program in the department, and the P2/CI project team provided input to that document (see Appendix G). The document proposes that P2 be used to complement command and control regulatory activities. A P2 program would focus on source reduction, and voluntary initiatives would be encouraged. Implementation strategies would include partnerships with stakeholders, industry associations and Environment Canada, and attention would be given to small and medium-sized industries. The P2/CI project team felt strongly that this framework gives Alberta Environment an opportunity to show leadership on the pollution prevention issue; thus

3. **The P2/CI Project Team recommends that Alberta Environment adopt and implement a framework based on the draft *Approach to Pollution Prevention Initiatives* framework, developed with input from the P2/CI team.**

5.3 Government Policy

Pollution prevention has been an implicit part of environmental protection in Alberta and has been formally incorporated into some policies; one example is the *Industrial Release Limits Policy* published by Alberta Environment in November 2000. "This policy document outlines the approach followed by Alberta Environment staff to develop industrial release limits for approvals under the *Environmental Protection and Enhancement Act.* The policy supports the Alberta government's commitment to sustainable resource and environmental management by outlining how pollution prevention/continuous improvement requirements are established for industrial releases to the environment."[14]

Pollution prevention can be effective, and is the preferred approach for dealing with industries and activities that are not heavily regulated but whose actions may have environmental impacts. Federal, provincial and municipal governments and related institutions can do much to facilitate effective pollution prevention/continuous improvement practices.

In May 2000, Alberta Environment compiled background information that the department could use as it moves to develop a pollution prevention program. The document examines P2 initiatives and issues in Europe and North America, and summarizes the results of interviews and workshops with Alberta Environment staff on the topic of a pollution prevention program.[15] It describes a number of projects now underway and lays out various approaches and benefits to be derived from preventing pollution.

The following are among the many options available to governments:

- Ban or restrict the use of certain substances, as was done with lead in gasoline and with ozone-depleting substances.
- Legislate that P2 be done for their areas of jurisdiction (e.g., The 1999 *Canadian Environmental Protection Act* authorizes the federal minister to require pollution prevention planning and implementation in some circumstances).
- Change legislation, regulation, policy or bylaws that encourage wasteful activity.
- Create a climate that encourages or facilitates the use of P2 or CI; for example:
    - Consider the removal of regulatory barriers (e.g., Some regulations may discourage industrial ecology activities, such as transactions that would send wastes from one facility to be used as inputs at another facility.)
    - Lead by example (e.g., green procurement, energy efficiency)
    - Set up education and outreach programs
    - Consider alternatives to command and control
- Consider P2 requirements in command and control approvals.
- Develop incentive programs to test and encourage P2 activities.
- Encourage or introduce economic instruments such as emissions trading, green taxes, green procurement, and development incentives.

[14] *Industrial Release Limits Policy*. 2000. Alberta Environment. p.1. This document is available online at http://www3.gov.ab.ca/env/protenf/publications/IndlReleaseLimitsPolicyNov00.pdf

[15] This document, entitled *Alberta Environment Pollution Prevention Program Development Background Document*, is available online at http://www3.gov.ab.ca/env/protenf/publications/P2BackgroundDocumentMay00.pdf

5.3.1 Municipal Government

Municipal governments have many opportunities and mechanisms to influence the environmental well-being of their citizens. In May 2001, the Federation of Canadian Municipalities (FCM) adopted the Environmental Issues Policy Statement 2001-2002, which includes direction on the actions that municipalities should take to protect air quality.

The FCM adopted pollution prevention in its statement of principles and includes the declaration that "Pollution prevention is best achieved by taking a systems approach so that water, energy, waste, transportation and building systems are designed to use resources efficiently and to minimize polluting emissions."[16]

Municipalities can do many things to lead by example and demonstrate the environmental, economic and social benefits of pollution prevention and continuous improvement. Examples of opportunity areas for municipal governments include:

- undertaking energy conservation programs in their operations;
- undertaking information and education programs to encourage the public to conserve energy;
- purchasing a portion of municipal electricity from green power sources;
- restricting urban sprawl by using the intensification concept in their urban development plans, thus lowering energy requirements and pollution;
- examining their opportunities to develop community energy systems that could significantly improve energy efficiency and reduce emissions (i.e., district heating);
- examining opportunities to use existing federal and provincial/territorial programs and services to improve energy efficiency;
- promoting transportation modal shift from single occupancy vehicles to public transit, car pooling and human-powered mobility;
- mixing land uses to minimize the need for commuter traffic;
- participating in the FCM's Partners for Climate Protection Program; and
- supporting the federal government's commitment to the Kyoto target.

5.4 Incentives and Recognition

Governments, industries and employers can all create situations that encourage pollution prevention activities. Examples include:

- Government incentives to industry (e.g., Alberta Environment's LEAD pilot program, Environment Canada's proposed Environmental Leaders Program, British Columbia's P2 pilot, Ontario's P4 program and cooperative agreements, CCME's P2 Awards)
- Employer incentives for employees (e.g., provide bus passes, encourage car pooling)
- Industry incentives to customers (e.g., utility company rebates for energy efficiency, promoting energy saving devices, promoting environmentally friendly products that incorporate P2 strategies)

Government incentives can be in the form of subsidies, or they can emphasize modifications in an approval or reporting process (e.g., facility-wide limits on emissions rather than

[16] FCM Environmental Issues Policy Statement, adopted May 2001 at the FCM annual conference; available online at www.fcm.ca/english/national/envirol.htm.

focussing on each process), or change the frequency of reporting. Usually the facility involved would be expected to improve its environmental performance in return for some flexibility in operating practices or reduced reporting requirements. Governments can also remove regulatory barriers to facilitate P2 or CI practices (e.g., possible impediments to eco-industrial activities).

Employer incentives that influence transportation choice can reduce vehicle emissions. Training is another way to influence environmental performance. It will obviously affect how employees carry out their work and can have beneficial effects away from the workplace.

Industry incentives to customers also have significant potential to prevent pollution.

