Canadian Environmental Protection Act

Strategic Options for the Management of Toxic Substances

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from the Steel Manufacturing Sector

Report of Stakeholder Consultations

Canada

DISCLAIMER

This report on stakeholder consultation is published by Environment Canada. It presents the results of the consultations, requested by the Minister of Environment and the Minister of Health, regarding management options for substances that have been designated as toxic under the *Canadian Environmental Protection Act* which are released, produced or used by the steel manufacturing sector.

Publication of this report does not constitute approval by the Ministers of Environment and Health of all its content.

ABSTRACT

Various substances which are released, produced or used by the Steel Manufacturing Sector have been declared toxic under the *Canadian Environmental Protection Act* (*CEPA*). A multi-stakeholder Strategic Options Process (SOP) Issue Table was launched to address the management of these substances. The report describes the SOP, and includes recommendations to Ministers of Environment and Health for the management of the *CEPA*-toxic substances for the Steel Manufacturing Sector.

ACKNOWLEDGEMENTS

The Chair of the Strategic Options Process Issue Table would like to extend appreciation to the Issue Table Secretariat and all the active members, observers, corresponding members, consultants, and other stakeholders that contributed to the development and review of this report*.

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LIST OF ACRONYMS

ARET	Accelerated Reduction or Elimination of Toxics
BATEA	Best Available Technology Economically Achievable
CCME	Canadian Council of Ministers of the Environment
CCPA	Canadian Chemical Producers' Association
CEN	Canadian Environmental Network
CEPA	Canadian Environmental Protection Act
COA	Canada-Ontario Agreement
CSPA	Canadian Steel Producers Association
DDT	Dichlorodiphenyltrichloroethane
EAF	Electric Arc Furnace
GLWQA	Great Lakes Water Quality Agreement
LRTAP	Long Range Transboundary Air Pollution
MISA	Municipal/Industrial Strategy for Abatement
NACEC	North America Commission for Environmental Co-operation
NAFTA	North America Free Trade Agreement
NPRI	National Pollutant Release Inventory
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PSL	Priority Substances List
RAP	Remedial Action Plan
SOP	Strategic Options Process
SOR	Strategic Options Report
TSMP	Toxic Substances Management Policy
UN ECE	United Nations Economic Commission for Europe
US EPA	United States Environmental Protection Agency

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S.1 Background

Environment Canada and Health Canada have joint responsibility for the management of toxic substances under the *Canadian Environmental Protection Act* (*CEPA*). Responsibilities under the Act include identifying substances that may be toxic, assessing them to determine whether they are toxic as defined by Section 11 of *CEPA* and, for substances that are found to be toxic, establishing and applying controls to prevent harm to human health or the environment.

Sixteen (16) substances which are released, produced or used by the Canadian Steel Manufacturing Sector were assessed as toxic under Section 11 of *CEPA*. Those substances are: hexavalent chromium compounds, inorganic arsenic compounds, inorganic cadmium compounds, lead, mercury, oxidic, sulphidic and soluble, inorganic nickel compounds, inorganic fluorides, benzene, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, dichloromethane, tetrachloroethylene, 1,1,1- trichloroethane, trichloroethylene, polychlorinated dibenzodioxins and polychlorinated dibenzofurans.

A Strategic Options Process (SOP) was launched in April, 1995 to assess potential options for the management of these substances in the Steel Manufacturing Sector. An ✌Issue Table✍ which was established under the SOP for the sector, included representatives from various federal departments, provinces, industry, and environmental non-government organizations. Eight meetings of the Issue Table were held starting July 24-25, 1995 and ending on November 25-26, 1996. Documentation on the SOP is accessible through a public file.

