Pollution Prevention Options for Incineration

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Part 1: Purpose of Paper

When the Canadian Council of Ministers of the Environment agreed to Canada-Wide Standards (CWS) for emissions of dioxins and furans from incinerators in May 2001, they agreed to "develop the necessary mechanisms to … apply pollution prevention as the preferred method of moving toward the virtual elimination of dioxins and furans emissions." The Development Committee for the CWS on Dioxins and Furans asked the incineration stakeholder advisory group to advise it "regarding the content and structure of potential strategies to prevent the production of waste incineration emissions of air pollutants including, but not limited to, dioxins and furans."

The purpose of this paper is to assist in the exploration of options for including the pollution prevention approach in the CCME's actions on incineration. The CWS for dioxins and furans from incinerators defines the range of issues that are to be followed in developing the pollution prevention strategy. These include the following:

1. "Waste diversion initiatives to minimize the generation of waste destined for disposal (waste reduction, material reuse options);
2. Waste segregation initiatives aimed at materials with greater potential to generate emissions of dioxins and furans or other air pollutants of concern (e.g., mercury, other heavy metals);
3. Combustion control of strategies to optimize performance of existing combustors at destroying pollutants of concern;
4. Use of alternative disposal or treatment technologies (e.g., anaerobic digestion of wastes with material recovery and combustion of biogas)."

In this paper, we focus on the first two of these types of initiatives: diversion initiatives and segregation initiatives. We have put a particular focus on looking for examples of how these provisions can be put within a regulatory framework.

We do not include type 3 (improved combustion strategies) because this is closer to a pollution control approach rather than a pollution prevention approach. In addition, the technical aspects of this approach are not within the scope of the expertise that we bring to this work. We explore the fourth approach (alternative technologies) in only a very limited way because this would require a much more extensive technical survey than provided for within the time allocated for this project.

Our survey covers pollution prevention approaches for municipal solid waste incineration, hazardous waste incineration, sewage sludge incineration, and biomedical waste incineration.

The primary focus in this paper is on dioxins and furans, and mercury. Implementation of a pollution prevention approach to these substances will also contribute to preventing or reducing the releases from incinerators of other substances of concern.

Part 2: The Background

Scientists generally agree that dioxins and furans, and mercury have dramatic negative effects on the health of humans and wildlife – even when present in the environment only in small concentrations. Scientists also generally agree that dioxins and furans, and mercury are currently present in the environment at levels that threaten the well-being of humans and wildlife.

As a result, most government jurisdictions have set as a goal the virtual elimination of the discharge of these substances from human activities. In order to achieve this goal, government jurisdictions in Canada emphasize the need for a pollution prevention approach to deal with substances such as dioxins and furans, and mercury.

The *Canadian Environmental Protection Act*, as amended in 1999, defines pollution prevention as "the use of processes, practices, materials, products, substances or energy that avoid or minimize the creation of pollutants and waste and reduce the overall risk to the environment or human health." CCME's *National Commitment to Pollution Prevention (1993)* lists the following types of pollution prevention practices:

> The use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and wastes, at the source…
>
> It focuses on areas such as:
>
> - substances of concern
> - efficient use and conservation of natural resources
> - operating practices
> - clean production processes which create less waste
> - training
> - equipment modifications
> - process changes
> - materials and feedstock substitution
> - product design and reformulation
> - product life-cycle
> - purchasing practices

Most provincial and territorial jurisdictions in Canada have adopted similar definitions. The CEPA definition and list of techniques has formed the basis upon which we have conducted the search that resulted in the inventory in this paper.

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Method / Technique I: Household Hazardous Waste (HHW)
Measures

HHW regulations and strategies aim to separate a range of hazardous consumer materials from the municipal solid waste stream. This is most frequently achieved through some form of extended producer responsibility. Although it is a small percentage of total municipal waste (approximately 1-2%), it constitutes the main health risk. HHW is composed mostly of used oil, paints, and solvents, with smaller amounts of acid/corrosive cleaners, pharmaceuticals, dry batteries and glues.

Jurisdiction	Initiative	Description
Manitoba	Proposed Household Hazardous Waste Stewardship Regulation (draft) http://www.gov.mb.ca/conservation/hhw/public.html	- Manitoba is proposing a draft regulation under the *Waste Reduction and Prevention Act* that would require product stewardship for companies that sell products designated as contributing to the Household Hazardous Waste stream. - under the regulation designated HHW includes: 1. Batteries 2. Consumer paint products 3. Corrosives (such as oven cleaners and drain cleaners) 4. Liquid fuels 5. Domestic pesticides 6. Pharmaceuticals (unused medications and hypodermic needles) 7. Pressurized-flammable gas containers (such as propane BBQ tanks and single use tanks) 8. Solvent and flammable liquids (such as gasoline, anti-freeze, and paint strippers) 9. Swimming pool chemicals 10. Consumer electrical and electronic equipment 11. Products containing mercury (includes thermometers and fluorescent lighting) - companies would have 3 months to develop plans for an alternative waste management program. - once the plans are approved, revenue and collection strategies would begin - probably using a depot network, plus return-to-retail for some products. - there would be reporting and monitoring requirements
British Columbia	- B.C. Reg. 200/94: Post-Consumer Paint Stewardship Program Regulation http://www.qp.gov.bc.ca/statreg/reg/W/WasteMgmt/200_94.htm - B.C. Reg.111/97: Post-Consumer Residual Stewardship Program Regulation http://www.qp.gov.bc.ca/statreg/reg/W/WasteMgmt/111_97.htm	- over 90% of reported HHW in B.C. is now regulated under industry product stewardship programs - 103 industry depots established for paint, funded by industry - 35 industry depots established for "residual" HHW categories of solvents/flammable liquids, gas, and pesticides paid for by industry - pharmaceuticals returned to drug stores
Nova Scotia	Solid Waste-Resource Management Regulations	- disposal / incineration bans on waste paint, car batteries, and antifreeze

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	O.I.C. 96-79 (February 6, 1996), N.S. Reg. 25/96 as amended up to O.I.C. 2000-287 (June 1, 2000), N.S. Reg. 100/2000 http://www.gov.ns.ca/just/regulations/regs/envsolid.htm	
Québec	Action Plan for Waste Management, 1998-2008: Household Hazardous Waste Fact Sheet http://www.menv.gouv.qc.ca/matieres/mat_res-en/fiches-en/sheet_household.htm	- some municipal programs - goal of 75% recovery for oils, paints, and pesticides by 2008 - will introduce product stewardship measures with collection depots, funded by industry - can pass costs on to consumers - funds for research and education
Method / Technique II: Source Reduction Measures for Dioxin:		
Jurisdiction	**Initiative**	**Description**
Nova Scotia	Solid Waste-Resource Management Regulations O.I.C. 96-79 (February 6, 1996), N.S. Reg. 25/96 as amended up to O.I.C. 2000-287 (June 1, 2000), N.S. Reg. 100/2000	- ban on open burning of municipal solid waste
Oakland, CA	Resolution for the City of Oakland Establishing a Regional Task Force and Policy On Dioxin, Public Health and the Environment (February 1998) http://www.greenaction.org/pueblo/oakldioxinres.shtml	- work with other local governments to convene a regional task force to identify and quantify the sources of regional dioxin pollution, develop dioxin pollution prevention strategies along with any cost implications, and make any further recommendations to implement the intent of this resolution - promotes less-toxic, non-chlorinated, sustainable alternative products and processes, such as chlorine-free paper and PVC-free plastics, to the extent possible - urges Oakland health care institutions to reduce PVC use and eventually become PVC-free
San Francisco	Establishing Dioxin Pollution as a High Priority For Immediate Action For the City and County of San Francisco in Order to Restore Water, Air and Total Environment Quality (March 22, 1999) http://www.greenaction.org/zerodioxin/sf032299.shtml	- directs the San Francisco Public Utilities Commission to exercise its full power and jurisdiction to phase out dioxin at its sources - implement dioxin pollution prevention practices as recommended by the regional task force - assess its current purchasing practices and encourage that less-toxic, non-chlorinated products and processes, such as chlorine-free paper and PVC-free plastics, are supported and used by the City and County of San Francisco to the extent possible - urges San Francisco health care institutions to reduce PVC use and eventually become PVC-free where appropriate alternative products composed of non-

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		chlorinated materials are available and where any substitution for a PVC product must provide a less toxic alternative with concern for the full public health implications of the replacement, including infectious considerations
Berkeley	Resolution 60,643-N.S.: Adopting a Comprehensive and Unified Plastics Policy (June, 2000) http://www.grrn.org/resolutions/berkeley.html	- Berkeley set up a Task Force in 1995 to look at the issue of plastic waste - manufacturers and producers of plastic products and packaging must take some form of stewardship over their material, including designing products for reuse or recyclability, using recycled materials in their products, and supporting the recycling infrastructure - encourage a "bottle-to-bottle" program of reusing plastic beverage containers rather than recycling them - encourage any local efforts for refillable plastic containers for beverages, solid foods, and other grocery products - encourages the trend for reusable commercial transport packaging such as collapsible plastic pallets, reusable bakery buckets and replacements for plastic film. - promote and encourage source reduction and recycling of plastics and purchase of products containing recycled materials, by all City Departments and contractors. - City will investigate the negative environmental impacts of PVC in the construction sector and from consumer packaging and recommend appropriate action.
Marin County, CA	- Resolution 99-168 to Eliminate Dioxin Where Possible (December 1999): http://dioxin.abag.ca.gov/pdf/marin_resolution.pdf	- Policy of promoting less toxic, non-chlorinated, sustainable products and processes such as chlorine-free paper and PVC-free plastics - encourage health care institutions in the county to become PVC-free - recommend that the Regional Water Quality Control Board implement a plan to phase out dioxin at its sources
Berkeley	Municipal Code: Chapter 11.60 Polystyrene Foam, Degradable and Recyclable Food Packaging http://www.ci.berkeley.ca.us/bmc/Berkeley_Municipal_Code/Title_11/60/index.html	- Prohibits styrofoam food packaging
Denmark	- Strategy on PVC (1999) http://www.mst.dk/homepage/default.asp?Sub=http://www.mst.dk/action/	- includes an "Action Plan for the Reduction and Phasing-Out of Phthalates in Soft Plastic" with a goal of reducing phthalates by 50% by 2010

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		- per / kg. taxes on PVC and phthalates - PVC products that are difficult to separate must be substituted as far as possible and must not be incinerated - limits on recycling PVC containing heavy metals - phased in bans from 2001-2003 on lead stabilisers in certain PVC building products including windows and profiles, gutters, roofing and pipes
Denmark	Action Plan for Brominated Flame Retardants (March 2001): http://www.greenstart.org/efc9/bfrs/BFR_2.pdf	- aims at phasing out the most problematic brominated flame retardants at the international level - a range of measures including promoting EU regulatory measures, information, education, promoting standardization and cleaner production, increasing knowledge, and international cooperation
Denmark	Planned phase-out of incinerating PVC: http://www.mst.dk/news/03030000.htm	- goal of eliminating incineration of PVC-containing waste by 2004
Denmark	Consolidated Act no. 101 on taxes on certain types of packaging, bags, disposable tableware, and PVC foils. (February 13, 2001): http://www.skm.dk/slutfil.php3?SlutFilId=1690	- includes a tax of DKK 20.35 per kg. on all PVC foils in food containers
Germany	- German Federal Environmental Agency (UBA) position paper: Fields of action and criteria for a sustainable, preventive materials policy exemplified by PVC (1999)	
Germany municipalities & towns	Phase-out or restriction policies regarding the use of PVCs in construction materials	
Netherlands	Position paper on PVC (1997)	- policy of reducing the use of PVC in products that cannot be recycled unless less polluting alternatives do not exist - reducing use of lead as a stabiliser without increasing the content of tin stabilisers - ban on PVC & asbestos in packaging
Sweden	1995 - Parliament voted to phase out both soft and rigid PVC	- all use of lead in PVC should stop by 2002 - all use of DEHP & other softeners in PVC for outdoor use such as tarpaulins, covered metals and corrosion preventers for cars should be phased out by 2001 - other uses of DEHP as softeners in PVC except for medical use phased out by 2005

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		- overall use of PVC in Sweden decreased 39x between 1994 and 1999
Sweden	Swedish chemicals policy	- inherent properties of a chemical, such as bioaccumulative capacity and stability, will be determining factors in deciding if it can be released on the market.
UK towns	Various measures to reduce PVC use in construction	- Newhaven Town Council adopted a PVC-free policy in 1998, which involved avoiding PVC in all purchases except where alternatives are unavailable - many local housing authorities have policies not to fit PVC windows
UK	Environmental purchasing policy: (HC 517-I The greening government initiative: volume I: report and proceedings of the Committee / Environmental Audit Committee, 2nd report - Available from the Stationery Office: ISBN 0 10 554126 5: £9.70)	UK Department of Environment, Transport and the Regions - Greening Government Report - Advises against the use of PVC and organochlorines in general
Method / Technique III: Source reduction measures for mercury:		
Jurisdiction	**Initiative**	**Description**
Canada and the United States	U.S.-Canada Great Lakes Binational Toxics Strategy: http://www.epa.gov/glnpo/p2/bns.html Mercury Workgroup: http://www.epa.gov/Region5/air/mercury/mercury.html	- voluntary program developed jointly by Canada and the U.S. and signed in 1997 - Canadian objective of achieving, by 2000, a 90% reduction in the release of mercury, or, where warranted, the use of mercury, from polluting sources resulting from human activity in the Great Lakes Basin
Canada and Ontario	Draft Canada-Ontario Agreement, 2001: http://www.on.ec.gc.ca/coa/2001/pollutants-e.html	- aim of an 85 % reduction in mercury releases compared to releases in 1988 by 2005 and a 90 % reduction by 2010.
United States	H.R. 2729 - *Omnibus Mercury Emissions Reduction Act of 2001*: http://thomas.loc.gov/cgi-bin/bdquery/z?d107:HR02729:@@@D&summ2=m&	- introduced August 2001; currently referred to House Sub- Committee - Act will amend the *Clean Air Act* to establish requirements concerning the operation of fossil fuel-fired electric utility steam generating units, commercial and industrial boiler units, solid waste incineration units, medical waste incinerators, hazardous waste combustors, chlor-alkali plants, and Portland cement plants to reduce emissions of mercury to the environment, and for other purposes - establish a program of long-term disposal research and publicize emission data for each facility - publish a list of mercury-containing items to be