5.5 Small and Medium-Sized Enterprises (SMEs)

Many sectors include a variety of relatively small companies that, collectively, create considerable pollution. Often, their activities are not heavily regulated and the small size of these companies makes it difficult for them to devote significant resources to P2 activities. In such cases, government outreach and education with information or fact sheets may be appropriate. Industry associations and other organizations such as Chambers of Commerce can assist their members by organizing or sponsoring education or training sessions as well as other education and outreach activities. (See section 5.8 for more details on education and outreach.) Various print resources aimed at SMEs are also available.[17]

5.6 Industrial Ecology

The industrial ecology approach to development promotes a shift from separate, linear systems to an integrated, interacting network of manufacturing systems similar to those found in nature. Through a holistic view of industrial systems, industrial ecology clusters facilities to maximize energy efficiency and resource use, minimize pollution, and eliminate waste. Eco-industrial parks are located and designed to take advantage of the outputs of adjacent operations and facilities, turning their wastes into raw materials for other processes. Specific environmental benefits of the eco-industrial approach include reduced greenhouse gas emissions, reduced air emissions and improved community health, promotion of pollution prevention and the 4 Rs (Reduce, Reuse, Recycle, Recover), improved resource conservation, promotion of green technology development, increased environmental awareness, and regeneration of green space. Thus,

4. **The P2/CI Project Team recommends that the Alberta government promote and advance industrial ecology as the new mode of industrial development in the province by supporting and/or participating in a world summit on industrial ecology in Alberta.**

5. **The P2/CI Project Team recommends that CASA members support and participate in a world summit related to industrial ecology in Alberta.**

[17] See, for example, D. Ramey, D. Sanders and J. Veenstra. "P2 Self-Assessment: A Sensible Approach for Small Businesses," *Pollution Prevention Review*, Summer 1999; and Texas Natural Resource Conservation Commission. *A Guide to Pollution Prevention for Small Businesses*, June 1998

5.7 General Public

Pollution has long been regarded by most members of the public as something that industries and big companies do and for which they should be held responsible. But the reality is that everyone contributes to the pollution burden and each person can also help to lighten that burden by practising pollution prevention. For this to happen, people need to change the way they think about pollution, about the products they purchase and use, and about their own behaviour. Things as simple as minimizing or avoiding the use of house and garden chemicals, choosing more energy-efficient methods of transportation, and turning down the thermostat all help to prevent pollution. Most of us want to do the right thing for the environment, which makes education and outreach about pollution prevention so important.[18]

5.8 Education and Outreach

This framework includes a particular focus on education and outreach activities because the project team recognized that a sound foundation of knowledge is the first step in overcoming barriers to implementing P2/CI programs. Although many education and outreach programs are available in Alberta and often contain a P2 component, few of them explicitly describe their activities or messages as pollution prevention or continuous improvement. Numerous formal education programs include P2 issues but are often not described as such. Some industry associations offer specific P2/CI training, but there is a lack of general information for industry as well as for small and medium-sized enterprises.

Education and outreach can inform businesses and the public about P2/CI practices and about programs that can help them incorporate P2/CI into their practices. There may also be opportunities to incorporate P2/CI messages into programs sponsored by a range of organizations and agencies. This section of the framework identifies potential delivery mechanisms and makes a series of recommendations that could enhance development and delivery of P2/CI education and outreach to Albertans.

5.8.1 CASA

CASA should not be expected to develop or deliver education or outreach programs. Nevertheless, project teams could address this topic in their work and recommend if it should be undertaken and then suggest who delivers the project or program and to what audience.

5.8.2 Governments

Governments deliver some education and outreach programs now and could deliver more.

The federal government should continue to deliver several existing programs and promote them more extensively. Environment Canada already does an excellent job of providing extensive information for those who might be legally required to undertake P2 planning. Natural Resources Canada also provides information for specific initiatives (e.g., residential wood combustion) and on more general topics such as energy efficiency.

[18] See the P24U website, geared exclusively to individuals and actions they can take to prevent pollution; http://pprc.org/pprc/p24u.html.

Municipal governments can also undertake P2/CI education and outreach. Their involvement and leadership in waste management, greenhouse gas emissions reduction, and other environmental issues means they can play an important role in informing the public and businesses connected with these issues.

The Alberta government has played a valuable role in P2/CI education and outreach in areas such as waste reduction. Its materials for schools have been well received and are widely used in provincial classrooms. Several of the education and outreach recommendations below were developed specifically for Alberta Environment.

5.8.3 Large Companies

Large companies can play a role in P2/CI education and outreach. Many of them are involved in public consultation as part of their operations. They may also be in a position to incorporate P2/CI as part of employee training. The motivation can be civic duty, employee wellness and cost savings.

5.8.4 Industry Associations

Industry associations can play an important role in education and outreach to their members. They can be especially effective in sectors with many small companies that, together, create significant pollution but lack the necessary resources to undertake their own P2/CI education programs. Industry associations may develop best practices manuals and environmental operating manuals, and can serve as a clearinghouse for P2 information or success stories. They can promote industry-wide stewardship initiatives such as Responsible Care in the chemical industry and Forest Care in the forest industry. They could also include P2/CI topics in industry conferences and workshops and discuss P2/CI issues in newsletters.

5.8.5 Non-Government Organizations

Various non-government organizations provide environmental education in Alberta; many of these are included in the inventory that was prepared for the P2/CI team.[19] They should continue this work and consider including explicit messages about P2/CI wherever possible.

[19] The *Inventory of Pollution Prevention and Continuous Improvement Public Education and Outreach Programs Available in Alberta* is available on the CASA website at http://www.casahome.org/uploads/PPCI_inventoryofP2CIprogramsinABMAR-2002.pdf

5.8.6 Education and Outreach Recommendations

The P2/CI Project Team envisions important roles in pollution education and outreach for several sectors, and therefore

6. **The P2/CI Project Team recommends that Alberta Environment incorporate pollution prevention/continuous improvement messages into materials it updates and into new environmental education documents.**
7. **The P2/CI Project Team recommends that Alberta Environment encourage and assist others to incorporate pollution prevention/ continuous improvement messages into their materials.**
8. **The P2/CI Project Team recommends that Alberta Environment initiate a pollution prevention/continuous improvement outreach program to industry, with particular emphasis on small and medium-sized enterprises.**
9. **The P2/CI Project Team recommends that utilities take advantage of opportunities for public education and outreach by including a pollution prevention/continuous improvement message with their bills.**
10. **The P2/CI Project Team recommends that the CASA secretariat and Alberta Environment seek opportunities to disseminate pollution prevention/ continuous improvement messages through their print and electronic communications vehicles. They should start by posting the Pollution Prevention Education and Outreach Inventory prepared for the P2/CI Project Team on their websites and establishing links to pollution prevention award websites.**

5.9 Sector Specific Proposals

The Criteria Air Contaminants Inventory[20] and the National Pollutant Release Inventory (NPRI)[21] were used to identify the most significant pollutants released into the air and to identify the economic sectors that produced those emissions. The project team identified six sectors that were among the top five polluters by volume in Alberta for at least one of the pollutants in Appendix H. Table 1 summarizes the major pollutants by sector. Significant amounts of greenhouse gases are also emitted by all except the residential wood combustion and the downstream oil and gas and petrochemicals sectors. P2/CI activities have the potential to contribute to significant emission reductions from these sectors:

- Electric power generation
- Transportation
- Residential wood combustion
- Oil sands and heavy oil
- Upstream oil and gas
- Downstream oil and gas and petrochemicals

[20] *Criteria Air Contaminant Emission Summaries.* Environment Canada. Available online at www.ec.gc.ca/pdb/ape/cape_home_e.cfm.
[21] *National Pollutant Release Inventory*. Environment Canada. Available online at www.ec.gc.ca/pdb/npri/npri_home_e.cfm.