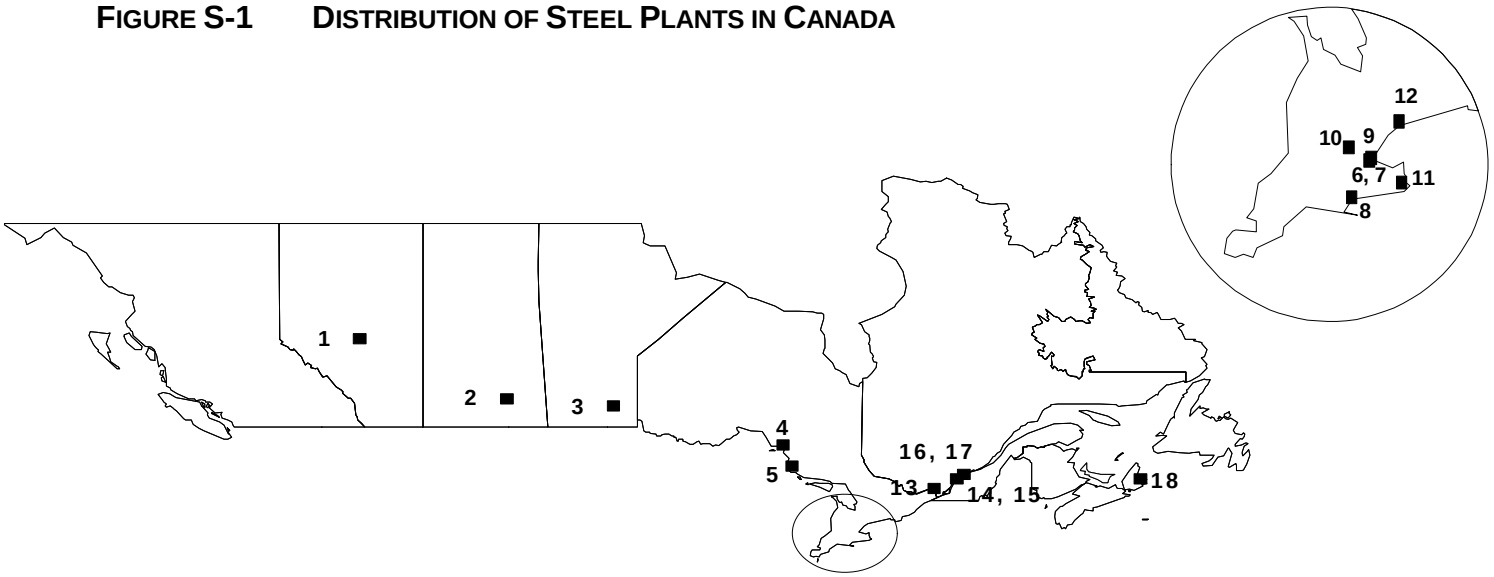
S.2 Overview of the Steel Manufacturing Sector

The steel manufacturing sector consists of five (5) integrated mills, twelve (12) non-integrated mills (also referred to as "mini-mills"), and a stand-alone sinter plant. Ten of these facilities, including four integrated mills, are located in Ontario. There are four mills in Québec and one each in Alberta, Saskatchewan, Manitoba and Nova Scotia. Ontario mills account for approximately 70% of Canadian steel production capacity.

In 1995, these 18 plants employed approximately 33,600 individuals, produced approximately 14.7 million tonnes of steel, and contributed approximately $11 billion in sales to the Canadian economy. Canada is a major participant in international steel trade, and international competitiveness is a significant issue for the industry. The steel manufacturing processes are extremely complex and offer many pollution prevention and pollution control challenges.

The location and capacity of Canadian steel plants is shown in Figure S-1.

FIGURE S-1 DISTRIBUTION OF STEEL PLANTS IN CANADA



Plant No.	Steel Plants	1993 Capacity (tonnes/year)
	Integrated Steel Mills	
5	Algoma Steel Inc. (Sault Ste. Marie, Ont.)	2,025,000
6	Dofasco Inc. (Hamilton, Ont.)	2,722,000
7	Stelco Inc. (Hamilton, Ont.)	2,449,000
8	Stelco Inc. (Nanticoke, Ont.)	1,569,000
17	QIT-Fer et Titane Inc. (Sorel, Que.)	400,000
	Sinter Plant	
4	Algoma Steel Inc. (Wawa, Ont.)	1,134,000
	Non-Integrated Steel Mills	
1	AltaSteel Ltd. (Edmonton, Alta.)	295,000
2	IPSCO Inc. (Regina, Sask.)	907,000
3	Gerdau MRM Steel Inc. (Selkirk, Man.)	282,000
9	Slater Steel (Burlington, Ont.)	310,000
10	Gerdau Courtice Steel Inc. (Cambridge, Ont.)	254,000
11	Atlas Specialty Steels (Welland, Ont.)	151,000
12	Co-Steel Lasco (Whitby, Ont.)	817,000
13	Ivaco Rolling Mills Limited Partnership (L'Orignal, Ont.)	408,000
14	Sidbec-Dosco (Ispat) Inc.(Contrecoeur, Que.)	1,461,000
15	Stelco McMaster Ltée (Contrecoeur, Que.)	436,000
16	Atlas Stainless Steels (Tracy, Que.)	105,000
18	Sydney Steel Corporation (Sydney, N.S.)	545,000