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		separated and removed from the waste streams that feed solid waste facilities - Requires labeling by manufacturers of products containing mercury - Prohibits, three years after this Act's enactment, the sale of mercury-containing products unless the manufacturer has been granted an exemption. - Requires reports on reductions of mercury emissions from medical and hazardous waste incinerators, military uses of mercury, the sources and extent of emissions in North America, and sedimentation trends in water bodies of concern
New England	- Model legislation from the Northeast Waste Management Officials Association "*An Act Concerning Mercury Education and Reduction*": http://www.newmoa.org/prevention/mercury/final_model_legislation.htm	- includes language supporting a phase-out of mercury in consumer products - mandates labelling requirements and manufacturer take-back programs - emissions limits on coal-fired power plants - has been used as the basis for some subsequent state legislation
Maine	*An Act to Reduce the Release of Mercury into the Environment from Consumer Products* (Chapter 779), and *Labelling of Mercury-added Products* (Chapter 870) http://janus.state.me.us/legis/ros/lom/LOM119th/6Pub751-791/TableofContents.htm	- Ch. 779 applies to mercury-added products including thermostats and thermometers, electric switches, medical or scientific instruments, electrical devises and lamps. - Requires labelling of mercury-added products other than mercury-added lamps sold in the state beginning January 1, 2002. - bans the disposal of mercury-added products in a solid waste disposal facility after July 15, 2002, but exempts products used in households from that ban until January 1, 2005. - established a Mercury Products Advisory Committee to recommend reduction measures and report annually. - Ch. 870 establishes the standards for labelling mercury-added products.
California	California Statutes 2001, ch. 656 *California Mercury Reduction Act, 2001* http://www.leginfo.ca.gov/statute.html	- removal of mercury-containing light switches from cars and prohibit of the sale of a vehicle, after January 1, 2005, containing a mercury-containing vehicle light switch. - ban on mercury fever thermometers, novelty products and use in schools.
Massachusetts	Draft Product Stewardship Action Plan for Products Containing Mercury http://www.productstewardshipinstitute.org/Mercury.htm	- outlines possible strategies for state and local governments to pursue to achieve increased manufacturer responsibility for full life-cycle costs of products containing mercury
Massachusetts	Municipal Waste Combustor Rule, 310	- requires municipal waste incinerators accepting more

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	CMR 7.08 (1999): http://www.state.ma.us/dep/bwp/hgres.htm	than 250 tons of waste per day to develop a Materials Separation Plan for the removal of mercury-bearing products and other toxic components or toxic precursors designated by the Dept of Environmental Protection - in future, other target pollutants, such as dioxin, cadmium, or lead can be added to the list - currently working on regulations requiring separation plans for the removal of mercury from medical waste incinerators and sewage sludge incinerators.
Massachusetts	Massachusetts Solid Waste Master Plan (December 2000) http://www.state.ma.us/dep/bwp/dswm/dswmpubs.htm	- use product stewardship to reduce toxics in products & packaging and to ensure proper recycling / reuse and collection - promote environmentally preferable products purchasing
Massachusetts	Massachusetts Zero Mercury Strategy: http://www.state.ma.us/envir/mercury.htm	- health care use reduction - promote mercury-bearing products collection - promote mercury labelling / take back legislation
Vermont	Sec. 1.10 VSA, Chapter 164: *Comprehensive Mercury Management* (March 2001) http://www.anr.state.vt.us/dec/ead/mercury/s91final.htm	- requires labelling of mercury-containing products requires manufacturers to establish systems for collection, transport & recycling of mercury-containing products - ban on mercury-containing novelty products - ban on mercury fever thermometers
Oregon	*Oregon Mercury Reduction Act* (2001): http://www.leg.state.or.us/01reg/measures/hb2800.dir/hb2816.intro.html	- prohibits sale of mercury thermometers - restricts the use of mercury thermostats and requires labelling that mercury is present - ensures recovery of mercury thermostats - prohibits the sale of mercury-containing novelty products - bans use of mercury in schools - recovery of mercury from auto switches
New Hampshire, Rhode Island, Maryland, Indiana, Minnesota	- these other U.S. states also have legislation restricting the use of mercury, and there may be others as well	
Sweden	Swedish Chemicals Policy	- use of mercury in the chlor-alkali industry must stop before 2010

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Method / Technique IV: Zero Waste Plans

The idea behind zero waste plans is to use all of the other techniques in an integrated approach in order to minimize waste or eliminate it altogether. There is a lot more going on here than is listed - this is just a sample.

A good overall list of zero waste resources is available at http://www.grrn.org/zerowaste/resource_zw.html

Target Zero Canada has information and links to Canadian zero waste resources:
http://www.targetzerocanada.org/

Jurisdiction	Initiative	Description
Halifax, NS and Nova Scotia province	Regional solid waste plan: http://www.region.halifax.ns.ca/wrms/ Nova Scotia Solid Waste-Resource Strategy: http://www.gov.ns.ca/envi/wasteman/	- three-stream waste separation - provincial disposal ban on organic waste, anything that can be composted, and anything that can be recycled - only private sector garbage pick-up at cost from businesses - NS has gone from 720 kg trash/person annually to 380 kg trash / person
Edmonton, AB	Edmonton Co-composter Facility: http://www.gov.edmonton.ab.ca/am_pw/waste_management/compost_facility.html	- diverts 70% of municipal waste stream - uses a large wet/dry composting and recycling plant
Québec	Action Plan for Waste Management, 1998-2008: http://www.menv.gouv.qc.ca/matieres/mat_res-en/	- a comprehensive strategy designed to address a range of municipal and hazardous waste issues. - plan aims to increase the overall recovery rate of waste from 43% to 65% by 2008, - for the municipal solid waste stream, there are diversion goals of 60% of glass, plastics, metals, fibres, bulky waste and putrescible material; 50% of textiles, and 80% of non-refillable beer & soft drink containers - a new emphasis on product stewardship - will amend the *Environment Quality Act* to make recovery of select products mandatory - require local municipalities to have waste management plans at the regional and community levels, and give them new powers over the quantity and source of waste disposed of in their areas - apply green procurement by government to favour purchase of recycled materials
California	Del Norte County Zero Waste Plan	four components including regulatory measures under

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	(2000): http://www.grrn.org/order/order.html#del_norte	two main headings: Ending "welfare" for wasting through: - a national materials policy - tax bads, not goods - campaign finance reform - content & reuse requirements - environmental labelling - deposits and ADF - extraction subsidies - franchises & permitting 2. Material measures: - Waste separation for recovery - Industry product stewardship for hazardous materials - Onsite management - Consumable - services, not stuff
Massachusetts	Massachusetts Solid Waste Master Plan (December 2000) http://www.state.ma.us/dep/bwp/dswm/dswmpubs.htm#swmp	- goal of 60% waste reduction of municipal solid waste - expanded source reduction programs - expand product stewardship initiatives and establish a national Product Stewardship Institute in Massachusetts - decrease packaging and provide more reuse options - promote pay-as-you-throw municipal trash programs - promote material exchange networks and other reuse options
Seattle, WA	Solid Waste Plan: On the Path to Sustainability http://www.cityofseattle.net/util/solidwaste/swplan/default.htm	- goal of 60% waste reduction by 1998 in the 1989 report - reached 44% by 1999
Toronto	Waste Diversion Task Force 2010 Report: http://www.city.toronto.on.ca/taskforce2010/index.htm	- goal of 30 per cent diversion by 2003, 60 per cent by 2006 and 100 per cent by 2010.
New Zealand	Zero Waste New Zealand Trust - national strategy for achieving zero waste by 2020 http://www.zerowaste.co.nz/	- pilot project launched in 1999 to achieve zero waste in 10 local councils - Under the project, Opotoki district has already reduced municipal waste by 80%
Santa Cruz County, California	Zero waste strategy (1999): http://www.grrn.org/zerowaste/resolutions/santa_cruz_110299.html	

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San Diego County, California	Disposal ban on anything recyclable: http://www.co.san-diego.ca.us/cnty/cntydepts/landuse/works/management/recycling.htm	

Other:

There are a wide range of other methods used to reduce municipal waste, from economic incentives such as pay-as-you-throw programs, government green procurement, measures to address construction and demolition waste issues, packaging reduction, recycling parks for one-stop reuse / recycle activities, beverage deposit-return systems, to name a few. A few of these are listed randomly but this is a vast topic not really addressed here.

Jurisdiction	Initiative	Description
United States	Clinton executive order 12873 "Federal Acquisition, Recycling and Waste Prevention", 1993: http://es.epa.gov/program/exec/eo12873.html	- This led to EPA's Environmental Preferable Purchasing program, which has elements such as mandatory recycled-content percentages for office paper products, preferences for decreased packaging
Eight provinces (except Ontario & Manitoba)	Beverage container deposit / refund systems: http://www.bottlebill.org/canada/canada-purpose.htm	Bottle deposit / refund systems
Prince Edward Island	Litter Control Regulations under the *Environment Protection Act:* http://www.gov.pe.ca/royalgazette/pdf/20010616.pdf	- Ban on the use of aluminum cans and non-refillable bottles as beverage containers in Prince Edward Island - PEI has a 98% soft drink and beer container return rate, the highest in North America

Construction and Demolition Waste:

Makes up around 1/3 by weight of waste stream. Consists of materials such as concrete, brick, wood, asphalt, metal, packaging, glass, carpeting, insulating materials, drywall, etc. 90% of the materials are recyclable but in practice recycling rates are low. Construction waste is easier to recover because it is mainly uncontaminated. Demolition waste is more likely to be mixed, hard to separate or contaminated. There have always been some salvage efforts, particularly for higher cost materials such as metal, aggregates, or wood.

Jurisdiction	Initiative	Description
Québec	Action Plan for Waste Management, 1998-2008: http://www.menv.gouv.qc.ca/matieres/mat_res-en/	- goal of recovering 60% of C&D waste by 2008 - gradually eliminate dry materials disposal sites - promote use of recovered concrete, asphalt, and bricks as backfill material
Massachusetts	Massachusetts Solid Waste Master Plan (December 2000) http://www.state.ma.us/dep/bwp/dswm/dswmpubs.htm	- goal of 88% reduction in C& D waste - ban disposal of unprocessed C & D by 2003 - promote source reduction in building design and construction

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Method / Technique V: Source Reduction: Producer Stewardship Initiatives:

These have been enacted for a range of hazardous products that would otherwise end up in the municipal waste stream. End-of-life vehicles, appliances, batteries, tires, packaging, and electrical and electronic equipment are some of the key areas where there has been a range of initiatives.

Vehicles:

Salvage and shredder facilities can reuse components and recycle metal

Approximately 25% by weight or 75% by volume remains as waste, known as auto shredder residue (ASR), or "fluff", composed of both recyclable and non-recyclable materials including plastics, fibers, foams, glass, and rubber. - Percentage of plastics, fibers and composites in vehicles is growing, so this residue is an increasingly serious waste problem. (Environmental Defense, Green Car: A Guide to Cleaner Vehicle Production, Use and Disposal, http://www.environmentaldefense.org/programs/PPA/vlc/)

The use of mercury in vehicles is another problem. See, for example, the Clean Car Campaign resources at http://www.cleancarcampaign.org/mercury.html

Jurisdiction	Initiative	Description
Maine	Bill for *An Act to Prevent Mercury Emissions from Recycling and Disposal of Motor Vehicles: draft*. October 2001 http://www.cleancarcampaign.org/pdfs/dep03billlang.pdf	- Proposed legislation introduced October 16, 2001
European Union	Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on End-of-Life Vehicles: http://www.bmu.de/english/download/waste/files/vehicles.pdf	- sets a goal of recycling 85% of vehicles by weight by 2002 and 95% by 2015 - requires car owners to obtain a "certificate of deregistration" confirming that their vehicle had been legally recycled - requires producers to use material coding standards that allow identification of the various materials during dismantling. - 18 months after the Directive is published, vehicle components and materials must not contain lead, mercury, cadmium, or hexavalent chromium, except as listed in an exemption annex

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Sweden	End-of-life vehicles legislation passed in 1995 An evaluation report on their experience with this is at: http://www.iiiee.lu.se/information/library/publications/reports/2001/responsibility.pdf	- The goals for the recovery and reuse of end-of-life vehicles are that at least 85% are to be recycled or reused as from 2002 and at least 95% as from 2015. - Dismantling industry is working to remove environmentally hazardous components before they reach dismantling plants - The vehicle scrapping industry is working on a certification system for car scrap merchants aimed at tightening voluntary requirements - The Swedish EPA has worked out a basis and proposal for general regulations on vehicle dismantling (not available in English) - Sweden reused or recycled 81% of the weight of every car scrapped in 2000
Germany	- Voluntary product take-back initiative by German vehicle manufacturers (1996)	- The voluntary pledge states that the industry will reduce the amount of auto shredder residue (ASR, or "fluff") sent to landfills from the current rate of 25 percent (by vehicle weight) to a maximum of 15 percent by 2002, and a maximum of 5 percent by 2015. - the new EU Directive borrowed some of the ideas of this earlier voluntary initiative.

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Electrical and Electronic Equipment:

Initiatives regarding electrical and electronic equipment tend to take the form of recycling programs, extended producer responsibility requirements or toxics use reduction policies. Large appliances and, increasingly, computers, are the main focus of these initiatives.