Table 1. Summary of Major Pollutants from Six Key Sectors

Sector	Major Pollutants
Electric power generation	PM, PM_{10}, $PM_{2.5}$, SOx, NOx, CO, fluorine, hydrochloric acid, hydrogen fluoride
Transportation	SOx, NOx, VOC, CO
Residential wood combustion	PM_{10}, $PM_{2.5}$, VOC, CO
Oil sands and heavy oil	SOx, NOx, ammonia, ethylene, toluene, sulphuric acid, hydrogen sulphide, xylene
Upstream oil and gas	SOx, NOx, VOC, CO, carbon disulphide, hydrogen sulphide, sulphuric acid
Downstream oil and gas and petrochemicals	SOx, NOx, ethylene, ethylene glycol, methanol, HCFC-142b, methyl ethyl ketone, vinyl acetate

The team focused on these sectors as well as two others: hospitals and renewable energy. Recommendations were developed for all eight of these sectors.

5.9.1 Hospitals

Hospitals, like many other institutions, offer a range of pollution prevention opportunities. The Cambridge Memorial Hospital (CMH) in southern Ontario, the institutional winner of the CCME's P2 award for 2002, is a good example of what hospitals can do to prevent pollution. CMH was the first hospital in North America to receive ISO 14001 certification and has successfully implemented a variety of pollution prevention initiatives that have also saved the hospital money. Examples include eliminating the use of mercury thermometers; eliminating the use of hazardous chemicals, including pesticides and herbicides; shutting down the on-site biomedical waste incinerator and treating such waste off-site at a state of the art facility; adopting a wide range of energy efficiency measures; and making energy conservation part of a new purchasing policy. The P2/CI project team believes that hospitals could be an important contributor to pollution prevention in this province and, therefore

11. The P2/CI Project Team recommends that Alberta hospitals consider developing and implementing pollution prevention and continuous improvement programs as part of their environmental management systems.

5.9.2 Renewable Energy

The P2/CI Project Team sees a major role for renewable energy in pollution prevention. Renewable energy markets in Canada are presently limited due to low demand, high costs and marginal economics. Nevertheless, low-impact renewable energy technologies contribute to improved air quality and lower greenhouse gas emissions. Since December 2000, the Clean Air Renewable Energy Coalition has been urging the federal government to support fiscal tax incentives for the advancement of renewable energy. The coalition has identified specific market mechanisms to increase the demand for green power on the consumer side and to provide financial incentives on the supply side to allow producers to invest in renewable energy projects on a more competitive basis with fossil fuel generation.

12. The P2/CI Project Team recommends that CASA's Electricity Project Team address renewable energy as part of its task to identify, assess and develop emissions management options and mixtures of options.

Examples include:

- Consumer green energy credits
- Other economic instruments

5.9.3 Electric Power Generation

Electricity generation is a significant source of air emissions in Alberta. As a sector, it accounts for around 20% of the province's SO_2 emissions and about 30% of its greenhouse gas emissions. Other significant pollutants include PM_{10}, $PM_{2.5}$, nitrogen oxides, carbon monoxide, hydrochloric acid, fluorine and hydrogen fluoride. Most of these emissions are the result of using fossil fuels to produce power. Coal-fired power plants produce a significant amount of Alberta's electricity. The burning of coal also creates mercury emissions, but these emissions are not yet regulated, and monitoring and reporting on them has only been required since 2001. In response to a request from the Alberta government, CASA has established a multi-stakeholder project team to develop an air emissions management approach, including standards and performance expectations, for the Alberta electricity sector. This is an opportunity to consider pollution prevention and continuous improvement approaches in a major Alberta sector. Therefore,

13. The P2/CI Project Team recommends that CASA's Electricity Project Team consider P2/CI in the development of its management approach for that sector.

Examples include:

- Fuel switching
- Demand side management
- Micro turbines
- Generation efficiency
- Control improvements

5.9.3.1 Co-generation

There is considerable potential to reduce the need for single-purpose electricity generation by co-generating electricity from existing and proposed projects, including those in the oil, gas, oil sands, heavy oil, refining and petrochemical sectors. Co-generation is typically about 70% efficient, compared with a much lower energy use efficiency for dedicated generation facilities. For each unit of electricity that is co-generated from heat energy, a corresponding unit of power from a single-purpose source is eliminated, thus reducing emissions. Therefore,

14. The P2/CI Project Team recommends that CASA's Electricity Project Team consider opportunities for co-generation as part of its overall approach to managing emissions from the electricity sector.

5.9.4 Transportation

Like the power generation sector, transportation relies heavily on fossil fuels and thus there are similarities in the types of emissions produced. In addition to SOx, NOx and carbon monoxide, this sector is also a major source of volatile organic compounds and greenhouse gases. Transportation includes light and heavy duty diesel- and gasoline-powered vehicles, as well as air and rail. The strategies for preventing pollution and ensuring continuous improvement are different for this sector than for many others because of the nature of the sources. Some federal initiatives such as better emissions controls on automobiles have shown good results and continued upgrades should be encouraged. In Alberta, the CASA Vehicle Emissions team is doing a lot of good P2/CI work already. Among their initiatives are the vehicle scrappage program in Calgary aimed at getting older vehicles off the road, their joint sponsorship with Environment Canada of vehicle inspection clinics, and ongoing education efforts with other partners to reduce emissions and enhance fuel efficiency. The Vehicle Emissions team is to be commended for its work, and encouraged to continue these efforts.

15. The P2/CI Project Team recommends that the CASA Vehicle Emissions Team include P2/CI in its future activities.

Examples include:

- Alternative modes (transit, telecommuting, cycling)
- Fuel formulation and alternative fuels
- Driver education for fuel efficiency
- Vehicle efficiency/vehicle choice
- Maintenance and operation
- New technology vehicles (LEV, zero emissions)

5.9.5 Residential Wood Combustion

Residential fuel wood combustion is a significant source of volatile organic compounds, carbon monoxide and particulate matter. CASA's Multi-Stakeholder Group on PM and Ozone confirmed in its 1999 work that residential wood burning is a major source of emissions of criteria air contaminants, including PM_{10}, $PM_{2.5}$, VOC, and CO. Natural Resources Canada is leading the joint initial actions under the Canada-Wide Standards process to reduce emissions from this sector. These efforts are encouraging higher efficiency-lower emission wood heating through technology (standards for new wood burning appliances) and through education (series of workshops across Canada to promote clean burning) directed at the end user. The educational messages focus on safety and health as well as reducing air pollution, and fact sheets address topics like storage of wood, how to start a fire and what to burn. The Burn-It Smart initiative can be accessed online at www.burnitsmart.org. Extending the reach of NRCan's program could reduce emissions from this source and therefore,

16. The P2/CI Project Team recommends that Alberta Environment and Environment Canada work with Natural Resources Canada to promote Natural Resources Canada's residential wood combustion initiatives.