S.3 Releases of *CEPA*-Toxics from the Steel Manufacturing Sector

Issue Table members decided at an early stage of their deliberations that the focus of this SOP would be on air and water, and not on process residues, recycling, and waste disposal. This decision reflects the Table's recognition that: a) most solid waste issues are primarily of provincial and municipal interest: and b) air and water pathways are generally the most significant pathways of exposure to humans and ecosystems.

However, it was also recognized that siting and integrity of landfills are important factors in minimising exposure to solid wastes, and audits of solid waste processes (i.e., landfill, on-site storage, recycling) were encouraged to verify that appropriate pollution prevention and solid waste management practices are being followed (reference Recommendation 11).

The reported 1993 air and water releases of *CEPA*-toxics from the steel manufacturing sector are tabulated below. These data are derived from National Pollutant Release Inventory (NPRI) data and other referenced sources (details are provided in Section 6.0).

Substance	Estimated Release To Air (tonnes/yr)	Estimated Release To Water (tonnes/yr)
Benzene	1,237	0.08*
Polycyclic aromatic hydrocarbons (PAHs)	186	0.17*
Arsenic and its compounds	24.5	1.42*
Cadmium and its compounds	1.2	0.15*
Chromium and its compounds (total)	4.26	31.3*
Lead and its compounds	79.22	4.4*
Mercury and its compounds	0.63	0.01*
Nickel and its compounds (total)	0.9	25.3*
Dioxins and furans (grams/year TEQ)	19.4*	No estimate available
Polychlorinated biphenyls (PCBs)	No estimate available	No estimate available
Chlorinated solvents	85*	0.001
Fluorides	28.4*	No estimate available

TEQ: Toxic equivalent
* Not all steel mills reported releases

S.4 Current Policy and Program Framework

The federal government's Toxics Substances Management Policy (TSMP) provided the broad framework for addressing the *CEPA*-toxics addressed by the Issue Table. The TSMP defines separate goals for two types of substances, i.e., "virtual elimination" for Track 1 substances and, ✌life-cycle management" for Track 2 substances. The goal of "virtual elimination" is to be based on strategies to prevent the measurable release of the substances into the environment. The goal of ✌life-cycle management✍ is to minimize environmental and health and environmental risks by reducing exposure to and/or the release of the substances into the environment.

The criteria for determining whether a substance is Track 1 or Track 2 are tabulated below.

Track	Substance Criteria	TSMP Goal
1	*CEPA*-Toxic or Equivalent Predominantly Anthropogenic Bioaccumulative Persistent	Virtual elimination (VE) from the environment
2	Not All Track 1 Criteria Met	Life-cycle management (LCM) to prevent or minimize release into the environment

Three of the sixteen substances addressed in the SOP (PCBs, dioxins and furans) are classified as Track 1 substances. All other substances which were addressed in this SOP are classified as Track 2 under the TSMP.

Various programs and initiatives which were considered by the Issue Table included:

- the Canada-U.S. Great Lakes Water Quality Agreement;
- the Canada-Ontario Agreement (COA);
- the St. Lawrence Action Plan;
- the Accelerated Reduction or Elimination of Toxics (ARET) Program;
- the Canadian Chemical Producers' Association Benzene Reduction Program;
- the North America Free Trade Agreement (NAFTA) Commission for Environmental Co-operation (CEC); and
- the United Nations Economic Commission for Europe (UNECE) Convention on Long Range Transboundary Air Pollution (LRTAP).

S.5 Assessment of Options

To assist the Issue Table in undertaking the SOP, a consultant group was contracted to develop a report on technical processes and associated releases of *CEPA*-toxic substances from the steel manufacturing sector. Six strategic management options, covering a range of regulatory and non-regulatory current and possible programs, were identified. Strategic options which were evaluated included:

- current regulations;
- current voluntary programs;
- enhanced voluntary programs;
- enhanced national and provincial programs;
- market-based instruments; and
- federal regulations.