Massachusetts	General Requirements, Procedures and Permits for Solid Waste Management Facilities, 310 CMR 19.000- Part I (April 2000): http://www.state.ma.us/dep/bwp/dswm/files/310cmr19.pdf	- Computer monitors and televisions now contain 5-9 lbs. of lead each - bans disposal of cathode ray tubes (CRTs) in solid waste - requires compliance plans for ongoing waste stream monitoring at solid waste facilities - program to reuse and recycle discarded computer monitors and televisions containing CRTs - also bans white goods including refrigerators, freezers, dishwashers, washers & dryers, stoves and hot water heaters
California	Emergency Regulations, Cathode Ray Tubes R-01-06, 22 CCR 66273, March 2001, http://www.ciwmb.ca.gov/electronics/RegIssues/default.htm	- bans disposal of cathode ray tubes (CRTs) in solid waste - program to reuse and recycle discarded computer monitors and televisions containing CRTs
Florida	Strategy for the Management of end-of-life Cathode Ray Tubes (CRTs), Computers and Other Electronic Equipment (Sept. 1999): http://www.dep.state.fl.us/waste/categories/electronics/documents/crt_9_2.pdf Update, November 1999: http://www.dep.state.fl.us/waste/categories/electronics/documents/crt_az99.pdf	- promotion of recycling infrastructure development - pilot project on collection, recycling, reuse, demanufacturing - consideration of a ban on disposal of CRTs
United States	WasteWise Program: http://www.epa.gov/epaoswer/non-hw/reduce/wstewise/	- voluntary program providing free technical assistance to businesses, government, and organizations wanting to reduce waste electronics - publishes a *Guide to electronics reuse and recycling* at: http://www.epa.gov/wastewise/pubs/wwupda14.pdf

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European Commission	Proposed Directive on Waste from Electrical and Electronic Equipment (WEEE) Proposal for a Directive of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment: http://europa.eu.int/comm/environment/docum/00347_en.htm	- Prohibits the use of mercury, cadmium, hexavalent chromium, and brominated flame retardants in all electrical goods by the year 2004. - by 2006, between 70% and 90% by weight of all collected equipment must be recycled or reused. - producers should integrate an increasing quantity of recycled material in new products with the goal that, by 2004, at least 5% of total plastic content must be recycled plastic. - producers must design equipment with labelling for recycling to identify plastic types and the location of all dangerous substances.
Sweden	Ordinance on Producer Responsibility (July 2001) - Section 25 of the Ordinance on Waste Collection and Disposal (July 2001) http://www.internat.environ.se/index.php3?main=/documents/issues/technic/electric.htm	The Ordinance on Producer Responsibility sets out an obligation for producers to dispose of waste consisting of electrical and electronic products, to supply information about this responsibility, to supply information about such products, and to enter into consultations regarding fulfillment of their obligations. It covers waste electrical and electronic equipment including: Household appliances, tools and garden equipment IT and office equipment Telecommunication equipment Television, audio and video equipment Cameras and photo equipment Clocks and watches Games and toys Lighting equipment Medical equipment Laboratory equipment - Section 25 of the Ordinance on Waste Collection and Disposal stipulates that WEEE must be treated at a certified establishment before landfilling, shredding or incineration.

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The Netherlands	No. 238: Disposal of White and Brown Goods Decree (April, 1998) http://www.nvmp.nl/html/10_english/03_fr_decree.htm	- First European electronics product take-back legislation - "White and brown goods" include: 1. refrigerating and freezing equipment 2. heating equipment 3. hot-water equipment 4. washing and drying equipment 5. equipment for preparing food by heat 6. sound equipment 7. image receiving equipment 8. computers 9. paper printing equipment 10. telecommunications equipment 11. electric and electronic charging equipment 12. electric and electronic kitchen appliances 13. electric and electronic tools 14. other electric and electronic domestic appliances. - consumers can either take in an old product when they buy a new version (and the supplier cannot charge them for this); or if they are not buying a new product, they can take the old ones to the local authority collection service - there is a ban on incineration of any of the goods that have been collected separately through this system
Denmark	Statutory Order from the Ministry of Environment and Energy No. 1067 of December 22, 1998, on Management of Waste from Electrical and Electronic Products: http://www.mst.dk/rules/02070000.htm	- Applies to radio and TV equipment, IT products, regulation and monitoring equipment, white goods, and office equipment. - The order is expected to redirect 25,000 tonnes of electronics from incineration and landfilling to recycling.
Batteries: Many jurisdictions have legislation or policies for stewardship or recycling of batteries, particularly for Ni-Cad and small sealed lead-acid batteries .		
Jurisdiction	**Initiative**	**Description**
United States	Battery Act (1996): http://www.epa.gov/epaoswer/hazwaste/state/policy/pl104.txt	- uniform labelling requirements for Ni-Cd and small sealed lead-acid batteries - covers collection, storage, and transportation of these batteries in all states - states can adopt more stringent requirements but not less stringent

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Florida	Florida Statutes Title 29, Chapter 403, Section 7192: Batteries; requirements for consumer, manufacturers, and sellers; penalties http://www.leg.state.fl.us/statutes/	- requires manufacturers, importers and marketers of Ni-Cd, small sealed lead-acid, and some mercuric oxide batteries to be responsible for used battery collection and disposal - requires labelling of rechargeable batteries and bans their disposal - bans sale of mercury button cell batteries and limits content of mercury in other non-rechargeable batteries sold in Florida
Minnesota and New Jersey	-These two states have the most far-reaching battery legislation Minnesota Statutes section 115A.915 to 9157: http://www.revisor.leg.state.mn.us/stats/115A/ New Jersey Statutes Title 13, sections 13:1E-99.61 to 13:1E-99:81: http://www.njleg.state.nj.us/Default.asp	- manufacturers of Ni-Cd batteries to collect and recycle / dispose of them - consumers must return them to collection points, including retail stores and HHW facilities - For batteries that aren't currently being recycled, such as alkaline batteries containing mercury, the legislation limits the content of heavy metals.
Rhode Island and Vermont	- battery legislation Vermont Statutes ch. 159, s. 6621	- manufacturers of Ni-Cd, non-consumer mercuric-oxide and small sealed lead-acid batteries to accept used batteries - prohibits disposal in solid waste
Germany	Batteries Ordinance (April 1998): http://www.umweltbundesamt.de/uba-info-daten-e/daten-e/batterieverwertung.htm	- Manufacturers assume total responsibility for their end-of-life products - Producers operate a communal takeback system for collecting, sorting and disposing of used batteries - Retailers and public waste disposal services must accept used batteries without charge and consumers are required to return all batteries, including imported ones - restricts the heavy metal content of certain batteries and requires that manufacturers label all hazardous batteries - favours production of long-life, reusable batteries - will recover approximately 900 million dry batteries per year
Norway	Batteries regulations (July 2000) - summary at: http://www.epa.gov/epaoswer/non-hw/reduce/epr/products/bintern.html	- retailers, importers, and producers of rechargeable batteries are responsible for takeback, collection, and disposal

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Netherlands	Batteries Disposal Decree (1995) - summary at: http://www.epa.gov/epaoswer/non-hw/reduce/epr/products/bintern.html	- manufacturers and importers are responsible for collecting and recovering batteries under 1 kg. - producers have also formed an industry funded collection foundation that takes back batteries up to 100 kg.
Tires: Tires are primarily composed of either synthetic rubber (petroleum derivative) or natural rubber; 10% of tires by weight is steel (rim). Without pollution prevention measures, most tires end up in landfill or in environmentally unsafe dumps. These dumps are a major fire hazard; the huge fires at Hagersville in Ontario and St. Amable in Québec (1990) illustrate the environmental dangers and massive cleanup costs these dumps can pose. However a range of scrap tire recovery and recycling programs are in existence in Canada and elsewhere.		
Jurisdiction	**Initiative**	**Description**
All provinces except Ontario & Newfoundland	Scrap tire recovery and recycling programs: There is an overview article in Solid Waste Magazine, June-July 1999, entitled "What Goes Around Comes Around: Used tire management in Canada" that contains a summary of provincial programs at http://www.solidwastemag.com/	- manufacturers must recover and recycle about 90% of all scrap tires - Only Ontario and Newfoundland do not have programs, although Ontario is responsible for 40% of Canada's scrap tires - In 1999-2000, in provinces with programs, 83-100% of tires are processed; in Ontario the rate is 38% and in Newfoundland 18% - programs are usually financed through environmental levies on sale of new tires
Québec	2002-2008 Québec Program for the Integrated Management of Scrap Tires (2002): http://www.recyc-Québec.gouv.qc.ca/D_PDF/Pneus/Progr_new_English2002_2008.pdf	- along with tire recovery/recycling & environmental levies on new tires, includes: - grants to develop markets for recycled material and to support scrap tire processing technologies - from April 2000, rehabilitation of the 50 or so tire dumps in Québec
United States - state governments	The U.S. EPA has a comprehensive guide to state scrap tire programs for each state,called: *State Scrap Tire Programs: A Quick Reference Guide (1999 Update)* http://www.epa.gov/epaoswer/non-hw/tires/scrapti.pdf	- guide to state tire programs for all states, summarizing legislation and regulations, funding information, detailed requirements for storage/processing, financial incentives, and contact information.

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United States	Federal procurement guidelines e.g.: Comprehensive Procurement Guideline Program (CPG), http://www.epa.gov/cpg/	- CPG promotes government purchase of tires containing maximum recycled material content practicable - 2000 guide - information and recommendations on purchasing recycled content vehicular products - The CPG program includes 8 buy-recycled series for 2000, including: Vehicular products, construction products, landscaping products, nonpaper office products, paper products, transportation products, park and recreation products, and miscellaneous products.
Sweden and Finland	Ordinances for recovery / recycling of scrap tires:	- requirement for tire producers to collect and recycle / reuse waste tires - applies to domestic & imported tires - carried out by tire suppliers producer organizations; consumer fee funds program

Selected Resources for Municipal Solid Waste:

Coalition of Northeastern Governors (United States). Toxics in Packaging Clearinghouse. Includes model legislation and a comparative analysis of state legislation based on it.
http://www.statesnews.org/tpch/tpch.htm

European Commission. Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on End-of-Life Vehicles

European Commission. Green Paper on Environmental Issues of PVC. July 2000.
http://europa.eu.int/comm/environment/pvc/

European Commission. Proposal for a Directive of the European Parliament and of the Council on Waste Electrical and Electronic Equipment; and Proposal for a Directive of the European Parliament and of the Council on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.

Environment Canada. Progress in Pollution Prevention 1999-2000: Fifth Annual Report of the Pollution Prevention Coordinating Committee.
http://www.ec.gc.ca/p2progress/1999-2000/en/index.cfm

Extended Producer Responsibility: A Materials Policy for the 21st Century, June 2000
Bette Fishbein (INFORM), John Ehrenfeld (MIT), and John Young (Materials Efficiency Project) (2000, 290 p.) http://www.informinc.org/eprbook.htm

Greenpeace UK: Michelle Allsopp, Pat Costner, and Paul Johnston. Incineration and Human Health: State of Knowledge of the Impacts of Incinerators on Human Health. March 2001. 84 p.
http://www.greenpeace.org/%7Etoxics/reports/euincin.pdf

Greenpeace International. PVC-Free Future: A Review of Restrictions and PVC-free Policies Worldwide: a list compiled by Greenpeace International. 8th ed. August 2001. 44 p.
http://www.greenpeaceusa.org/toxics/solutionstext.htm

Greenpeace. Toxic-free Future: Time to Act. May 2001. 32 p.
http://www.greenpeace.org/~toxics/reports/Toxic-freefuture.pdf

KEMI (National Chemicals Inspectorate, Sweden):
http://www.kemi.se/default_eng.htm
Contains English translations of Swedish chemicals legislation including:
- Prohibition etc. in Certain Cases in Connection with Handling, Import and Export of Chemical Products Ordinance 1998:944
- Chemical Charges Ordinance 1998:942

Maine. *An Act to Reduce the Release of Mercury into the Environment from Consumer Products*. (Public Laws of Maine, Chapter 779), and Labelling of Mercury-Added Products (Public Laws of Maine, Chapter 870).

Maine. *An Act to Prevent Mercury Emissions from Recycling and Disposal of Motor Vehicles: draft.*
http://www.cleancarcampaign.org/pdfs/dep03billlang.pdf

Mercury Policy Project. States Mercury Products Legislation (Existing & Proposed): Comparison of key elements chart: draft. 1 p. March, 2001.
www.mercurypolicy.org

The Netherlands. Decree no. 238: White and Brown Goods.

New Hampshire Department of Environmental Services. The New Hampshire Dioxin Reduction Strategy. February 2001. 64 p.
http://www.des.state.nh.us/ard/dioxin/strategy.pdf

Norway. Ministry of the Environment. Action Plan on Hazardous Substances. August 1999. 26 p.
http://odin.dep.no/archive/mdbilder/01/03/actio035.pdf

Oregon. House Bill 3828. *A bill for an Act relating to the environment; creating new provisions, amending ORS 453.005 and 468.065; and declaring an emergency.*
http://www.leg.state.or.us/01regulation/measures/hb3800.Directive/hb3828.intro.html

Sweden. Ministry of the Environment. A Strategy for an Environmentally Sound Product Policy. Government Communication 1999/2000: 114.
http://www.miljo.regeringen.se/english/pdf/ds19992000_114-eng.pdf

Washington. Department of Ecology. Proposed Strategy on Persistent, Bioaccumulative Toxics (PBTs). December 2000. 65 p.
www.economy.wa.gov/programs/eap/pbt/pbtfaq.html

Vehicles:

Environmental Defense. Green Car: A Guide to Cleaner Vehicle Production, Use and Disposal
http://www.environmentaldefense.org/programs/PPA/vlc/

Great Lakes United. Toxics in Vehicles: Mercury. June 2001.

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Method I: Toxics Reduction Legislation:

Jurisdiction	Initiative	Description
Canada	*Canadian Environmental Protection Act, 1999* http://www.ec.gc.ca/CEPARegistry/the_act/	- Part 4 - provision to enable the Minister to require pollution prevention plans with respect to a substance or group of substances specified on the List of Toxic Substances in Schedule 1 of CEPA 1999 or substances to which subsections 166 (regarding international air pollution) or 176 (regarding international water pollution) apply.
Ontario	Ontario Municipal-Industrial Strategy for Abatement http://www.e-laws.gov.on.ca/home_E.asp?lang=en	- Regulation 760/93 sets out effluent limits for the pulp and paper sector under the Municipal-Industrial Strategy for Abatement (MISA). In its original version, the regulation also included a requirement that mills that bleach pulp using chlorine and chlorine-containing compounds must prepare AOX (organochlorine) elimination reports outlining how to achieve the goal of zero AOX discharge by December 31, 2002. This provision was revoked by O.Reg. 645/98 in 1998.

In the United States, slightly more than half of the states (around 30) have enacted legislation to promote pollution prevention. There is also a federal statute, the Pollution Prevention Act (1990). Most of the legislation was passed in the late 1980s and early 1990s.

One example of such legislation is the Massachusetts *Toxics Use Reduction Act* (1989). The goals of this Act are:

- to establish a statewide goal of reducing toxic waste generated by 50% by 1997 through toxics use reduction
- to establish toxics use reduction as the preferred means for achieving compliance with any laws or regulations related to toxics and for minimizing the risks associated with toxics use and the production of toxic substances
- to promote innovation in toxics use reduction and management
- to promote reductions in the production and use of toxics through the Act and through other toxics-related programs
- to enhance the enforcement of environmental laws and regulations in Massachusetts
- to promote coordination between all state departments and agencies dealing with toxics

Toxics use reduction is defined under the Act as "In-plant changes in production processes or raw materials that reduce, avoid, or eliminate the use of toxics or hazardous substances or generation of hazardous by-products per unit of product, so as to reduce risks to the health of workers, consumers, or the environment, without shifting risks between workers, consumers, or parts of the environment."