5.9.6 Oil Sands and Heavy Oil

Oil sands and heavy oil developments have proceeded rapidly in northern Alberta in the last decade, with much of the activity concentrated in the Fort McMurray area. In addition to greenhouse gases, pollutants from the oil sands sector include SOx, NOx, ammonia, ethylene, toluene, xylene, sulphuric acid, and hydrogen sulphide. Stakeholders have recognized the need to be cognizant of the cumulative effects of developments in the area, and have formed the Cumulative Effects Management Association to consider air emissions as well as other environmental impacts. The P2/CI team believes that this association is in a good position to advance pollution prevention/continuous improvement work for the oil sands and heavy oil sector. Therefore,

17. The P2/CI Project Team recommends that the Cumulative Effects Management Association (CEMA) incorporate P2/CI actions and strategies into their emissions management framework.

Examples include:

- Fleet maintenance
- Operation and process change
- Co-generation opportunities
- Supply chain criteria
- Demand side management
- Pollution technology controls
- Best management practices
- Eco-industrial synergies

5.9.7 Upstream Oil and Gas

The upstream oil and gas sector has been a major engine of the Alberta economy for decades. It is also one of the major sources of a wide range of emissions, including greenhouse gases, SOx, NOx, VOC, CO, carbon disulphide, hydrogen sulphide and sulphuric acid. Considerable progress has been made in the application of new technology and upgrades to older facilities, with a recent example of success being the substantial reduction in solution gas flaring to about 50 percent of 1996 levels. However, the diversity in activities and the number of facilities keep this sector among the top five sources of many atmospheric pollutants in Alberta. A range of strategies is needed to prevent pollution and ensure continuous improvement in the upstream oil and gas sector and the P2/CI team believes that industry associations are well-positioned to lead in developing these strategies. Therefore,

18. The P2/CI Project Team recommends that the Canadian Association of Petroleum Producers (CAPP) and the Small Explorers and Producers Association of Canada (SEPAC) develop and promote P2/CI programs.

Examples include:

- Reduction and elimination of flaring and venting
- Fleet maintenance and operation
- Waste management plans
- Low NOx burners
- Leak detection programs (operations and maintenance)

- SO_2 controls
- Best management practices
- Eco-industrial synergies

5.9.8 Downstream Oil and Gas and Petrochemicals

The downstream oil and gas and petrochemicals sector has a strong presence in Alberta. For reporting purposes, it includes petroleum refineries and the chemical industry, which makes the types of emissions different from those of sectors mentioned above. The pollutants of note from this sector include SOx, NOx, methanol, ethylene, ethylene glycol, vinyl acetate, methyl ethyl ketone, and HCFC-142b. Again, the project team is of the view that industry associations are in a position to help this sector prevent pollution and identify cost-effective continuous improvement opportunities. Therefore,

19. The P2/CI Project Team recommends that the Canadian Petroleum Products Institute (CPPI) and the Canadian Chemical Producers Association (CCPA) develop and promote P2/CI programs that will reduce emissions.

Examples include:

- Fleet maintenance
- Product change (e.g., low sulphur fuels)
- Operations and process changes
- On-site reuse and recycling
- Equipment change
- Leak detection and repair
- Improved pollution control equipment
- Best management practices
- Eco-industrial synergies
- Reduced flaring and venting

6 Conclusion of the Project Team's Work

Pollution prevention is recognized as an encompassing theme of CASA, transcending topic and sector boundaries to become, in essence, the ultimate goal. It is essential to consider pollution prevention strategies during the conceptual phase of any industrial process or activity. The knowledge gained at this point drives research that will lead to the development of new technologies that reduce or eliminate pollution.

Although the industrial complex has a substantial impact on air quality, the activities of individuals are also important. With the submission of this report and 20 recommendations, the P2/CI Project Team has completed its work and is confident that these recommendations will enhance and promote P2/CI initiatives in all sectors throughout Alberta. Implementation will be important, and therefore

20. The P2/CI Project Team recommends that the CASA board review and report on progress on implementation of these recommendations by June 2004.

Appendix A. Strategic Planning Framework

Key Focus Area: **Pollution Prevention/Continuous Improvement (PP/CI)**

Issue: *Clean air is a valuable resource and should be protected.*
Opportunity: *Continuously improve air quality by minimizing the use of polluting processes, practices, materials, and products.*

Goals	Objectives	Potential Opportunities	Current Initiatives
1. A working environment in which Pollution Prevention/ Continuous Improvement is used to protect air quality. 2. Public contributes to pollution prevention by making clean air friendly choices.	• Identify and recommend cost-effective reduction opportunities. • Encourage innovative reduction opportunities in all sectors. • Establish system of incentives for PP/CI. • Promote development and implementation of strategies to reduce fossil fuel consumption. • Increase public's understanding of its role in contributing to air pollution and its ability to reduce air pollution.	1. Develop and promote emission reduction strategies for major sources. 2. Ensure development of improved emissions inventories. 3. Promote/encourage the use of alternative fuels/renewable energy. 4. Use PP/CI approaches to reduce ecological footprint and consumption of fossil fuels. 5. Promote less polluting technologies and uses of fossil fuels (e.g., re-injection). 6. Review and propose use of emissions credits/trading. 7. Develop guidelines, codes of practices that enable emitters to implement PP/CI. 8. Develop mechanism to benchmark, measure and report PP activities. 9. Encourage PP/CI performance targets for all sectors and zones. 10. Recognize and promote successful PP/CI incentives and initiatives. 11. Promote development of alternate energy technologies and export them to the developing world. 12. Develop PP/CI education and training programs.	• Flaring Project Team • Vehicle Emissions • Climate Change • SO_2 (Enhanced Performance Subgroup) • CASA Communications Strategy (Clean Air Views, Clean Air Week, AEP's State of Environment Report, etc.)

Appendix B. CASA Pollution Prevention/Continuous Improvement Project Team

Charleen Currie	Strathcona County
Rod Frith	Environment Canada
Mark Harries	TransAlta Corporation
Martin Holysh	Suncor Energy
Gray Jones	Western Canada Wilderness Committee
Myles Kitagawa	Toxics Watch Society of Alberta
Martha Kostuch	Prairie Acid Rain Coalition
Bryan Lane	Mount Royal College
Christine Macken	Clean Air Strategic Alliance
Stan McBride	Nexen Canada Limited
Kevin McLeod	Alberta Health and Wellness
George Murphy	Alberta Environment
Henry Pirker	South Peace Environmental Association
Tim Taylor	Petro-Canada
Ken Tsang	Dow Chemical Canada Inc.
Larry Wall	Alberta Industrial Heartland Association
Andrea Walter	Petro-Canada
Scott Wilson	Alberta Motor Association
Doug Younie	Alberta Environment

Corresponding Member:

Gord Lambert	Suncor Energy Inc.