A subsequent consultant study was commissioned to develop and assess the cost and associated socio-economic impacts of potential management options.

S.6 Additional Considerations of the Issue Table

The consultant studies provided the Issue Table with a basis for focusing discussions. In addition, the Issue Table also considered a number of other on-going initiatives and issues, which included:

- implementation of the Toxics Substances Management Policy;
- renewal of the *Canadian Environmental Protection Act*;
- harmonization of Federal-Provincial management of toxic substances;
- application of the principles of Pollution Prevention;
- activities of the Federal-Provincial Task Force on Dioxins and Furans;
- fairness and the creation of "a level playing field" in terms of environmental performance;
- the effectiveness of voluntary programs;
- the effectiveness of traditional regulatory approaches;

- apparent gaps between COA and ARET release reduction targets and schedules;
- the relative contributions of natural and anthropogenic emission sources;
- the potential impacts of the options on the competitiveness of the steel industry; and
- possible improvements in the quality of release data and reporting practices.

S.7 Recommendations

The Strategic Options Report (SOR) recommendations recognize the effectiveness of the initial voluntary ARET program, and the voluntary commitments made by most of the sector companies. However, the SOR recommendations will strengthen current voluntary programs by ensuring verification and full appropriate participation by all sector companies, and by having complementary regulatory requirements where appropriate. Generally the Environmental Codes of Practice and the targets and schedules are intended to provide a level playing field of environmental standards and foster the concept of continuous improvement in environmental performance by all companies in the steel manufacturing sector in Canada.

The following conclusions and recommendations are offered to Ministers for the management of *CEPA*-toxics from the Steel Manufacturing Sector. These reflect a number of considerations which include providing a framework for continuous improvement in the environmental performance of the steel manufacturing sector.

The recommendations which are summarized in Table S-1, call for enhanced voluntary programs and non-regulatory environmental performance standards, backed up by possible regulatory requirements under *CEPA*.

TABLE S-1 SUMMARY OF STRATEGIC OPTIONS REPORT (SOR) RECOMMENDATIONS FOR THE STEEL MANUFACTURING SECTOR

Recommendation No., Subject	Summary of Recommendations (See SOR text for complete Recommendations)
1.Federal-Provincial Harmonization	Implement toxic management initiatives under the auspices of the Canada-Ontario Agreement (COA) and the Canadian Council of Ministers of the Environment (CCME).
2. Benzene Emissions	Implement an enhanced voluntary program to reduce 1993 benzene emissions by approximately 55% by 2000, 80% by 2005, and 90% by 2015. Develop and adopt a COA Environmental Code of Practice by December, 1998.
3. Polycyclic Aromatic Hydrocarbon (PAH) Emissions	Implement an enhanced voluntary program to reduce 1993 PAH emissions by approximately 45% by 2000, 65% by 2005, and 70% by 2015. Develop and adopt a COA Environmental Code of Practice by December, 1998.
4. Metals - Air Emissions	Reduce overall sector emissions of *CEPA*-toxic metals. Develop and adopt a CCME Environmental Code of Practice by December, 1998. Develop metals emission reduction targets and schedules for the Algoma Wawa sintering plant and the Sidbec-Dosco non-integrated mill. (See also Recommendation 7)
5. Metals - Water Effluents	Reduce overall sector wastewater releases of *CEPA*-toxic metals. Develop and adopt a CCME Environmental Code of Practice by December, 1998.
6. Dioxin and Furan Emissions	Participate with all other sectors now considered to be potential sources of dioxin and furan emissions, in a Research Program to characterize, quantify and prioritize actions for various emission sources.
7. Sintering Plant Emissions	Develop an enhanced voluntary program which includes emission reduction targets and schedules for the Algoma sintering plant by December, 1997. Evaluate and report on toxics management options for the Stelco Hilton Works sintering plant by December, 1997.
8. Mercury Emissions	Conduct a Mercury Release Assessment Program for the integrated mills and sintering plants and report on results by June, 1997.
9. Contaminated Sites	Continue remediation of Hamilton Harbour, Ontario, and St. Mary's River, Ontario, and develop a remediation plan for the tar ponds and coke oven site in Sydney, Nova Scotia.
10. Pollution Prevention Plans	Prepare and implement Pollution Prevention Plans.
11. Environmental Audits	Conduct periodic voluntary audits.
12. Ministerial Review	Submit a report on the implementation and effectiveness of the Strategic Options Report Recommendations to Ministers by March, 1999.