Toxics use reduction techniques under the Act include:

- Input substitution
- Product reformulation
- Production unit redesign or modification
- Production unit modernization
- Improved operation and maintenance of production unit equipment and methods
- Recycling, reuse or extended use of toxics

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Specific measures under the Act include:

- Established the Office of Toxics Use Reduction Assistance and Technology (now called the Office of Technical Assistance for Toxics Use Reduction).
- Established the Toxics Use Reduction Institute to develop training programs for those involved in toxics use reduction, and to carry out research, development, and demonstration of toxics use reduction methods among other things.
- Requires large quantity toxics users to develop an inventory of chemicals in each production process at a facility and requires a toxics use reduction plan for each such process.
- Established a Toxics Use Reduction Fund, which uses annual fees from firms governed by the Act to administer the TUR program. Fees vary according to the size of the firm and the number of listed chemicals used above the annual threshold.
- Established an Administrative Council on Toxics Use Reduction to recommend the allocation of the Toxics Use Reduction Fund and to designate certain industry groups as "priority user segments."

Jurisdiction	Initiative	Description
United States	U.S. Code, Title 42, ch. 33, *Pollution Prevention Act*, 1990 Http://www.epa.gov/opptintr/p2home/p2policy/act1990.htm	- established a national policy that pollution should be prevented or reduced at its source - states that pollution that cannot be prevented should be recycled or treated in a safe manner and that disposal or other releases should be used only as a last resort - directed EPA to develop and implement a strategy to promote source reduction - added information on source reduction practices used by facilities to Toxics Use Inventory (TRI) reporting requirements
Alaska	Alaska Statutes 46.06.032 to .041, *Solid and Hazardous Waste Management Act* (1990) http://www.legis.state.ak.us/FOLHOME.HTM	- Promotion of various voluntary pollution prevention activities such as technical assistance and training
Arizona	Arizona Revised Statutes, Title 49, ch. 5, article 4 - Pollution Prevention Http://www.azleg.state.az.us/ars/49/title49.htm	- Requires pollution prevention plans for facilities over a filing threshold.
California	*Hazardous Waste Source Reduction and Review Act*, SB 14, 1989 http://www.dtsc.ca.gov/LawsRegulationsPolicies/hs_code.html	- Applies to facilities that annually generate more than 12,000 kgs. of hazardous waste or 12 kgs. of extremely hazardous waste. - Requires regulated facilities to undertake source reduction planning.

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California	*Hazardous Waste Source Reduction: Toxic Chemical Releases* -- SB 1916 (Sher, 1998) http://www.leginfo.ca.gov/pub/97-98/bill/sen/sb_1901-1950/sb_1916_bill_19980928_chaptered.html	- Builds on SB14, requires certain organizational changes such as the creation of an advisory committee and a 2-year pollution prevention plan with priority sectors to be addressed. It also specifies a set of activities designed to promote source reduction of hazardous waste using education, outreach, and other voluntary techniques.
Colorado	Colorado Revised Statutes 25-16, *Pollution Prevention Act* 1992. http://64.78.178.125/stat01/index.htm	- Provides for the creation of a Pollution Prevention Advisory Board, who are to implement a range of voluntary pollution prevention activities in conjunction with the Department of Public Health and Environment - Provides for the collection of pollution prevention fees from certain facilities
Connecticut	Connecticut General Statutes Appendix Pamphlet, P.A. 91-376, *An Act Providing Environmental Assistance to Business*, 1991 http://prdbasis.cga.state.ct.us/BASIS/TSAMDHP/LIN1/AMD/MSF (then search for 91-376 in text; and select "public acts (1988-2001)" in database list).	- $10 million revolving loan fund to assist businesses and industry to change production processes, practices, and raw materials to reduce or eliminate hazardous by-products and toxic substance use.
Delaware	Delaware Code, title 7, sections 7801-7805 http://198.187.128.12/	- Voluntary pollution prevention with the objectives of targeting industries and locations for technical assistance; and providing education and outreach.
Florida	Florida Statutes 403.72 - .074, *Florida Pollution Prevention Act*, 1991 http://www.dep.state.fl.us/waste/categories/p2/pages/laws.htm	- Voluntary pollution prevention activities focusing on technical assistance and training. - Incorporates facility waste audits and pollution prevention planning in enforcement activities to offset fines.
Georgia	Georgia Code chapter 393-3-11 *Hazardous Waste Management Act* (Revised November 2000) http://www.state.ga.us/dnr/environ/rules_files/exist_files/391-3-11.pdf Georgia Code ch. 12-8-181 - establishes the pollution prevention division	- 1991 - attempt to establish a hazardous waste incinerator in Georgia came up against intense public resistance - In response, creation of a non-regulatory pollution prevention division, which started in 1993, to implement source reduction measures through providing resources such as technical assistance, awards, outreach, and education.
Illinois	Illinois Statutes, *Toxic Pollution Prevention Act*, 1989 http://www.legis.state.il.us/ilcs/ch415/ch415act85.htm	- Voluntary program focussing on technical assistance, regulatory integration, and education
Indiana	Indiana, *Pollution Prevention and Safe Materials Act*, 1990	- Established the Office of Pollution Prevention and Technical Assistance

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Iowa	Iowa Code, 455B.516- .518, *Waste Minimization Act*, 1989 http://www.legis.state.ia.us/IACODE/2001/455B/	- requires the establishment of a toxics pollution prevention program - Promotes pollution prevention planning, technical assistance, research, and education activities
Kentucky	Kentucky Revised Statutes, ch. 224.46.305 to .335; http://www.lrc.state.ky.us/KRS/224-46/CHAPTER.HTM	- Establishes a Center for Pollution Prevention, a Pollution Prevention Fund, and an Environmental Leadership Program
Louisiana	Louisiana RS 30:2291-2295, *Louisiana Waste Reduction Law* http://www.legis.state.la.us/tsrs/toc.asp?level=2&lawbody=RS&level1=30	- Requires regulated facilities to report annually on the history and progress of waste reduction efforts
Maine	Maine Revised Statutes, Title 38, ch. 26, *Toxics Use and Hazardous Waste Reduction*, (1990, amended 1991, 1993) http://janus.state.me.us/legis/statutes/38/title38ch26sec0.html	- Applies to approximately 362 of Maine's largest toxic users. - Facilities in the program must develop toxic reduction plans with input from their workers. Facilities will set reduction goals for 2002, 2004 and 2006, and report their goals and progress to the Department of Environmental Protection every two years. - There is public Internet access to the facilities' goals and progress made towards meeting those goals, available at http://www.mainedep.com/tur/
Massachusetts	Massachusetts General Laws, ch. 21I, sections 1-23, *Toxics Use Reduction Act*, (1989), beginning at: http://www.state.ma.us/legis/laws/mgl/21I-1.htm	- See example at beginning of section
Minnesota	Minnesota Statutes, ch. 115D, sections 1-12, *Minnesota Toxic Pollution Prevention Act* (1990, amended 1995) http://www.revisor.leg.state.mn.us/stats/115D/	- Requires pollution prevention plans from regulated facilities along with annual reporting on progress - Office of Environmental Assistance required to submit a Pollution Prevention Evaluation Report to the Legislature every 2 years to evaluate progress
Minnesota	Minnesota Statutes, *Environmental Regulatory Innovations Act*, 1996 http://www.revisor.leg.state.mn.us/stats/114C/	- Promotes Minnesota Project XL permits that require permittees to reduce overall levels of pollution below what is required by existing regulations, but which grants greater operational flexibility to achieve this.
Mississippi	Mississippi Code, Title 49, chapter 31, sections 1 to 27, *Mississippi Multimedia Pollution Prevention Act* (1990, amended 1995) http://www.mscode.com/free/statutes/49/	- Requires large and small quantity hazardous waste generators to have a waste minimization plan (similar to a pollution prevention plan) - Companies are required to update the plan annually

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	031/index.htm	- Companies must also file annual certified reports describing waste reduction and recycling activities, goals, and impediments
New Jersey	New Jersey Revised Statutes Title 13, chapter 1D, sections 35-50, *New Jersey Pollution Prevention Act* http://www.state.nj.us/dep/legal/nj_env_law.htm	- Requires facilities to develop Pollution Prevention Plans - Plan Summaries and Plan Progress Reports must be submitted every five years - Reports describing each facility's progress in achieving pollution prevention must be submitted annually after the initial submission of the P2 Plan Summary
New York	New York Consolidated Laws, Article 27, Title 9, Industrial Hazardous Waste Management http://assembly.state.ny.us/leg/?cl=37&a=125	- Requires hazardous waste reduction plans from regulated facilities - Requires updates to the plans at least biennially - Requires annual status reports to the Department of Environmental Conservation
Oregon	Oregon *Toxics Use Reduction and Hazardous Waste Reduction Act* (1989) http://www.leg.state.or.us/ors/465.html	- Requires facilities to develop toxics reduction plans and monitor their progress through annual progress reports and "pounds reports" (on quantities of toxics used).
Rhode Island	Rhode Island General Laws, *Hazardous Waste Reduction, Recycling, Treatment Research, and Demonstration Act*), 1986 http://www.rilin.state.ri.us/Statutes/TITLE23/23-19-10/INDEX.HTM	- Requires hazardous waste generators to report on volume and toxicity of wastes - Establishes a hazardous waste technology, research, development, and demonstration program to study means of reducing hazardous waste
Tennessee	Tennessee Code, 68-212-301 to 312, *Tennessee Hazardous Waste Reduction Act* (1990) http://198.187.128.12/ *Second Century Environment Act* (1992)	- Requires mandatory hazardous waste reduction plans and progress reports
Texas	Texas Administrative Code, Title 30, chapter 335, subchapter Q, *Texas Waste Reduction Policy Act* (1991) http://info.sos.state.tx.us/pub/plsql/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=335&sch=Q&rl=Y	- Requires regulated facilities to prepare a five-year source reduction/waste minimization (SR/WM) plan, submit an executive summary of the plan, and report annually on pollution prevention activities.
Vermont	Vermont Statutes Annotated, Title 10, ch. 159, subchapter 2, sections 6623 to 6632*, Hazardous Waste Management Act* (1990, as amended) http://www.anr.state.vt.us/dec/rules/pdf/act100.pdf	- Requires toxics use reduction and hazardous waste reduction plans and performance reports - Establishes a pollution prevention division to provide technical assistance, an information clearinghouse, education, and on-site consultations

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Washington	Washington Revised Code 70.95C.010 to .240, *Hazardous Waste Reduction Act* (1988, as amended) http://www.ecy.wa.gov/laws-rules/ecyrcw.html#title70, then select Ch. 70.95C RCW - Waste reduction	- Requires regulated facilities to prepare plans for voluntary reduction of hazardous substance use and hazardous waste generation. These plans must address current hazardous substance use; waste reduction, recycling and treatment activities; analysis of further reduction opportunities; and five-year performance goals.
Wisconsin	Wisconsin Statutes, ch. 299.13, Pollution Prevention, *Wisconsin Act 325*, 1989 http://www.legis.state.wi.us/rsb/Statutes.html	- Creates a program offering technical assistance, education and training.

Method II: Selective Pollution Prevention Initiatives:

A selective listing, just to give a sense of some of the types of voluntary initiatives going on in many jurisdictions. There is definitely some overlapping here with the above legislation, as some of the measures described below are required by the legislation, while others are not. Examples of measures include:

- Technical assistance programs
- Mandatory facility planning
- Voluntary programs (awards)
- Outreach and education programs
- Information clearinghouses
- Regulatory integration
- Fees / pollution prevention funds
- Clean production initiatives

Jurisdiction	Initiative	Description
Canada	National Office of Pollution Prevention	- The report *Pollution Prevention - A Federal Strategy for Action,* June 1995, (http://www.ec.gc.ca/pollution/strategy/en/index.cfm) initiated a primarily voluntary pollution prevention approach for Canada - five annual progress reports have been published since then (http://www.ec.gc.ca/p2progress/indexE.cfm)

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Canada	Accelerated Reduction / Elimination of Toxics (ARET) program http://www.ec.gc.ca/aret/homee.html	- Voluntary pollution prevention and abatement initiative - 316 industry and government organization participants, but many facilities using toxics do not participate - Stated aim of virtual elimination of emission of 30 persistent, bioaccumulative and toxic substances and the reduction of another 87 toxic substances to levels insufficient to cause harm - original goals were for the year 2000, but a renewal process for the program has begun - Three "Environmental Leaders" reports published
Canada	Toxic Substances Management Policy http://www.ec.gc.ca/toxics/toxic1_e.html	- life cycle management of toxic substances
Canada	- Federal government sustainable development strategies http://www.oag-bvg.gc.ca/domino/cesd_cedd.nsf/html/deptsd_e.html	- overseen by the Commissioner of the Environment and Sustainable Development
Canada and Ontario	- Canadian Automotive Manufacturing Pollution Prevention Project - Canadian Auto Parts Manufacturing Pollution Prevention Project	- pollution prevention partnerships with 5 industrial sectors and one municipality, aimed at reducing toxics use - annual progress reports
Canada, Ontario and Alberta	- Canadian Chemical Producers Association, Canada, Ontario and Alberta: MOU and Annex on reduction of emissions of volatile organic compounds (VOCs) under CCPA Responsible Care program http://www.ec.gc.ca/nopp/chemical/ccpa/indexe.htm	
Ontario, Canada	Ontario Metal Finishing Pollution Prevention Project	- MOU with metal finishing sector to promote voluntary development of pollution prevention plans and publish progress on toxics use reduction - six progress reports http://www.c2p2online.com/main.php3?section=37&heading=70&resource=105&session=

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Ontario	Canadian Vehicle Manufacturers' Association (CVMA) Project	- First Memorandum of Understanding signed in 1992, with successive agreements signed since then. Goal of verifiable reduction in toxics. - Outreach activities such as pollution prevention workshops - 7 progress reports outlining 138 case studies
Alberta	Pollution prevention program development	- report released in 2000 on a pollution prevention strategy for Alberta
Manitoba	Manitoba Heavy Construction Association http://www.mb.ec.gc.ca/pollution/e00s57.en.html	- industry, federal and Manitoba government partnership - voluntary EMS and audit systems, also accreditation - technical pollution prevention assistance
United States	Project XL http://www.epa.gov/projectxl/	- Federal project started in 1995 designed to provide regulated firms with the option of developing alternative strategies to replace or modify existing regulatory requirements on the condition that they would produce greater environmental benefits.

Technical assistance programs:

These include, for example:

- opportunity assessments - voluntary onsite confidential waste assessments to identify potential waste reduction strategies
- information clearinghouses
- phone hotlines to provide technical pollution prevention information to industry
- computer searches and research to assist industry with information about new technologies, efficient processes, current regulations, etc.