Former Team Members:

Kim Johnson	Shell/CPPI
Neil Shelly	Alberta Forest Products Association

Appendix C. Pollution Prevention/Continuous Improvement Project Team Terms of Reference

Membership
The project team will be composed of representatives from the following sectors:

- Industry
- Government
- Public/Consumers
- Labour
- Environment and Health Non-Government Organizations
- Transportation
- Agriculture
- Construction Industry/Environmental Design Sector
- Research/Technology Development Sector

Goal
To make recommendations to CASA for actions that, when implemented, will achieve:

- A working environment in which Pollution Prevention/Continuous Improvement is used to protect air quality
- The public contributes to pollution prevention by making clean air friendly choices

Objectives
1. Develop and promote emission reduction strategies for major sources
2. Recommend PP/CI tools that are user friendly and can be implemented to achieve source reductions
3. Provide support and direction to CASA project teams
4. Identify and recommend cost-effective reduction opportunities
5. Encourage innovative reduction opportunities for all sectors and/or zones
6. Establish system of incentives for PP/CI
7. Expand the range of cost-effective options for environmental decision-making
8. Promote and encourage the use of alternative fuels/renewable energy
9. Encourage the use and application of by-product synergies and industrial ecology

Tasks
a) Identify PP/CI initiatives being undertaken elsewhere
b) Identify opportunities for collaboration/synergy with existing initiatives
c) Identify and evaluate PP/CI tools
d) Conduct gaps analysis and make recommendations to fill gaps
e) Identify and evaluate reduction opportunities in all sectors and/or zones
f) Identify and evaluate incentives for PP/CI
g) Identify opportunities to promote the use of alternative fuels/renewable energy
h) Establish links and promote synergies with CASA project teams
i) Encourage recognition and sharing of success stories

j) Identify PP/CI education and outreach initiatives
k) Identify resources required to complete/implement terms of reference
l) Report to CASA Board on progress
m) Prepare final report and recommendations, including implementation plan

Time Lines
Secure participation on project team - March/April 2000
Develop work plan - June 2000
Undertake tasks identified in work plan - June 2000-March/April 2001
Develop draft recommendations - April-June 2001
Report to CASA Board - Summer/Fall 2001

Appendix D. Pollution Prevention/Continuous Improvement Success Factors

Essential Elements

- Projects must exceed current compliance objectives
- Projects must result in measurable decreases in waste, emissions, etc.
- Be entered into voluntarily by both partners (i.e., government and company)
- Drivers needed inside and outside an industry or company
  - Inside – need support of senior management as champions and change advocates
  - Outside – industry associations, regulatory groups, trade councils, community and environmental groups, and government as change advocates
- Requires a shift in corporate culture to perspective that "P2 opportunities exist and are good for business"
- Measurable goals and deadlines for meeting goals
- Agreed upon baseline data to set priorities, goals and targets
- Transparent tracking and reporting mechanisms to track progress and report results
- Full cost accounting system to incorporate the cost of storage, handling, treatment and disposal of waste, and costs associated with risk, liability, and risk avoidance
- A formal environmental review carried out on the company's site/operations including inputs, outputs, processes, emissions and wastes
- Retention of the permitting/regulatory regime
- In large companies, involvement of business units and line departments
- Education and training in P2 processes, techniques, models, etc.
- For major initiatives, community/public input on identifying P2 issues and opportunities, priorities, goals and deadlines
- Government involvement in P2 planning and monitoring of initiatives so as to protect the integrity of the overall process
- Periodic performance review by company or qualified consultant
- Public reporting of progress and environmental performance

Desirable Elements

- Partnership approach – industry, public/NGO and governments
- Integration with other environmental management tools, such as ISO models
- Stakeholder consultation/participation in projects
- Positive economic return/decrease in costs
- Pro-active initiative (as opposed to enforced change)
- System of incentives (government support, award programs, tax credits)
- No regulatory barriers to implementation
- No confidentiality barriers
- Involvement of outside P2 expert
- Measurement process should be subject to audits by qualified third parties
- Group facilitator

Appendix E. Sample Pollution Prevention Initiatives Undertaken in the United States

April 2001

Colorado

(**http://www.coloradop2.org/cop2p.htm**)
One component of Colorado's P2 program is its **Pollution Prevention Partnership** (P3) (see http://www.coloradop2.org/p3a.htm). The partnership includes some large companies (e.g., Coors, Lucent Technologies, Samsonite), federal, state and municipal government agencies, and some non-government groups (e.g., League of Women Voters.) Part of the Colorado web site is dedicated to partnership activities. There is a forum for information exchange. Members of the partnership put their P2 plans on the web site. Comments other partners make about the member's plans are included. Accomplishments are also listed.

Florida

(**http://www.dep.state.fl.us/dwm/programs/p2/default.htm**)
Florida's technical assistance to businesses includes on-site visits and advice if requested. This component is usually delivered through a **Retired Engineers Program** (http://www.dep.state.fl.us/dwm/programs/p2/engineers.htm). Retired engineers and plant managers are a pool of expertise that can be called on as needed.

Kentucky

(**http://www.nr.state.ky.us/nrepc/dep/waste/dwm%5Freview/programs/p2/ppdivisi.htm**)
Kentucky set a goal to reduce the weight of regulated hazardous waste and toxic chemicals. P2 was the preferred approach and some incentive programs were set up to encourage P2.

Kentucky's **Environmental Leadership Program (**http://www.lrc.state.ky.us/KRS/224-46/335.PDF**)** provides incentives for good performers. Elements of the program could include

- accelerated review of permits and applications
- reduced frequency of monitoring or reporting by a facility
- consolidating a facility's requirements into one permit
- reduced fees for hazardous waste generation or for permits
- access to an ombudsman to assist in cutting red tape
- offset of voluntary actions against future regulatory requirements.

Kentucky has also established a **Center for Pollution Prevention** (http://www.kppc.org/htm) to facilitate commercial implementation of P2 technologies and to provide technical and financial assistance to business and industry. The Board of Directors is appointed by the Governor and includes representatives from universities, industry, environmental groups, agriculture and municipalities. The board reviews and authorizes P2 projects and programs. Examples include:

- on-site assessments
- industrial materials exchange
- EMS Alliance (companies share their experiences about how to develop an EMS)
- Wood Waste Alliance (reduce amount of waste going to landfills)
- technical manuals

Massachusetts

(**http://www.state.ma.us/ota/ota.htm**)
Massachusetts set a goal to reduce toxic waste by 50% of 1989 levels. Toxics use reduction is the desired way to achieve this. The *Toxic Use Reduction Act* provides the framework. It requires "large quantity toxics users" to inventory chemicals flowing in and out of each production process at a facility and to develop a toxics use reduction plan for each production process. (This is a "self-help exercise, expecting that facilities will identify possibilities to reduce pollution and reduce costs.)

The Act established:

- An Office of Technical Assistance within the environment department. It does outreach or educational work targeting specific sectors (e.g., health card, auto body, environmentally preferable purchasing).
- A *Toxics Use Reduction Institute* at the University of Lowell (http://www.turi.org.) The institute undertakes training sessions for toxics users, toxics use reduction planners (a planner must certify the plans that facilities develop) and government regulators. It also undertakes research and demonstrates reduction methods.

A Science Advisory Council prepared a list of "more hazardous", "less hazardous" and "uncategorized" substances to assist facilities considering chemical substitution as part of their toxics use reduction.