S.7.1 Recommendation #1 - Federal-Provincial Harmonization

It is recommended that toxic management initiatives for integrated steel mills be developed and implemented jointly and co-operatively by Environment Canada and Ontario Environment and Energy under the auspices of the Canada-Ontario Agreement, and that initiatives for the non-integrated steel mills in Canada be developed and implemented under the auspices of the Canadian Council of Ministers of Environment (CCME) and the leadership of Environment Canada.

S.7.2 Recommendation #2 - Benzene Emissions

It is recommended that an enhanced voluntary program be developed to reduce 1993 benzene releases from integrated mills by approximately 55% by 2000, 80% by 2005, and 90% by 2015. It is recommended that this program include the development and adoption of an Environment Canada-Ontario Environment and Energy Code of Practice by December, 1998 which includes: a) release guidelines for benzene emissions from new, existing and modified sources; b) standardized benzene emission measuring, monitoring and reporting practices; and c) best environmental management practices for coke-making by-product facilities.

S.7.3 Recommendation #3 - Polycyclic Aromatic Hydrocarbon (PAH) Emissions

It is recommended that an enhanced voluntary program be developed to reduce 1993 PAH releases from integrated mills by approximately 45% by 2000, 65% by 2005 and 70% by 2015. It is recommended that this program include the development and adoption of an Environment Canada-Ontario Environment and Energy Code of Practice by December, 1998 which includes: a) release guidelines for PAH emissions from new, existing and modified sources; b) standardized PAH emissions monitoring and reporting practices; and c) best environmental management practices for coke-making facilities.

S.7.4 Recommendation #4 - Metal Emissions to Air

It is recommended that overall sector air emissions of CEPA-toxic metals be reduced through the development and adoption of a CCME Code of Practice by December, 1998 which includes: a) emission guidelines for new, existing and modified sources; b) standardized emissions measuring, monitoring and reporting practices; and c) best management practices for achieving continuous improvement in the design, operation and maintenance of air pollution control systems. It is further recommended that source-specific targets and schedules be developed for the Wawa sintering plant and Sidbec-Dosco. (Refer also to Recommendation #7)

S.7.5 Recommendation #5 - Metal Effluents to Water

It is recommended that overall sector reductions in wastewater releases of CEPA- toxic metals from non-integrated mills be targeted through the development and adoption of a CCME Code of Practice by December, 1998 which includes: a) effluent release guidelines for new, existing and modified sources; b) standardized effluent measuring, monitoring and reporting practices; and c) best management practices for achieving continuous improvement in the design, operation and maintenance of water pollution control systems.

S.7.6 Recommendation #6 - Emissions of Dioxins and Furans

It is recommended that, consistent with the work of the multi-sectoral Federal-Provincial Task Force on Dioxins and Furans, the steel sector participate with all other sectors now considered to be potential sources of dioxins and furans, in a Research Program to be conducted and completed by December, 1998. The objective of this Program would be to characterize, quantify and prioritize emissions of dioxins and furans from these potential sector sources with the aim of developing appropriate management options.

S.7.7 Recommendation #7 - Emissions from Sintering Plants

It is recommended that an enhanced voluntary program be developed jointly by Algoma, Ontario Environment and Energy and Environment Canada to reduce emissions of dioxins and furans, arsenic, cadmium, lead and mercury at the Algoma Sintering Plant, by December, 1997. This voluntary program would include emission reduction targets and schedules for these substances and would be consistent with the Toxics Substances Management Policy. It is recommended that an Emission Management Program be conducted at the Stelco Hilton Works Sintering Plant, that reports on the characteristics and controls of emissions be submitted by Ontario Environment and Energy to Environment Canada, and that the status be reviewed by December, 1997.