These programs are usually carried out by government agencies, although some jurisdictions also involve universities, NGOs, or local programs

Jurisdiction	Initiative	Description
British Columbia	http://wlapwww.gov.bc.ca/epd/epdpa/industrial_waste/pollution_prvntn/ipphome.html	- Pilot pollution prevention project set up in 1995 and 1996 with six companies as a means of developing a pollution prevention process in B.C. - July 2001 report on Recommendations For Implementing Pollution Prevention Planning For Large Industry In B.C. at: http://wlapwww.gov.bc.ca/epd/epdpa/industrial_waste/pollution_prvntn/P2IACReportFinal1.pdf

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British Columbia	CleanPrint BC http://www.cleanprint.org/bc/html/a_01.htm	- voluntary industry / government group focusing on reduction in use of toxics in printing industry - focus on technical assistance and the development of voluntary pollution prevention plans
Ontario	CleanPrint - MOU agreement covering pollution prevention for printers was renewed to 2001 http://www.cleanprint.org/regional/on/index.html	-technical assistance, education, web site information provision - 3rd progress report in 1999
Atlantic provinces	Atlantic Green Printers Project http://www.gov.ns.ca/enla/rmep/p2/profiles.htm	- technical assistance and education, Internet resources
Saskatchewan	P2 Compliance Assessment with Sask. Printing & Graphics Association http://www.cleanprint.org/regional/sk/index.html	- waste audit / toxics inventory of 12 Sask. printing & graphics businesses
Nova Scotia	Pollution Prevention Implementation Plan http://www.gov.ns.ca/enla/rmep/p2/plan1.htm	- voluntary program including awards, development of pollution prevention projects at provincial facilities, partnerships with industry, and community level pollution prevention projects.
Québec	ENVIROCLUB™	- Trois-Rivières business / government voluntary club to enhance pollution prevention efforts amongst small & medium-sized businesses - workshops, technical assistance with pollution prevention projects and environmental management systems (EMS)
Alabama	Waste Reduction and Technology Transfer Foundation: http://www.wratt.org	- provides on-site, confidential pollution prevention and waste reduction assessment
California	Department of Toxic Substances http://www.dtsc.ca.gov/PollutionPrevention/p2program-overview.html	- A range of pollution prevention programs including technical assistance
Florida	Florida Department of Environmental Protection http://www.dep.state.fl.us/waste/categories/p2/default.htm	- onsite technical assistance from retired engineers, operates a pollution prevention resource centre
Illinois	Illinois Environmental Protection Agency Office of Pollution Prevention http://www.epa.state.il.us/p2/tech-assistance.html	- technical specialists on staff to carry out site visits, student internship program

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Indiana	Indiana Office of Pollution Prevention and Technical Assistance http://www.IN.gov/idem/ctap/index.html	- Compliance and Technical Assistance Program including confidential site visits, phone advice, manuals and guides
Maine	Department of Environmental Protection Office of Pollution Prevention http://www.state.me.us/dep/oia/p2about.htm	- on-site technical assistance, coordinating Total Quality Environmental Management projects with businesses, planning assistance with pollution prevention projects, conducting research on pollution prevention topics for businesses, internship program, providing case studies
Massachusetts	Massachusetts Office of Technical Assistance for Toxics Use Reduction http://www.state.ma.us/ota/ota.htm	- comprehensive on-site assistance, partnerships with industry, universities, other government agencies to promote innovative pollution prevention technologies and practices
Minnesota	Minnesota Technical Assistance Program (MnTAP), University of Minnesota http://www.mntap.umn.edu/	- voluntary pollution prevention technical assistance program operated by the university - site visits, internship program, publishes the Minnesota Guide to Pollution Prevention (P2) Planning
Minnesota	Minnesota Pollution Control Agency P2/Sustainability Program http://www.pca.state.mn.us/programs/p2-s/index.html#overview	- technical assistance - Environmental Innovations program to reward use of innovative environmental technologies / processes - Great Printers project
New Hampshire	New Hampshire Department of Environmental Services Pollution Prevention Program http://www.des.state.nh.us/nhppp/	- technical assistance, onsite assessments, research, case studies, information on vendors and products, phone assistance, case studies
New Jersey	New Jersey Technical Assistance Program for Industrial Pollution Prevention (NJ Institute of Technology) http://www.cees.njit.edu/njtap/	- provides on-site assessments, assists facilities with adopting pollution prevention technologies, provides information
New York	New York Dept of Environmental Conservation Multi-media Pollution Prevention (M2P2) program http://www.dec.state.ny.us/website/ppu/p2proj.html	- ongoing program of multi-media analysis and inspection of selected industrial facilities to evaluate compliance with the law and to identify environmental management improvements
Oregon	Toxics Use / Waste Reduction Assistance Program http://www.deq.state.or.us/wmc/tuwrap.html	- on-site consultations, respond to facility inquiries, provide training, and assist with implementing facility planning and reporting provisions required under the *Toxics Use Reduction and Hazardous Waste Reduction Act*

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Washington	Hazardous Waste & Toxics Reduction Technical Assistance Services http://www.ecy.wa.gov/programs/hwtr/p2/ta.htm	- toxics reduction specialists carry out on-site visits, phone consultations, workshops to assist with pollution prevention - increasing focus on particular sectors through industry sector studies and single industry campaigns
Washington	Toxics Reduction Engineer Efficiency Team (TREE) program http://www.ecy.wa.gov/programs/hwtr/TREE/index.html	- on-site visit by pollution prevention specialist engineers who provide recommendations that can then be implemented on a voluntary basis
Information Clearinghouses:		
Jurisdiction	**Initiative**	**Description**
Canada	Canadian Centre for Pollution Prevention http://www.c2p2online.com/	- Internet-based information clearinghouse - produces newsletters - operates a telephone and e-mail inquiry service
Canada	Canadian Pollution Prevention Information Clearinghouse http://www3.ec.gc.ca/cppic/en/index.cfm	- has over 1200 references on pollution prevention ranging from fact sheets to case studies
United States	EPA Pollution Prevention Information Clearinghouse http://www.epa.gov/opptintr/library/libppic.htm	- nonregulatory information service provided by the EPA
United States	Enviroene program http://www.es.epa.gov	- Central EPA repository for pollution prevention, compliance assurance, and enforcement information and data bases
United States	National Pollution Prevention Roundtable http://www.p2.org/	- primary US state and local officials pollution prevention forum - published 1997 version but is soon to be updated
United States	Great Lakes Regional Pollution Prevention Roundtable http://www.glrppr.org/	
United States	Pacific Northwest Pollution Prevention Resource Center http://www.pprc.org/	
United States	Western Regional Pollution Prevention Network http://www.westp2net.org/	

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United States	There are 9 regional information roundtables / networks in total, including the three listed here. The others are listed at http://www.epa.gov/p2/programs/ppin/directory.htm	
United States	Pollution Prevention Information Network (P2Rx) http://www.epa.gov/p2/programs/ppin.htm	- funded by EPA, this network is made up of the 9 regional centres and functions as a means of sharing technical information among them
Massachusetts	Toxics Use Reduction Institute http://www.turi.org	- P2 Gems Internet search reference for technical, process and materials management information (http://www.p2gems.org/)
Fees / Pollution prevention funds:		
Jurisdiction	**Initiative**	**Description**
Canada	Technology Partnerships Canada http://strategis.ic.gc.ca/SSG/tp00167e.html	- funds development of environmental technologies among other objectives
United States	Pollution Prevention Incentives for States (PPIS) grant program http://www.epa.gov/p2/programs/ppis.htm	- grant program created under the authority of *the Pollution Prevention Act* of 1990 - approximately $5 million of grant money available in FY 2001. - provides matching funds to state and tribal programs to support P2 activities across all environmental media and to develop state P2 programs
Outreach and education activities: These include, for example: ▪ workshops/seminars/training programs for industry and government officials ▪ publications such as guides, newsletters, fact sheets, and reports ▪ grants and loans for educational projects related to pollution prevention		
Jurisdiction	**Initiative**	**Description**
Ontario	Ministry of the Environment Training and education programs including videos, guidebooks, environmental management systems, case studies and codes of management practice.	Pollution prevention planning guide (1995) http://www.ene.gov.on.ca/envision/gp/2586e.pdf

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Illinois	Illinois EPA. Office of Pollution Prevention http://www.epa.state.il.us/p2/educational-outreach.html	Conference, workshops, events, speakers
Indiana	Indiana Office of Pollution Prevention and Technical Assistance	- workshops, educational materials
Massachusetts	Toxics Use Reduction Institute http://www.turi.org	- extensive technical resources on pollution prevention in their library and through their web site - conducts training
Maine	Department of Environmental Protection Office of Pollution Prevention http://www.state.me.us/dep/oia/p2about.htm	- training, pollution prevention finance workshops
Minnesota	Minnesota Pollution Control Agency P2/Sustainability Program http://www.pca.state.mn.us/programs/p2-s/index.html#overview	- training, publications
New Hampshire	New Hampshire Department of Environmental Services Pollution Prevention Program http://www.des.state.nh.us/nhppp/	- publications, workshops, conferences
United States	Most other states provide publications and many provide training and workshops as well.	

Clean production initiatives:

Clean production covers all components of a product from concept to design to manufacturing, and considers the eventual fate of the product rather than dealing with end-of-life products as a waste problem after the fact. The list below is a selection of initiatives only.

Design-for-Recyclability (DfR) Principles:
1. Use recyclable materials
2. Use recycled materials
3. Reduce the number of different materials used within an assembly
4. Mark parts for simple material identification
5. Use compatible materials within an assembly -
6. Make it easy to disassemble (Design for Disassembly) - nuts & bolts preferred to use of adhesives

Jurisdiction	Initiative	Description

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United Kingdom	Clean Production Action Directory of Contacts http://www.cpa.most.org.pl/CP-contact.pdf	- This network published an international directory in October, 1999 called *Towards Clean Production: Contact List* which is one good starting place with many further resources on product design, pollution prevention / cleaner production, and reports on clean production issues. The guide includes contact information and Internet addresses.
Canada	Environment Canada National Office of Pollution Prevention: http://www.ec.gc.ca/nopp/english/index.cfm	- Ecocycle Newsletter on policy and technical issues related to product environmental life-cycle management (LCM) along with a couple of guides to LCM. http://www.ec.gc.ca/ecocycle/english/
Ontario	University of Windsor Environmentally Conscious Design Lab http://zeus.uwindsor.ca/imse/people/ecdm_info.html	- environmentally conscious engineering research and publications, maintains an Internet mailing list on the topic
British Columbia	Ecodesign website: www.ecodesign.bc.ca	- links to sources and information about sustainable design in architecture and interior design
United States	Design for Environment: http://www.epa.gov/dfe/	- voluntary program to encourage the incorporation of environmental considerations into product design
United States	Green Chemistry Program: http://www.epa.gov/opptintr/greenchemistry/	- Voluntary program to promote the reduction of toxics use in the design, manufacture and use of chemical products through research grants, awards, education, conferences and international cooperation
Massachusetts	Toxics Use Reduction Institute: http://www.turi.org/	- Industry Matching Grants Program, which provides direct funding to Massachusetts industries to support the development, use and demonstration of innovative techniques that reduce the use of toxic chemicals or the generation of toxic by-products
Massachusetts	Lowell Center for Sustainable Production http://www.uml.edu/centers/lcsp/	- Associated with the Toxics Use Reduction Institute above. - Develops, studies, and promotes environmentally sound systems of production, and healthy work environments. - Operates the Sustainable Hospitals web site
Michigan	Center for Sustainable Systems, University of Michigan http://css.snre.umich.edu/	- Focuses on life cycle assessment, industrial ecology, product design, sustainability indicators, case studies

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Indiana	Indiana Clean Manufacturing Technology and Safe Materials Institute, Purdue University http://www.ecn.purdue.edu/CMTI/	- 3P2M Indiana Relative Chemical Hazard Score (to rank toxicity of chemicals used in Indiana), information clearinghouse, research, publications on substances such as solvents
Pennsylvania	Carnegie Mellon University Green Design Initiative http://www.ce.cmu.edu/GreenDesign/	- industry and academic partnerships to promote environmentally conscious engineering, design and manufacturing
New York	INFORM Inc. http://www.informinc.org	- nonprofit research institute that publishes research on pollution prevention including chemical hazards prevention
New Jersey	Demanufacturing Partnership Program, Rutgers University http://accounting.rutgers.edu/raw/gsm/dpp/	- research and education on demanufacturing as a means of pollution prevention
California	Consortium on Green Design and Manufacturing, University of California Berkeley http://greenmfg.me.berkeley.edu/green/Home/Index.html	- Academic / industry / government partnerships for research and education on environmental management, design for environment and pollution prevention issues in critical industries
Tennessee	Center for Clean Products and Clean Technologies, University of Tennessee Knoxville http://eerc.ra.utk.edu/clean/	- Research on safe substitutes for the use of toxics in products and industrial processes.
United Kingdom	Clean Production Action http://www.cpa.most.org.pl/documents.html	- This network published an international directory in October, 1999 called *Towards Clean Production: Contact List* which lists many further resources on product design, pollution prevention / cleaner production, and reports on clean production issues. The guide includes contact information and Internet addresses. They also have a *Citizen's Guide to Clean Production*
Europe	European Roundtable on Cleaner Production http://www.lu.se/IIIEE/ercp/	- Annual conferences begun in 1994. 7th Roundtable was held in May 2001 in Lund, Sweden; 8th will be in Cork, Ireland in October 2002 - Consists of workshops, exhibits, panel discussions and debates to foster CP initiatives
Europe	Preventive Environmental Protection Approaches in Europe (PREPARE-NET) http://www.prepare-net.org/	- European network of experts in clean production and sustainable development from government, academic institutions and industry

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The Netherlands	Delft University of Technology Design for Sustainability Program http://www.io.tudelft.nl/research/dfs	- Education, research, and publications on environmental industrial design and engineering
The Netherlands	Reverse Logistics (Take-back technology), Eindhoven University of Technology http://www.logistics.tue.nl/	- process of continuously taking back products and /or packaging in order to avoid incineration / waste disposal
Germany	Wuppertal Institute für Klima Umwelt und Energie http://www.wupperinst.org	- product life cycle, sustainability indicators, resource efficiency
Ireland	Clean Technology Centre (Cork) http://www.ctc-cork.ie/	- not-for-profit partnership between industry and the Cork Institute for Technology - undertakes technical assistance, training and research activities to foster cleaner production
United Kingdom	The Centre for Sustainable Design, Surrey Institute of Art and Design http://www.cfsd.org.uk/	- publishes the Journal of Sustainable Product Design - research on sustainable products and services - training, information clearinghouse
United Nations	UN Cleaner Production Program: http://www.uneptie.org/pc/cp/	- International Declaration on Cleaner Production (voluntary commitment to strategy and practice of CP) - UNIDO / UNEP National Cleaner Production Centres' Network to encourage clean production in developing and transition countries http://www.unido.org/doc/331390.htmls - annual international conferences on CP - Publishes an *International Guide to Clean Production*