Michigan

(**http://www.deq.state.mi.us/ead/p2sect**)
Michigan has several P2 efforts under way. It entered into a voluntary partnership with the big three automakers. The **Michigan Automotive Pollution Prevention Project (**http://www.deq.state.mi.us/ead/p2sect/auto**)** is a commitment to reduce pollution during vehicle manufacturing and assembly. The companies will focus on reducing the use, generation and release of persistent toxic substances and other materials of concern. They commit to producing at least 12 case studies per year. Another objective is to influence suppliers to practice P2. The big three also agree to work with the State to exchange non-proprietary technologies with suppliers and others and to support collaborative research into clean production.

The State has a program aimed at **Regulatory Integration of Pollution Prevention (**http://www.deq.state.mi.us/ead/p2sect/reginteg/regintp2.html**).** The goal is to integrate voluntary P2 into regulatory policies and programs. Staff received training on integrating P2 into permitting, inspections and enforcement and on how to assess P2 assistance. Other activities include multi-media permits, multi-media compliance inspections, consideration of P2 efforts in enforcement settlements and including P2 language in administrative rules and legislation.

The State also has an **Environmentally Preferred Purchasing** program (http://www.deq.state.mi.us/ead/p2sect/epp/) whereby State agencies purchase products that impact the environment less than competing products. It considers characteristics of the products such as raw materials, production processes, manufacturing, packaging, distribution, reuse, operation and maintenance and disposal.

Minnesota

(**http://www.moea.state.mn.us**)
Minnesota has technical assistance programs similar to those in other jurisdictions. It also requires P2 plans from facilities that are subject to TRI or Minnesota's environmental auditing program. Those facilities must also submit annual progress reports about achieving P2 objectives for each chemical. The plans are not binding or enforceable but are expected to challenge facilities to improve their environmental performance.

The Office of Environmental Assistance must present a **Pollution Prevention Evaluation Report (**http://www.moea.state.mn.us/berc/p2evaluation2000.cfm**)** to the legislature every two years. The report for 2000 discussed trends, identified progress, summarized programs and presented strategies for the next several years. The strategies are to:

- Work with stakeholders to determine priorities and programs
- Work with federal and State agencies (e.g., health) to develop a priority chemical list for reduction
- Work with manufacturers, retailers and recyclers to establish and implement voluntary stewardship programs
- Seek State commitment for environmentally responsible purchasing

Some economic instruments are being considered. One is a revolving fund that would provide low interest loans to implement proven P2 technology. A second is the possibility of tax incentives such as tax credits for purchasing P2 equipment or exemptions from sales taxes.

New Jersey

(**http://www.state.nj.us/dep/opppc/main**)
P2 planning is required from facilities that report to the Toxics Release Inventory. Substantial information and guidance is available to the facilities.
(http://www.state.nj.us/dep/opppc/planning/ppp.htm)

New Jersey institutes a **Silver and Gold Track Program for Environmental Performance** (http://www.state.nj.us/dep/opppc/silver.htm) Good recent environmental performance is the main criterion for acceptance. Silver Track offers incentives and recognition to encourage facilities to improve their environmental performance. Silver Track II requires participants to also achieve verifiable greenhouse gas reductions. Gold Track (being implemented as a pilot in 2001) requires participants to also have an environmental management system and a community outreach program in place before participating. Gold track participants will be required to:

- Achieve greenhouse gas emission reductions
- Achieve criteria and hazardous air pollutant emission reductions over time
- Commit to enhanced handling, storage and treatment of hazardous waste
- Reduce potable or groundwater use
- Reduce quantity of TRI chemicals discharged
- Incorporate enhanced P2 and/or source reduction in day to day operations

Participants will be eligible for greater multi-media operational and regulatory flexibility such as facility wide emissions caps or reductions in the frequency of monitoring

Texas

(**http://www.tnrcc.state.tx.us/exec/sbea/p2tech.html**)
Texas requires five year Source Reduction and Waste Minimization Plans from facilities that report to the Toxic Release Inventory or exceed thresholds for hazardous waste. Some "large quantity generators" may be required to provide annual progress reports. The government provides guidance documents for small quantity generators to use. Facilities are not required to file the actual plans with the TRNCC. They file an Executive Summary and a certificate of completeness and correctness and must produce the plan if there is a site inspection.

Texas also has a **Regulatory Flexibility Program** (http://www.tnrcc.state.tx.us/admin/topdoc/rg/335.pdf) that allows operators of facilities to apply for exemptions from specific statutes or environmental rules. The intent is to reduce red tape, reward good environmental performers and encourage innovative and improved environmental practices. The applicant must describe how the proposed alternative would provide at least an equal level of environmental protection as the status quo. Transfers of pollutants from one medium to another are not discouraged, but the applicant must indicate how there would be a net benefit. Public notification and stakeholder consensus are conditions. The bureaucratic review to determine if the alternative would be at least as protective as the status quo considers many characteristics of pollution prevention such as more efficient use of raw materials and energy, identification of source reduction and stewardship opportunities and employee training.

Other

Several other states have P2 programs with initiatives similar to those mentions above. Those states include:

- Arizona (http://www.adeq.state.az.us/environ/waste/capdev/p2/index.htm)
- Illinois (http://www.epa.state.il.us/p2)
- Ohio (http://www.epa.state.oh.us/opp/)
- Oregon (http://www.deq.state.or.us/programs/p2/p2.htm)
- Pennsylvania (http://www.dep.state.pa.us/dep/deputate/pollprev/pollution_prevention.htm)
- Washington (http://www.ecy.wa.gov/programs/hwtr/p2/index.html)

Appendix F. Potential P2/CI Tools and Strategies

I. LEGISLATIVE

A. Regulatory backstop
B. Mandated P2 plans
C. Economic instruments
D. Tax incentives for good performers
E. Preferential tax treatment for companies that pursue P2
F. Emissions trading
G. Green procurement
H. Liabilities for senior executives
I. Review of licences
J. Approval conditions to implement P2

A. Regulatory backstop

P2 is not and will not become the only kind of environmental management. Legislation, guidelines and consequences for not achieving levels of environmental performance will still be in place.

B. Mandated P2 plans

Government legislation or policy may require companies to develop and implement P2 plans. Provisions in the *Canadian Environmental Protection Act (*CEPA) give the federal Minister the authority to require P2 plans for some industry sectors or for companies that use or produce specified toxic substances. Some jurisdictions in the U.S. require P2 plans. Usually those mandated plans are for substances that are listed in the Toxics Reduction Inventory or that fall under a State's definition of hazardous substance.

C. Economic instruments

Economic instruments are policy tools that attempt to improve the environment by explicitly affecting private costs and benefits. They include public expenditure instruments (grants, subsidies, tax allowances) revenue generating instruments (taxes, fees, charges) and budget-neutral instruments (deposits and refunds, distributive credits).

D. Tax incentives for good performers

E. Preferential tax treatment for companies that pursue P2

F. Emissions trading

Emissions trading attempts to reduce total emissions in a region by allowing facilities to trade part of their allowable emissions to another facility. The expectation is that companies will thus be encouraged to find ways to use less than their total allowable emissions and sell part of the allowable limit to other companies.