Regulatory integration:

Regulatory integration involves the integration of pollution prevention into a broader spectrum of environmental regulatory activity. Examples include:

- Enforcement settlements - use of enforcement action to encourage pollution prevention in order to enable companies to come into compliance, sometimes with lessened penalties
- Permitting - requirement that facilities have pollution prevention plans as part of permitting process
- Compliance inspections
- Integration of pollution prevention into municipal waste management

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Jurisdiction	**Initiative**	**Description**
Illinois	Illinois EPA Office of Pollution Prevention http://www.epa.state.il.us/p2/reg-integration.html	- regular program to integrate pollution prevention into other EPA activities - special regulatory integration projects to address specific issues and / or specific sectors
New York	Multi-media Pollution Prevention (M2P2) Program: http://www.dec.state.ny.us/website/ppu/	- Pollution Prevention Unit of the NY State Department of Environmental Conservation acts to integrate pollution prevention elements into other environmental department activities
Other states also have programs in this area		
Awards programs:		
Jurisdiction	**Initiative**	**Description**
Canada	CCME P2 Awards and Recognition Program	- 5 year award program started in 1997
Ontario	Ontario Pollution Prevention Pledge Program http://www.ene.gov.on.ca/envision/news/041701mba.htm	- recognition and incentive program for companies that achieve reductions in the use, generation and / or release of hazardous wastes and industrial effluents - 150 facilities have participated at at least the level of a public pledge
Connecticut	GreenCircle Award Program http://dep.state.ct.us/grncrc/greencircle.htm	- recognition for activities such as development of a facility-wide pollution prevention program, certification to ISO 14001 or manufacturing process changes that eliminate or significantly reduce use of toxics
Illinois	Governor's Pollution Prevention Awards http://www.wmrc.uiuc.edu/governorsawards/Gov15Information.htm	- given out by the Illinois Waste Management and Research Center
Indiana	5-Star Environmental Recognition Program Governor's Awards http://www.IN.gov/idem/oppta/programs/	- awards for voluntary participation in pollution prevention activities in various sectors, particularly small businesses
New Jersey	Silver and Gold Track Program	- voluntary program for industry with progressively more stringent levels of participation
US - other state programs	Many other states also have Governor's Awards and sometimes additional awards schemes	
Measurement:		

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Jurisdiction	**Initiative**	**Description**
Massachusetts	Toxics Use Reduction Institute http://www.turi.org	- 1990 goal was to cut the quantity of toxic and hazardous waste generated by Massachusetts industries in half by 1997 A 1997 program evaluation of the success of the Toxics Use Reduction Act, covering 1990-1995 data, included: - Three independent studies commissioned for the evaluation: 1. a survey of 1993 firms that filed reports, with 67% responding
Massachusetts	Toxics Use Reduction Institute - http://www.turi.org (continued)	2. an in-depth investigation of TUR at 25 manufacturers 3. a social benefit-cost analysis of the TURA program, including: - An inventory and assessment of the programs and activities that TURA agencies carried out in order to achieve the TURA mandate - Analysis of the TURA data: The 1997 report concluded that there had been quantifiable benefits as a result of the legislation (for the most recent statistics see below). The report also identified areas for further progress, including: - Dealing with barriers to TUR, with company concern about impact on product quality and customers not accepting change in products being the most often cited by survey respondents - the need to reward firms making good progress and to focus efforts on firms that have not made much progress - finding ways to involve small quantity toxics users in similar efforts, and - expanding TUR principles to other areas with health & environmental consequences including water use, energy use, and the impact of the product after manufacture. The results of the annual reports are posted on the Internet at http://www.turi.org/turadata/index.html and allow data to be searched by individual facility, chemical, or community. From 1990 to 1999:

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		- When the 1999 reported data has been adjusted for production, TURA filers have decreased their toxic chemical use by 41% - Filers are generating 57% less byproducts or waste per unit of product and have reduced releases of TRI reported on-site chemicals by 87% (also adjusted for increase in production). - Quantities of chemicals shipped in product have varied over the past years, with an overall production adjusted reduction of 55% since 1990.
New York	Department of Environmental Conservation Pollution Prevention Unit http://www.dec.state.ny.us/website/ppu/p2oeca.html	Measuring Compliance Assistance Outcomes in New York State project (2001): '- Goal is the development of an infrastructure to be used by the Pollution Prevention Unit (P2 Unit) to measure the impact of its compliance and technical assistance activities on the regulated community and the environment. - Techniques are to include developing appropriate output and outcome measures, collection of metrics data/information, and enabling the transference of the outcome metrics system and metrics data to others

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Method / Technique I: Source reduction:

In a review of sewage sludge regulation in Ontario, the 2000/2001 annual report of the Environmental Commissioner of Ontario, stated:

> "The most common fate of hazardous and industrial wastes is to be poured into municipal sewer systems, and to end up in sewage treatment plants. "

Because of this, the source reduction and waste segregation measures proposed for avoiding releases from hazardous waste, municipal solid waste, and medical waste incineration would have the added benefit of reducing contamination of sewage sludge. For example, if mercury is eliminated from hospitals, it will also be eliminated from the wastewater coming from hospitals.

Accordingly, for additional initiatives and provisions related to this method, see measures listed under "source reduction" in the other three incineration tables.

Jurisdiction:	Regulatory and other initiatives:	Description / Provisions:
European Union	European Commission. Working Document on Sludge: 3rd Draft (April 2000): http://europa.eu.int/comm/environment/sludge/report10.htm	- Includes a section on the need for pollution prevention as a means of dealing with sludge, through actively reducing pollution in wastewater. - This would involve drawing up detailed plans for reducing the amount of potentially hazardous substances, materials, and elements or compounds that end up in sewers and therefore in sewage sludge because of their presence in cleaning products, detergents, cosmetics, medicine, animal fodder, pipes, amalgam fillings, and others. These plans should aim at: ▪ reducing the quantities of these substances, elements or compounds that end up in sewage sludge so that limits to heavy metals and organic compounds can be met ▪ maximizing the higher-quality sludge and minimizing overall quantities of heavy metals and organic compounds ▪ informing consumers of the products, substances or materials that could end up in the sewer and how to dispose of them in a way that doesn't pollute wastewater.

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Method / Technique II: Waste Segregation

The intractable nature of the problem of what to do with sewage sludge centres on the fact that an organic and recyclable waste stream is being combined with industrial and other hazardous waste streams. In the long run, therefore, in addition to source reduction, pollution prevention would be best undertaken by segregating these waste streams. There are no jurisdictions that currently manage to entirely separate the two waste streams, but it should still be stated because the existing ways of dealing with sewage sludge in the absence of complete segregation - basically incineration, landfill, and land application - all have serious shortcomings from an environmental standpoint.

Alternative technologies for treating sewage as a separate waste stream currently do exist, such as through wetlands management or the use of composting toilets, but the use of these measures to date has been on a relatively small scale. (e.g., Body Shop in Toronto & UBC Asian Studies building)

Sewer use legislation is the primary means of regulation to keep toxics from polluting wastewater.

As with Method I above, waste segregation measures will reduce the quantities of contaminants entering wastewater:

For additional initiatives and provisions related to this method, see measures listed under "waste segregation" in the other three incineration tables.

Jurisdiction	Initiative	Description
Toronto	Toronto Municipal Code Chapter 681 and by-law amendment 01-0081: http://www.city.toronto.on.ca/involved/wpc/nbylaw.htm	- limits on substances discharged into sewers - requirement for pollution prevention by industries discharging subject pollutants
Massachusetts	The Massachusetts Water Resources Authority (MWRA): http://www.mwra.state.ma.us/	- prohibits the discharge of mercury by industrial facilities to its sewer system and imposes an effective discharge limitation for mercury of 1.0 part per billion (ppb) from its regulated sources, including hospitals and institutions
Massachusetts	Municipal Waste Combustor Rule, 310 CMR 7.08 (1999): http://www.state.ma.us/dep/bwp/hgres.htm	- currently working on regulations requiring separation plans for the removal of mercury from medical waste incinerators and sewage sludge incinerators.

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Method / Technique III: Land application of Sewage Sludge

As jurisdictions move away from incinerating sewage sludge, the most frequently adopted alternative is land application, which has become a major alternative to incineration throughout North America and Europe. However, there is increasing uncertainty about the environmental and health effects of heavy metals, pathogens, and organic compounds on agricultural and other lands. There is also concern about the environmental impacts of sludge runoff into waterways.

<table>
<tr><th>Jurisdiction</th><th>Initiative</th><th>Description</th></tr>
<tr><td>European Commission</td><td>Process to tighten the standards for sewage sludge in the current Directive on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture (86/278/EEC)

For more information, see "Disposal and recycling routes for sewage sludge. Part 2 - Regulatory report" (October 2001) at: http://europa.eu.int/comm/environment/sludge/sludge_disposal.htm</td><td>European measures for controlling sewage sludge:

- Limit values for heavy metals in sludge

- Limit values for pathogens in sludge

- Limit values for organic compounds in sludge

- Limit values for soil for application

- Obligations for treatment

- Surfaces on which use of sludge is prohibited

- Frequency of sampling analysis

- Further quality related restrictions such as certification and information requirements, codes of practice and guides, voluntary agreements on disposal and recycling of sewage sludge

- Labelling distinguish treated, higher-quality sludge

- Specific requirements for use of sludge in silviculture, forest, and reclamation and green areas</td></tr>
<tr><td>Denmark:

- one of the more stringent European countries in terms of the regulatory framework for land application of sewage sludge

Other countries with stringent regulations include Finland, Sweden, and the Netherlands</td><td>Three Statutory Orders govern sludge:

• SO 2000/49 on Application of Waste Products for Agricultural Purposes (2000)

• SO 590 of 27.6.94 on the Protection of the Environment

• SO/2000/56 on describing control of sewage sludge for agricultural use

http://europa.eu.int/comm/environment/waste/landspreading_annexes1.pdf</td><td>1. SO 2000/49 (and SO 1996/823):
- determines the limit values for heavy metals in sludge. For example, compared to Directive 86/278/EEC, Denmarks limits are up to 25 x lower:

<table><tr><th>Substance</th><th>EU Directive mg/kg DM (dry matter)</th><th>Denmark mg/kg DM (dry matter)</th></tr><tr><td>Cadmium</td><td>20-40</td><td>0.8</td></tr></table></td></tr>
</table>

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		Mercury	16-25	0.8
		Nickel	300-400	30
		Lead	750-1200	120 (60 for private gardens)
		Zinc	2500-4000	4000
		Chromium	-	100
		Copper	1000-1750	1000
		Arsenic	-	25 (for private gardens)
		Source: EC. Disposal and recycling routes for sewage sludge, part 2, p. 14		
		http://europa.eu.int/comm/environment/sludge/sludge_disposal.htm - sets the maximum quantity of sludge to be spread on land at 10 tonnes of dry matter per hectare per year - for advanced treated sludge, there must be no salmonella and faecal streptococci must be below 100 per g. - Limit values for organic compounds in sludge for agricultural use including limits on DEHP, PAHs (8 elements), NPE (Nonylphenole (+ Ethoxylates)) and LAS (Linear alkylbenzene sulphonates) - Prohibits the agricultural use of untreated sewage sludge and requires different levels of treatment for different sludge sources, and for different agricultural uses.		
		- Prohibits application of sludge to surfaces where it is likely to run off into lakes, watercourses or drains; surfaces where it is likely to pollute groundwater; and surfaces where it is likely to cause significant nuisances or unsanitary conditions. - Heavy metal concentrations in sludge must be analysed by wastewater treatment plants every 3 months; and organic compounds must be analysed every 12 months. - Wastewater treatments must provide information and an annual report to regional councils every year - Sludge can be applied in forests under certain conditions; and sludge used in green areas must be pasteurised.		

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Sweden, Denmark, Netherlands	- Policies of no net degradation	- limiting inputs to the soil so they do not exceed outputs in order to prevent the accumulation of pollutants in the soil. This approach strives to limit the addition of contaminants to the levels that are present in uncontaminated soils.
British Columbia	*Organic Matter Recycling Regulation* (OMRR): http://wlapwww.gov.bc.ca/epd/epdpa/mpp/omrreg.html	- comparably high limits for toxics - no limits on frequency of application - limited monitoring
Ontario	Guidelines for the Utilization of Biosolids and Other Wastes on Agricultural Lands (March 1996) http://www.ene.gov.on.ca/envision/gp/3681e.pdf *Nutrient Management Act* (Bill 81): http://www.ontla.on.ca/library/bills/81372.htm	- not enforceable - recommendations, no measurable conditions - use of terms like "acceptable level" and "high concentrations" without quantification of these terms - 2000/2001 ECO report found "significant weaknesses in the current legislation and practices governing the land spreading of sludges and septage". - the effectiveness of the recent *Nutrient Management Act* proposed as a solution to this will depend on the regulations developed under the Act
Ontario	Internal review of policies regarding the land application of sewage sludge via a formal *EBR* consultation by MOE in conjunction with MMAH and OMAFRA.	
United States	EPA s reviewing the consequences of land application, and the National Academy of Science is undertaking a study of the risks involved	
United States	EPA Proposed Rule Revising the Standards for Use and Disposal of Biosolids (40 CFR part 503): http://www.epa.gov/ost/biosolids/rule.pdf	- Limit values for heavy metals are generally considerably higher than in Europe.

Selected Bibliography of Sewage Sludge Resources:

Legislation:

British Columbia. Ministry of Environment, Lands and Parks, Organic Matter Recycling Regulation (OMRR), http://wlapwww.gov.bc.ca/epd/epdpa/mpp/omrreg.html

Ontario. Ministry of the Environment. Guidelines for the Utilization of Biosolids and Other Wastes on Agricultural Land, March 1996.
http://www.ene.gov.on.ca/envision/gp/3681e.pdf

Ontario. *Nutrient Management Act, Bill 81*
http://www.ontla.on.ca/library/bills/81372.htm

City of Toronto. Sewer Use By-law. Municipal Code Chapter 681 and By-law amendment 01-0081.
http://www.city.toronto.on.ca/involved/wpc/nbylaw.htm

United States. Environmental Protection Agency. Proposed Rule Revising the Standards for Use and Disposal of Biosolids. [40 CFR Part 503].
http://www.epa.gov/ost/biosolids/rule.pdf

European Commission. Council Directive 86/278/EEC of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture.
http://europa.eu.int/eur-lex/en/lif/dat/1986/en_386L0278.html

European Commission. DG Environment; prepared by Arthur Andersen. Disposal and recycling routes for sewage sludge. Part 2 - Regulatory report. [Contains summaries of the sewage sludge regulatory framework in each EU country]. October 2001.
http://europa.eu.int/comm/environment/sludge/sludge_disposal.htm

Reports:

Cornell Waste Management Institute, Cornell University Center for the Environment. Ellen Z. Harrison, Murray B. McBride and David R. Bouldin. The Case for Caution: Recommendations for Land Application of Sewage Sludges and an Appraisal of the US EPA's Part 503 Sludge Rules: Working Paper, revised 1999 ed.
http://www.cfe.cornell.edu/wmi/PDFS/LandApp.pdf

European Commission. DG Environment; prepared by Arthur Andersen. Disposal and recycling routes for sewage sludge. Part 1 - Sludge use acceptance report. [Contains an analysis of attitudes to sludge in each EU country]. October 2001.
http://europa.eu.int/comm/environment/sludge/sludge_disposal.htm

U.S. EPA. Office of Water. Technical Support Documents and External Peer Review Comments to support the development of a final EPA action on the land application of sewage sludge regarding dioxins.
All are at http://www.epa.gov/waterscience/biosolids/support.html:

Exposure Analysis for Dioxins, Dibenzofurans, and Coplanar Polychlorinated Biphenyls in Sewage Sludge- Technical Background Document Including Appendices. External Peer Review Draft.
Appendices. November 30, 2001

Risk Characterization of "Exposure Analysis for Dioxins, Dibenzofurans, and Coplanar Polychlorinated Biphenyls in Sewage Sludge- Technical Background Document Including Appendices". External Peer Review Draft. December, 2001.

"Estimate of Population Exposed to Dioxins from the Land Application of Sewage Sludge and Corresponding Number of Annual Cancer Cases from this Exposure". External Peer Review Draft.

PART 6: INVENTORY OF POLLUTION PREVENTION OPTIONS FOR BIOMEDICAL WASTE INCINERATION

Method / Technique I - Source Reduction Measures: Mercury

Jurisdiction	Initiative	Description
Individual hospitals in Ontario	Healthcare Memorandum of Understanding Regarding Mercury. (April 1996 - signed by the Centenary Health Centre, Hospital for Sick Children, The Toronto Hospital (now the University Health Network), and the Health Care Environment Network, along with Pollution Probe, Environment Canada, and the Ontario Ministry of the Environment and Energy More hospitals including North York General Hospital, St. Mary's (Kitchener) and Cambridge Memorial have since pledged to become mercury-free Information on individual hospitals at: http://www.c2p2online.com/main.php3?session=&section=88&doc_id=174	- pledge to voluntarily reduce and eliminate the use of mercury in hospitals - Cambridge Memorial's program has included a mercury audit, in-service education, ongoing measures to phase out mercury-containing products - Hospital for Sick Children replaced 40,000 lamps containing mercury and reduced the use and purchase of mercury-containing processes and medical equipment - University Health Network - Under their Mercury Management Program, non-mercury alternatives are now regularly purchased for thermometers, sphygmomanometers, and esophageal dilators and the continued expansion of product substitution is planned. - St. Mary's Hospital has replaced mercury-containing blood pressure cuffs with non-mercury substitutes - Orillia Soldiers' Memorial Hospital has reduced mercury by 90% since signing the MOU in 1997. - A survey of current mercury reduction initiatives in Ontario hospitals (2000): http://www.c2p2online.com/documents/EC-Health-survey.pdf
United States	Memorandum of Understanding between the U.S. EPA and the American Hospital Association (1997): http://www.epa.gov/glnpo/toxteam/ahamou.htm	Commitment to "virtually eliminate" mercury-containing waste by 2005
California	California Statutes 2001, ch. 656 *California Mercury Reduction Act, 2001* http://www.leginfo.ca.gov/statute.html	- Restricts use and distribution of mercury fever thermometers
Indiana	HB 1901: An Act to amend the Indiana Code concerning environmental law (July 2001): http://www.noharm.org/library/docs/Indiana_Mercury_Law_House_Bill_1901.htm	- Limits sale of mercury fever thermometers
Maine	Maine Pollution Prevention Agreement with the Maine Hospital Association (March 2001): http://www.state.me.us/dep/ppagree.htm Facility-specific agreement:	- institute purchasing programs that eliminate the use of mercury-added and mercury-formulated products, and substituting mercury-free products wherever possible - replace mercury-free thermometers - recycle

	http://www.state.me.us/dep/facspecppagree.htm Note: The Canadian Coalition for Green Health Care Briefing Document recommends implementing a similar agreement to the Maine one in Ontario.	existing ones - replace mercury-containing diagnostic & treatment equipment with mercury-free alternatives - replace batteries with mercury-free ones & recycle mercury-added ones - replace mercury-added switches, thermostats, and industrial thermometers with mercury-free alternatives & recycle existing ones - replace mercury-added and mercury-formulated cleaners & degreasers with mercury-free ones - train staff to segregate all mercury-containing wastes so that all waste streams are mercury-free
Maine	LD 1665: An Act to Further Reduce Mercury Emissions from Consumer Products (June 2001): http://janus.state.me.us/legis/bills/billtexts/LD166501-1.asp	- Bans sale of mercury fever thermometers - Requires manufacturers who sell products to hospitals to provide a certificate of mercury content upon hospital request
Maryland	HB 75 Environment - Mercury and Products That Contain Mercury (May 2001): http://mlis.state.md.us/2001rs/billfile/HB0075.htm	- Ban on sale of mercury fever thermometers as of October 2002 except for special circumstances
Massachusetts	House Bill 2217/4717: An Act Regulating Products Containing Mercury (pending): http://www.state.ma.us/legis/bills/house/ht04717.htm	- As of November 5, 2001, Bill 2217 had been amended, and the new draft bill 4717, relating to mercury reduction and education is still in progress. - Would require product stewardship and labelling of all mercury-containing products - Requires manufacturers to disclose the mercury content of products used in hospitals on request - Mandates labelling of mercury-added products
Minnesota	SF 70, HF 274 An act relating to the environment; restricting the sale of mercury thermometers; amending Minnesota Statutes 2000, section 116.92, subdivision 6. (April 2001): http://www.revisor.leg.state.mn.us/slaws/2001/c047.html	- Prohibits sale or distribution of mercury fever thermometers
New Hampshire	HB 1418 An Act Relative to Mercury Containing Products (June 2000): http://www.gencourt.state.nh.us/legislation/2000/HB1418.html	- Prohibits the sale of certain mercury-added products; - Establishes notification and disclosure requirements for permissible mercury-containing products; - Establishes limitations on the use of elemental mercury;

Oregon	HB 3007: The *Oregon Mercury Reduction Act* (2001): http://www.leg.state.or.us/01reg/measures/hb2800.dir/hb2816.intro.html	- Phases out the use of mercury thermostats - Prohibits the sale of mercury fever thermometers as of July, 2002 - Prohibits the sale of mercury-containing novelties as of January, 2002
Rhode Island	S 0153: An Act Relating to Health and Safety. Chapter 24.8 Mercury Fever Thermometers (July 2001): http://www.noharm.org/library/docs/Rhode_Island_Mercury_Thermometer_Law_S0153.htm	- Prohibits the sale of mercury fever thermometers
U.S. cities including Chicago, Duluth, Freeport (ME), Boston, Ann Arbor, San Francisco, others.	Local ordinances Examples at: http://www.noharm.org/index.cfm?page_ID=14	- Ban on mercury fever thermometers - "In the year 2000, 17 tons of mercury from thermometers alone will be disposed as municipal waste in the United States, and in many cases will be incinerated and end up in the food chain, so this step alone is a significant one" (source: "Administrator of EPA New England Calls on New England Communities to Ban Mercury", http://www.epa.gov/region1/pr/files/113000a.html)
Various jurisdictions	Detailed guides for medical facilities concerned with implementing source reduction measures for toxic substances. (see list under voluntary pollution prevention guides below)	Measures such as: - Identification of sources of mercury in hospitals - Best management practices tools to identify priority techniques / product substitutes - Green procurement policies - Product databases: ▪ Sustainable Hospitals has an Internet-based database of alternatives to mercury-containing products (www.sustainablehospitals.org) ▪ MASCO (Medical, Academic and Scientific Community Organization, Inc.) has tested many health care and laboratory products for mercury content and has a searchable mercury-containing products database and has information on mercury-free alternatives http://www1.netcasters.com/mercury/ - Development of effective mercury spill response programs - Staff education and training on proper treatment of mercury-containing substances

Method / Technique II- Source Reduction Measures: Dioxins And Furans		
Jurisdiction	**Initiative**	**Description**
United States	1997 - Memorandum of Understanding between the U.S. EPA and the American Hospital Association: http://www.epa.gov/glnpo/toxteam/ahamou.htm	Commitment to minimize the production of PBT pollutants
New Hampshire	Dioxin Reduction Strategy (February 2001): http://www.des.state.nh.us/ard/dioxin/strategy.pdf	New Hampshire Dioxin Reduction Strategy recommendations: - draft legislation by November 2001 to come into force by 2002 banning the construction of medical waste incinerators in New Hampshire and phasing out operation of existing incinerators by 2010 - virtual elimination of all PVC-containing products from the medical waste stream by 2005 - draft legislation by November, 2001 to come into force by 2005 to prohibit the disposal of PVC-containing products and materials in medical waste incinerators - change solid waste rules to ban the incineration of residues from medical waste treated by non-incineration technologies - labelling of all PVC products by January 2002
Maine	Maine Pollution Prevention Agreement with the Maine Hospital Association (March 2001): http://www.state.me.us/dep/ppagree.htm	- Goal of continuously reducing the use and disposal of PVC plastic in hospitals - Goal of continuously reducing the use of other chlorinated compounds such as chlorinated solvents (replace with non-chlorinated ones), sodium hypochlorite bleach (non-chlorinated bleaches), bleached paper products (chlorine-free / unbleached), any other chlorinated compounds found in use through auditing
Maine	LD 1543*: An Act to Reduce the Release of Dioxin from Consumer Products into the Environment* (May 2001) janus.state.me.us/legis/bills/billtexts/LD154301-1.asp	- measures to avoid incineration of PVC products - state government to purchase alternatives to PVC products - consumer education about burning PVC products
European Union	European Commission Green Paper on PVC (July 2000): http://europa.eu.int/eur-lex/en/com/gpr/2000/com2000_0469en01.pdf	- called for a strategy to substitute alternative non-PVC products especially for products directly linked to human health
Sweden	Swedish Chemical Policy Committee (1997)	- As soon as possible and no later than 2007, PVC plastic materials are to be substituted by materials that are environmentally compatible in the long term

Various jurisdictions	Detailed guides for medical facilities concerned with implementing source reduction measures for toxic substances. (see list below).	- green procurement policies - replacing disposable PVC products with reusable non-PVC products

Method / Technique III: Waste Stream Segregation And Minimization:

The percentage of medical waste that is regular waste has been estimated to be about 80%. For this waste, appropriate pollution prevention options would be the same as those listed in the municipal solid waste section above, including measures to reduce paper and packaging material, composting organic food waste, purchasing products with recycled content, recovering silver from photographic chemicals, etc.

Medical waste can be segregated into:
- potentially infectious waste
- hazardous waste
- low-level radioactive waste
- regular waste

Each separate category of waste should be handled in the most environmentally appropriate manner. This is crucial to avoid contamination of medical waste by hazardous materials and to avoid over-classification of waste that occurs when mixed waste must all be treated at the level of the most contaminated elements. Many hospitals used to incinerate all waste streams indiscriminately. However, only 1-2% of medical waste is estimated to be pathological waste such as body parts and chemotherapy wastes, and according to Health Care Without Harm, even this waste can be effectively treated using non-incineration methods.

According to a recent Canadian Medical Association Journal article, "A 1993 study by the Ontario Ministry of the Environment found that 10% of the 150 000 tonnes of waste produced by the province's hospitals each year was handled as biomedical waste (Ontario Ministry of the Environment. A strategy for the development of new biomedical waste management facilities in Ontario. Toronto: The Ministry; 1992) but a subsequent study revealed that 39% of it was ordinary waste that needed no special treatment (Ontario Ministry of the Environment and Energy. Evaluation of biomedical waste generated in Ontario. (Toronto: The Ministry; 993)." (Sibbald, Barbara. "Crackdown on hospital incinerators coming soon*". Canadian Medical Association Journal* 2001, v. 164 (4), p. 533.http://www.cma.ca/cmaj/vol-164/issue-4/0533b.htm)

Jurisdiction	**Regulatory or other measure:**	**Description / Provisions:**
Ontario - Individual hospitals	Accreditation - in this case voluntary but could be a requirement.	- Cambridge Memorial Hospital was the first hospital in North America to achieve ISO 14001 certification for its environmental management system.
Ontario - Individual hospitals	Voluntary measures to reduce the total waste stream	Hospital for Sick Children: - waste audit showed that 20 products generated 80% of waste and that 80-90% of the biomedical waste stream was composed of items that didn't need to be there - developed waste management guidelines for each waste stream - achieved an 80% reduction in biomedical waste volumes and a 78% increase in recycling, and since 1992 has reduced waste management costs from $560,000 to $107,000 for a savings of $453,000 - staff training on environmental policies; handling of mercury spills

		Cambridge Memorial Hospital: - 40% increase in recycling materials collected in 1999; 20% further increase in 2000 - 21% reduction in biomedical waste generated in 1999 St. Mary's Hospital (Kitchener, ON): - reduction in the amount of biomedical waste by 25% from 1999-present through waste segregation - increase in recycling by 33% from 1999 Environmentally progressive U.S. hospitals such as Beth Israel in New York City or the Albany Medical Center have had similar success with waste segregation.
United States	- MOU between the EPA and American Hospital Association (1997)	- Commitment to reduce total waste by 1/3 by 2005 and 50% by 2010
Various jurisdictions	Guides for medical facilities on ways to implement waste segregation measures.	

Method / Technique IV - Non-Incineration Technologies For Remaining Pathological Wastes Only:

Non-incineration technologies:

Use of these is primarily voluntary, although plans by New Hampshire and several municipalities to phase out all medical waste incineration would encourage the use of non-incineration methods, rather than simply sending the waste to other jurisdictions.