G. Green procurement

Green procurement considers environmental concerns, along with price and performance, as factors in purchasing decisions. The expectation is that the products purchased under a green procurement policy will have fewer negative effects on human health and the environment when compared with other products available for the same purpose.

H. Liabilities for senior executives

This type of strategy entails legislation that makes company executives personally liable for damages that a company's actions may cause.

I. Review of licences

J. Approval conditions to implement P2

Updating and renewal of approvals and permits provides opportunities to make P2 a requirement or condition of the approval. If alternative or innovative approaches are a possibility for "good performers," P2 may be already part of the "good performance."

II. VOLUNTARY INITIATIVES AND PARTNERSHIPS

A. Voluntary initiatives
B. Personal P2 plans
C. Codes of practice
D. Partnerships
E. Partnerships
F. Industry stewardship initiatives

A. Voluntary initiatives

These are initiatives that are not mandated by law. Some are broad-based (e.g., ARET, Voluntary Challenge Program) while others are sector specific (e.g., Responsible Care, Forest Care). Characteristics of the initiatives vary widely with some having features such as independent audits or verification of results.

B. Personal P2 plans

C. Codes of practice

Codes of practice are usually developed by industry groups. They set out a list of activities, procedures and/or reporting procedures that companies agree to follow, usually with the intent to be environmentally responsible.

D. Partnerships

Different groups often work together to achieve an environmental goal. Various combinations of NGOs, industry and government are possible. The partnership may be specific to a topic or issue or it may be ongoing.

E. Industry Stewardship Initiatives

Stewardship initiatives vary from those that address some aspect of waste management (beverage containers, used tires) to more encompassing activities such as product certification to confirm that the item was manufactured or obtained in an environmentally responsible way (e.g., Forest Stewardship Council).

III. EDUCATION

A. Education to alter public behaviour and create a societal shift
B. Study tours for companies
C. P2 symposium
D. P2 training for corporate and institutional staff

A. Education to alter public behaviour and create a societal shift

B. Study tours for companies

C. P2 symposium

Conferences and symposia offer opportunities for delegates to demonstrate and exchange P2 ideas. The Canadian Centre for Pollution Prevention (C2P2) organizes a conference every year.

D. P2 training for corporate and institutional staff

IV. CHARACTERISTICS/COMPONENTS OF P2/CI TOOLS AND STRATEGIES

A. Geographic boundaries
B. Cross fertilization
C. Holistic approach
D. Thinking "outside the box"
E. Paradigm shift
F. Flexibility
G. Employee participation in generating ideas
H. Look for micro or macro solutions, think globally act locally, energy pods
I. Inspirational appeal

A. Geographic boundaries

Denmark is an example of a geographic community that has had success with P2/CI, due in part to the natural synergies created by its size and the effect of distinct political and geographic boundaries. The zone concept as used by CASA offers similar advantages and opportunities.

B. Cross fertilization

C. Holistic approach

Many opportunities to implement P2/CI become evident when an individual or company takes a more holistic approach to the issue. Life cycle value assessment is one example.

D. Thinking "outside the box"

E. Paradigm shift

F. Flexibility

G. Employee participation in generating ideas

H. Look for micro or macro solutions, think globally act locally, energy pods

I. Inspirational appeal

V. DESIGN/IMPLEMENTATION

A. Industrial ecology
B. Sectoral pollution prevention plans
C. Coordinated, integrated planning among players in a given area
D. Awards and recognition
E. Positive behaviour is appropriately rewarded
F. Integrate reporting with existing programs
G. Issue challenges
H. Green procurement
I. Sectoral source requirements
J. Transportation demand management
K. Eco-efficient communities initiative
L. Effective design
M. Recycle, reuse, reduce
N. Garbage fair
O. Demonstration projects

A. Industrial ecology

Different industries can make intentional connections among themselves to reduce the negative impacts they have on the environment and their communities. The most common example is using the waste of one company as an input to another activity. Economic benefits to companies may include lower costs and development of new markets for by-products or waste. Environmental benefits may include reduced use of raw materials and reduced amounts of waste requiring disposal.

B. Sectoral pollution prevention plans

All companies in a sector can prepare pollution prevention plans. CEPA has provisions authorizing the federal environment Minister to require P2 plans from companies using or producing a toxic substance or from companies in a specific industrial sector.

C. Coordinated, integrated planning among players in a given area

Opportunities often arise in a particular area for the various players to explore and develop synergies to ensure that facilities are not working at cross-purposes.

D. Awards and recognition

A number of foundations and other organizations recognize good environmental performance; among these are Alberta's annual Emerald Awards and the CCME's annual Pollution Prevention awards. The Ecologo and ISO certification both involve third party assessment and indicate to consumers that certain standards of environmental practices have been achieved.

E. Positive behaviour is appropriately rewarded

F. Integrate reporting with existing programs

When P2 reporting requirements are integrated with requirements of existing programs, it reduces the paper burden on companies and minimizes duplication. The National Pollutant Release Inventory is one example.

G. Issue challenges

Canada's national climate change Voluntary Challenge and Registry, for example, encourages a competitive spirit and spurs innovation and creativity both within a sector and between sectors.

H. Green procurement

Companies and agencies with green procurement policies take into account the environmental characteristics of a supplier's products or operations, along with price, quality, service, and other attributes. The expectation is that the products purchased in this way will have fewer negative effects on human health and the environment when compared with other products available for the same purpose.

I. Sectoral source requirements

J. Transportation demand management

Transportation demand management means influencing the nature (public transit vs. private automobile) and volume of transportation use to reduce pollution.

K. Eco-efficient communities initiative

L. Design stage and EIA regulatory review

It is almost easier and less costly to incorporate pollution prevention characteristics into a project in the design stage than it is to add them afterward.

M. Recycle, reuse, reduce

N. Garbage fair

Garbage fairs are becoming more popular as they give people a change to exchange or donate still useful materials that would otherwise go to landfill.

O. Demonstration projects

Appendix G. Draft Approach to Pollution Prevention Initiatives in Alberta Environment

INTRODUCTION

Pollution prevention (P2) is usually described as reducing or eliminating pollution, environmental disturbance or waste at the source rather than dealing with it after it has been created. It has been an implicit part of environmental protection in Alberta without being formalized in programs or policies. P2 is often presented as a win-win situation because environmental benefits (reduced pollution) and better financial performance (e.g., reduced costs, reduced liabilities, more efficient material or energy use) may both be achieved. P2 can be an effective approach to dealing with industries or activities that are not heavily regulated.

P2 is part of cleaner production, along with industrial ecology and by-product synergy. AENV is trying to raise the profile of P2 to make government and industry aware that it can be an effective tool for environmental protection. Discussions of P2 often refer to *source reduction*. In the P2 context this means avoiding or minimizing the creation of pollutants or waste. It should not be confused with similar command and control terminology that may regard a source of pollution as the facility or the end of the pipe.