Note on non-incineration technologies:

According to a recent Health Care Without Harm report, there is no ideal alternative. The various non-incineration methods reduce emissions of dioxins and other contaminants to air, although they may still generate some toxic emissions. Each method has particular benefits and drawbacks, so it is very important that medical facilities have the opportunity to make informed decisions.

A key element is that these technologies should be used *only* for those materials that cannot be reduced or treated in other ways. This consists of the potentially infectious waste that comprises a very small percentage of the waste stream (1-2%). Non-incineration technologies need to be used in conjunction with a program of waste segregation and waste minimization measures.

Non-incineration methods include thermal processes (from low heat to high heat), chemical processes, biological processes, irradiation, and mechanical processes such as shredding (usually combined with other processes). All of these technologies are currently in commercial use. For more information, see the Health Care Without Harm report "Non-incineration Technologies for Medical Waste", October 2001, http://www.noharm.org/index.cfm?page_ID=10 for a discussion of the various methods and their pros and cons, and a listing of specific vendors and manufacturers.

Jurisdiction	Initiative	Description
Ottawa - Ottawa Hospital	- Voluntary measure	- Replacement of on-site incinerator with two hydroclave devices
New Hampshire	- New Hampshire Dioxin Reduction Strategy	- Recommended ban on construction of new medical waste incinerators by 2002 and an end to all medical waste incineration in New Hampshire by 2010 would encourage the use of non-incineration alternatives.

Selected Resources on Alternatives to Medical Incineration:

Healthcare EnviroNet. A Resource Guide to Pollution Prevention in the Health Care Sector. Revised ed. Sarnia, ON: Canadian Centre for Pollution Prevention, 2001. 150 p.

Mercury Source Reduction:

Environment Canada and U.S. EPA. Binational Toxics Strategy Mercury Workgroup: Links page:
http://www.epa.gov/Region5/air/mercury/reducing.html#canada

Environmental Working Group / The Tides Center. Protecting By Degrees: What Hospitals Can Do To Reduce Mercury Pollution. Washington, DC, 1999. 34 p.
http://www.noharm.org/library/docs/Protecting_by_Degrees_2.pdf

Hospitals for a Healthy Environment (partnership between the U.S. EPA and the American Hospitals Association). Mercury Waste Virtual Elimination Model Plan. 2000. 184 p.
http://www.h2e-online.org/htm/files/mercurywaste.pdf

Medical Academic and Scientific Community Organization, Inc (MASCO). Mercury Management Guidebook. Boston, MA: MASCO, May 1999.

National Wildlife Federation. Great Lakes Field Office; Guy Williams. Mercury Pollution Prevention in Healthcare: A Prescription for Success. Ann Arbor, MI: NWF, July 1997. 25 p.
www.nwf.organization/greatlakes/resources/mercury.html

Terrene Institute. The Case Against Mercury: Rx for Pollution Prevention. Washington, DC, 1995.
www.terrene.org

Additional Canadian Resources:

Canadian Coalition for Green Health Care; Dr. Trevor Hancock. Doing Less Harm: Assessing and Reducing the Environmental and Health Impact of Canada's Health Care System. Toronto, ON. November 2001. 70 p.
http://www.greenhealthcare.ca/reports.htm

Canadian Coalition for Green Health Care. Green Hospitals: Success Stories of Environmentally-Responsible Health Care. Toronto, ON. October 2001. 24 p.
http://www.greenhealthcare.ca/reports.htm

Canadian Coalition for Green Health Care and Health Care Without Harm. Mercury Thermometers and your Family's Health. (brochure). 2001:
http://www.greenhealthcare.ca/documents/Canadian%20HTH-mercurybrochure.pdf

Ontario. Guideline C-4 The Management of Biomedical Waste in Ontario:
http://www.ene.gov.on.ca/envision/gp/C4.pdf

Other:

Health Care Without Harm. Non-Incineration Medical Waste Treatment Technologies: A Resource for Hospital Administrators, Facility Managers, Health Care Professionals, Environmental Advocates, and Community Members. Washington, DC, August 2001. 105 p.
www.noharm.org

Maine. LD 1665: An Act to Further Reduce Mercury Emissions from Consumer Products
http://janus.state.me.us/legis/bills/LD.asp?LD=1665

Maryland. HB 75: An Act relating to Mercury and Products That Contain Mercury
http://mlis.state.md.us/2001rs/billfile/hb0075.htm

Maine Department of the Environment and Maine Hospitals Association. Maine Pollution Prevention Agreement. March 2001.
http://www.state.me.us/dep/ppagree.htm

Massachusetts. House no. 3772: An Act Further Regulating the Sale of Mercury Thermometers.
http://www.state.ma.us/legis/bills/house/ht03772.htm

Massachusetts. House no. 2217: An Act Regulating Products Containing Mercury.
http://www.state.ma.us/legis/bills/house/ht02217.htm

New Hampshire. HB 1418: An Act Relative to Mercury Containing Products
http://www.gencourt.state.nh.us/legislation/2000/HB1418.html

New Hampshire Department of Environmental Services. The New Hampshire Dioxin Reduction Strategy. February 2001. 64 p.
http://www.des.state.nh.us/ard/dioxin/strategy.pdf

Organizations:

Canadian Association of Physicians for the Environment:
www.cape.ca

Canadian Coalition for Green Healthcare:
http://www.greenhealthcare.ca/index2.htm

Healthcare Environet (Canadian Centre for Pollution Prevention):
http://www.c2p2online.com/main.php3?section=83&doc_id=169

Toronto Environmental Alliance:
http://www.torontoenvironment.org/campaigns/campaigns-hc.html

Pollution Probe, Mercury Reduction Program:
http://www.pollutionprobe.org/merc/merc.htm

Health Care Without Harm:
www.noharm.org

Hospitals for a Healthy Environment (American Hospitals Association / U.S. EPA partnership):
www.h2e-online.organization/home.htm

Physicians for Social Responsibility:
www.psr.org

Sustainable Hospitals Project:
Database of many product alternatives (U.S.-based)
www.sustainablehospitals.org

Part 7: Findings

Municipal Solid Waste Incineration

Hazardous Municipal Waste
The municipal waste stream contains substantial quantities of hazardous wastes from the household, commercial, institutional, and industrial sectors. This includes wastes contaminated with mercury (e.g., some batteries, fluorescent lamps, thermometers, some paints, and pharmaceuticals) and materials that create dioxins and furans when they are burnt (e.g., bleaches, cleaning products, solvents, and pesticides).

Source reduction in addressing these wastes has taken two forms:

- Reformulating products to eliminate or reduce the toxic component. For example, there have been substantial reductions in the amounts of mercury in batteries over the past decade.
- Retrieving toxic-bearing products before they get into the waste disposal stream. Household hazardous waste programmes exist in most communities to encourage people to take their hazardous products to a special depot. In some jurisdictions, these are municipally owned, operated and financed. In other jurisdictions, extended producer responsibility programmes have been set up through which manufacturers, distributors, and/ or sellers of the products take responsibility for the retrieval systems. In some cases, these producer stewardship programmes are required by regulations (e.g., B.C.); in other cases, they are voluntary programmes (e.g., the take-back programme of Rechargeable Battery Recycling Corporation).

PVC Waste
Numerous programmes are being developed and implemented to address these kinds of wastes, especially in Europe. Maine has the most extensive programme in North America aimed at removing PVC waste from the municipal waste incineration stream. The goal of this programme is to “reduce the release of dioxin from consumer products.” The legislation discourages the burning of PVC waste in favour of landfill disposal.

Producer Stewardship
Numerous programmes are now being set up requiring the producers of products to take responsibility for the products that they create and sell. These are particularly focussed on vehicles, electronics, and tires, as well as items that are usually defined as household hazardous wastes, which were discussed under municipal hazardous waste.

Waste Reduction
Since the products containing dioxin and furan precursors are so widespread, a major focus in reducing the release of dioxins and furans is on reduction or elimination of municipal waste disposal in incinerators or landfills. To this end municipalities are setting up waste diversion programmes, including reduction, reuse, recycling and composting programmes. As of 1998, Canada-wide approximately 30% of garbage was being diverted from disposal.

Several municipalities have set a long-term goal of achieving zero waste. Some municipalities have already made substantial progress towards this goal. For example, in 2000, Halifax diverted 60% of the municipal solid waste in its community from disposal (incineration and landfill). In 1999, 55% of municipal solid waste in Edmonton was diverted from disposal.

Hazardous Waste Incineration

The pollution prevention approach to hazardous waste incineration is focused on toxics use reduction programmes. These programmes are not primarily aimed at avoiding incineration through commercial hazardous waste incinerators. They are much broader – aimed at avoiding health problems in the workplace, and releases of toxics from a facility into the air, water or onto the land. Nevertheless toxics

use reduction programmes are the most effective pollution prevention approach for hazardous waste incinerators by reducing the amounts of hazardous materials being sent to these facilities.

Toxics use reduction legislation exists in many jurisdictions. For example, approximately 30 states in the United States have passed such legislation. Common components in these programmes include:

- Jurisdiction-wide targets for reduction in the use of toxics and/or reductions in hazardous waste generation,
- Requirements for the development and implementation of toxics use reduction plans for specified facilities,
- Agencies and clearinghouses set up specifically to help educate toxics users on how they can reduce their use of toxic substances,
- Training programmes for facilities using toxic substances
- Funds to help facilities implement their plans, and
- Awards programmes.

Often governments that don't have specific toxics use reduction legislation do have activities that implement certain components in the above list.

Sewage Sludge Incineration

Mercury Releases
As with other forms of incineration, the primary focus in reducing the release of mercury from sewage sludge incinerators is source reduction. This means working to ensure that those materials that contain mercury are kept out of the system by not having them go into the sewage collection system. The most effective way to avoid this is by eliminating the use of mercury-containing items by the users of the sewage system.

The Western Lake Superior Sanitary District, whose sewage treatment plant is located in Duluth, Minnesota, has the broadest programme focussed on achieving zero discharge of mercury in the effluent and sewage sludge that comes from its treatment plant. The WLSSD has put a major emphasis on working with sectors in the community such as dentists, medical and university laboratories, and industries such as the pulp and paper industry to eliminate the sources of mercury in their operations and to recycle those streams where mercury cannot be eliminated. For example, they found that a pulp and paper mill was releasing mercury to the sewage system. They worked with the company to trace down the source of mercury in the plant and found it was coming from the sulphuric acid that the company bought as a processing agent from a lead smelter. As a result, the company found another source of sulphuric acid, which resulted in a 98% decrease in mercury in the mill's effluent. The WLSSD also assessed its own processing chemicals for mercury contamination and, as a result, made changes in their processing agents.

Dioxin and Furan Releases
The two main ways in which municipalities try to avoid the release of dioxins and furans through sewage sludge incinerators are through sewer use by-laws restricting discharges into sewers and through closing down their sewage sludge incinerators.

It is becoming increasingly common for municipalities to have sewer use by-laws that put limits on the concentrations at which substances can be discharged into the sewer system. Most of these do not actually ban discharges, but rather put concentration limits on them. This means that they can be quite effective at reducing the quantities of chlorine-bearing substances reaching the sewage treatment plant and thus ending up in the sludge but do not eliminate them. As a result there are likely to still be substantial quantities of substances that can create dioxins and furans when they are burnt going into sewage sludge incinerators.

Increasingly, municipalities are closing down their sewage sludge incinerators to avoid pollution problems. Instead, the sludge is used as a nutrient by spreading it on agricultural fields or on rehabilitation sites for operations such as old mine tailing sites. This raises concerns about whether the sludge is clean enough to avoid contaminating the soils and vegetation grown in these areas.

Being able to use land disposal as an alternative to incineration requires effective use of source reduction methods to keep toxics out of the sludge. The WLSSD found that their intensive programmes aimed at getting dischargers to the sewers to eliminate or reduce their use of mercury-containing items and of dioxin and furan precursors so dramatically reduced the amounts of these substances in their sewage sludge that the sludge was now suitable for land application. In June 2001, the WLSSD closed down its sewage sludge incinerator.

Biomedical Waste Incineration

Mercury Releases:
The overwhelming focus in addressing mercury emissions from medical waste incinerators is increasingly on source reduction. Hospitals and government jurisdictions are instituting programmes that eliminate the use of mercury-containing items in hospitals so they will not enter the waste stream. The most widespread of these programmes are focused on eliminating the use of mercury-containing thermometers. But now some places are expanding this approach to all mercury-containing items used in hospitals. One of the most wide-reaching of these programmes is the Maine Pollution Prevention Agreement with the Maine Hospital Association.

Some of these programmes are voluntary commitments made by hospitals to government through instruments such as memorandums of understanding. Some jurisdictions have gone beyond this to legislation that bans or restrict certain uses of mercury.

Hospitals also use waste stream segregation as a method to keep mercury out of medical waste incinerator emissions. Care is taken to keep mercury-containing items used in hospitals such as thermometers, batteries and medical equipment out of the waste stream that goes into the medical waste incinerator.

Those hospitals focused on eliminating the use of mercury-containing items in their operations also use waste segregation methods to avoid mercury releases while they are phasing out the mercury-containing items that were already in their hospitals before the mercury ban or phase-out was fully implemented.

Dioxin and Furan Releases:
PVCs are widely used in hospitals and are known to be a source of dioxins and furans when they are burnt. Although programmes to eliminate the use of PVCs in hospitals are not nearly as extensive as those that are being developed to eliminate the use of mercury-containing items, the same approach is being explored in some jurisdictions. For example, the Maine Pollution Prevention Agreement has a goal of reducing the use of PVC plastics in hospitals. The European Union calls for a strategy that substitutes non-PVC products, especially for products directly linked to human health activities.

The more common approach now being taken to PVC is to try to separate the PVC-containing plastics from the materials that go to the medical waste incinerator. But this segregation approach is limited in its effectiveness because many of the PVC plastics have been in direct contact with pathological materials and, therefore, are sent to the incinerator.

Dixoins and furans are also produced as the result of burning other chlorine-containing items used in hospitals, such as solvents, bleaches, and bleached paper products. In this case the dual approach of changing the items used and of separating these materials from the waste stream that goes to the medical waste incinerator are currently being used.

In the case of mercury, hospitals and governments are confident that they can track down all the sources of mercury emissions from human activities and eliminate the sources. The types of materials used in

hospitals that generate dioxins and furans when they are burnt are much more widespread than are those causing mercury emissions. Therefore, the source reduction and segregation approaches may not be effective enough at reducing and eliminating the release of dioxins and furans by medical waste incinerators. As a result, non-incineration technologies for disposing of pathological wastes are being explored.