P2 programs in other jurisdictions in Canada and the U.S. range from educational or outreach activities (workshops, fact sheets, guidance documents) to legislated requirements for P2 planning and implementation. In Canada, the *Canadian Environmental Protection Act 1990* (CEPA) has provisions authorizing the federal Minister to require that P2 plans be prepared and implemented for specified economic sectors or for specified substances. To date the Minister has not used those provisions. In the few U.S. jurisdictions with legislated requirements for P2 planning, components of traditional environmental regulatory regimes (e.g. reporting requirements) trigger the requirement to do P2.

DEFINITION

The proposed definition for AENV draws heavily from the Canadian Council of Ministers of the Environment (CCME) definition that has been adopted by several Canadian jurisdictions. It is also similar to Environment Canada's definition. This similarity should minimize the likelihood that industry would be faced with federal and Alberta P2 initiatives that are inconsistent.

It is proposed that AENV define pollution prevention as:

The use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste or environmental disturbance, and reduce risk to human health or the environment.

Pollution prevention techniques and practises focus on:

- *Substances of concern*
- *Materials and feedstock substitution*
- *Operating efficiencies*
- *On-site reuse and recycling*
- *Training*

- *Purchasing practices*
- *Product design*
- *Equipment modifications*
- *Product reformulation*
- *Process changes*
- *Clean production*
- *Avoidance of cross-media transfer of pollutants or waste*

PROGRAM STATEMENT

Alberta Environment recognizes the importance of the preventative approach as a complement to command and control. P2 is a preferred approach for industries or activities that are not heavily regulated but whose actions may have environmental effects. AENV's P2 efforts will pay particular attention to small and medium sized enterprises. AENV will encourage and, where appropriate, facilitate voluntary initiatives to undertake P2. The focus will be on voluntary initiatives but AENV may consider the possibility of mandatory P2 planning for some sectors or activities.

DESIGN CRITERIA OF AENV'S P2 INITIATIVES

Several principles will guide Alberta Environment's P2 initiatives. Those principles recognize and respect existing environmental protection efforts in Alberta.

AENV's P2 initiatives will complement existing AENV programs. AENV has an effective environmental management program in place. P2 will not replace the need for typical approvals and the monitoring and reporting that is associated with them. We will look for opportunities where P2 may be a useful complement to existing programs.

AENV will attempt to make its P2 activities compatible with those of Environment Canada. If federal and provincial expectations of industry differ, it will reduce the incentive for companies to voluntarily practice P2. If the federal Minister exercises his authority to require P2 plans, P2 plans done for other purposes (e.g. provincial requirements) will be acceptable to the extent that they meet the CEPA requirements.

AENV's P2 efforts will focus on minimizing or avoiding the creation of pollutants or waste. Other AENV programs deal with end of pipe, waste management, recycling and reclamation activities. Focussing on source reduction will provide some compatibility with P2 activity by the CCME, Environment Canada and other jurisdictions. This means that **AENV will consider off-site recycling to be P2 only if it is part of a wider initiative regarding industrial ecology/ by-product synergy.**

AENV's P2 efforts will not reduce pollution in one medium by transferring it to another medium.

AENV will promote and encourage P2 activities by the Alberta Government. Government will have opportunities to practice P2, for example in achieving energy efficiency, purchasing policies, etc.

IMPLEMENTATION STRATEGIES

AENV will work with stakeholders to develop and implement P2 activities. Because P2 requires searching for opportunities for source reduction, possibilities will vary from facility to facility, making it difficult to produce a common prescriptive approach to all facilities.

AENV will put its initial focus on voluntary action but may consider mandatory P2 planning for some activities at a later date. Most P2 activity in other jurisdictions is voluntary. Companies recognize that good environmental practices make good economic sense. Facilities search for opportunities to achieve efficiencies through process changes, product reformulation, etc. Where a mandatory approach to P2 planning is under consideration, experience in other jurisdictions can serve as a guide.

When examining the possibility of having a mandatory component to P2, *AENV will investigate the practicality of working P2 into approvals.* Approval holders are expected to be continuously improving their environmental performance. Developing and implementing P2 plans may be one way of doing that. There would be challenges to incorporating P2 without weakening the existing process. Significant input is required from approval writers on the merits and shortcomings of implementing P2 into approvals.

AENV will work with industry associations of those sectors that are dominated by small and medium sized enterprises. Industry sectors that are not closely or directly regulated by AENV (e.g. some construction activities, many service activities) have the potential to create significant amounts of pollution. Associations present a practical way to involve an industry sector, especially if it is comprised mainly by small enterprises.

AENV will consider using pilot projects to test the practicality of P2 initiatives. It is appropriate to test possible approaches before making a full-scale commitment. Likely participants would be firms that have good track records. Other jurisdictions (e.g., British Columbia) have done this and AENV can learn from their experiences.

AENV will consider entering into partnerships with Environment Canada and/or industry associations on specific P2 initiatives. This should ensure that Alberta and federal expectations of industry will be similar and it could help AENV leverage scarce funds.

Governments often produce guidance documents to facilitate P2 efforts by companies. The documents may include a detailed checklist of actions that are involved in P2 planning and implementation. *AENV will adopt or modify existing guideline documents from another jurisdiction or will produce documents specifically for Alberta.*

Appendix H. Major Air Contaminants in Alberta

Major Sources of Criteria Air Contaminants and CO_2 in Alberta									1999 Major Sources of NPRI Contaminants into the air for substances greater than 100 tonnes																
Rankings									Rankings																
	PM	**PM_{10}**	**$PM_{2.5}$**	**NOx**	**SO_2**	**CO**	**CO_2**	**VOC**	**Ammonia**	**Carbon disulphide**	**Ethylene**	**Ethylene glycol**	**Fluorine**	**Formaldehyde**	**HCFC-142b**	**Hydrochloric acid**	**Hydrogen fluoride**	**Hydrogen sulphide**	**Methanol**	**Methyl ethyl ketone**	**n-Hexane**	**Sulphuric acid**	**Toluene**	**Vinyl acetate**	**Xylene**
Open Sources	1	1	1																						
Wood Industry	2	2	2			2								1					2						
Grain Industry	3																								
Other Industry	4	4	5						1										1		1				
Electric Power Generation	5	3	3	3	3	5	1						1			1	1								
Residential Fuel Wood Combustion		5	4			3		3																	
Oil Sands				4	2		3*		2		2							2				1	1		1
Petroleum Refining					4																				
Transportation				2	5	1	2	2																	
Upstream Oil and Gas Industry				1	1	4	3*	1		1								1				2			
Chemical Industry				5							1	1			1				3	1				1	
General Solvent Use								4																	
Surface Coatings								5																	
Mining							4																		
Residential							5																		

Above based on 1995 emission inventory data for CAC and CO_2 and 1999 NPRI data for Alberta.

Note: *These sources are combined in the CO_2 inventory.
Open Sources have been grouped together
If fires were the only source, they were not listed.
Transportation sources were grouped together.