S.7.8 Recommendation #8 - Emissions of Mercury

It is recommended that a Mercury Release Assessment Program be established for the integrated mills and sintering plants (refer to Recommendation 7) at Algoma, Dofasco and Stelco, and that a report be submitted by Ontario Environment and Energy to Environment Canada by June, 1997.

S.7.9 Recommendation #9 - Contaminated Sites

It is recommended that the existing Canada-Ontario Remedial Action Plans for Hamilton Harbour and St. Mary□s River continue their remediation activities, using equitable funding formulas which include participation by local industries.

It is recommended that Canada and Nova Scotia support an open and transparent community-based process to develop a Remediation Plan for the tar ponds and coke oven site in Sydney, Nova Scotia.

S.7.10 Recommendation #10 - Pollution Prevention Plans

It is recommenced that steel manufacturing sector facilities prepare and implement Pollution Prevention Plans.

S.7.11 Recommendation #11 - Environmental Audits

It is recommended that periodic voluntary environmental audits be conducted to verify compliance with provincial and federal regulations, adequacy of internal environmental management systems, and consistency with voluntary commitments and applicable Codes of Practice. These audits would be in addition to the compulsory compliance testing required by provincial regulatory agencies.

S.7.12 Recommendation #12 - Ministerial Review

It is recommended that a report, developed by Environment Canada and Health Canada staff, on the implementation and effectiveness of the SOR recommendations and relevant provincial toxics management programs, be submitted to the Ministers of Environment and Health by March 1999, so that regulatory action or further non-regulatory action can be taken, as appropriate.

S.8 Other Views of Issue Table Members

The recommendations of the Strategic Options Report represent a very high degree of consensus among all members of the Issue Table, considering the wide range of perspectives and interests which were represented. However, some members wished to have their views on some topics documented in the Report.

Some members suggested having additional meetings and drafts of the report before issuing it to stakeholders who did not participate in the Strategic Options Process. However, most members believed that further delays in issuing the report would not significantly enhance the quality of the report or substantively modify the recommendations.

The representative of the Hamilton Harbour Remedial Action Plan suggested that members of the local community in Hamilton affected by the recommendations should

have the opportunity to directly comment on the draft report. However, it was not possible to arrange a public meeting in Hamilton within the time schedule of the Strategic Options Process.

The representative of the Canadian Environmental Network supported many of the recommendations including: the releases reduction targets and schedules of *CEPA*-toxics from the sector, the development of standardized release reporting procedures, the program for dioxins and furans, and pollution prevention plans.

However, they did not support the use of voluntary programs by industry instead of *CEPA* regulatory requirements. They did not support the selection of CCME Environmental Codes of Practice and Release Guidelines as the recommended policy instruments.

It was recognized by the CEN representative that it was also recommended that the effectiveness of the enhanced voluntary programs proposed would be reviewed by federal Ministers of Environment and Health by March, 1999.

Stakeholders not represented at the Issue Table were invited to review the Report before February 21, 1997, so that any comments received could be taken into account by Ministers.

S.9 Public Comments on Issue Table Draft Strategic Options Report

Comments on the December 30, 1996 Strategic Options Report were provided by Issue Table members and others. These included representatives from steel mills, a provincial government and the Canadian Steel Producers Association.

A representative of an integrated mill agreed with the thrust of the recommendations of the Strategic Options Report and recognized the ongoing need to reduce toxic releases. The representative also indicated that the steel mill is taking steps to eliminate many of the 16 *CEPA*-toxic substances from their wastewater effluents, in addition to reducing emissions of benzene and PAHs from their coke-making operations through pollution prevention techniques.

A representative of the Canadian Steel Producers Association (CSPA) supported the need for responsible action in the management of releases of toxic substances. While not all its members participated in the Strategic Options Process, the CSPA and its members have established a working group to develop a comprehensive implementation plan which will demonstrate their commitment to protecting the environment through responsible voluntary action.

Another reviewer suggested that it is important getting large release sources such as steel mills to do stack testings for compounds such as particulates, PCBs, dioxins, furans, hexachlorobenzene (HCB), PAHs, mercury, cadmium and lead.

Additional comments were submitted by the public on Strategic Options Report from a public meeting held in Burlington, Ontario on January 30, 1997. This meeting was sponsored by the Hamilton Harbour Remedial Action Plan (RAP) for local citizens affected by the recommendations.

A representative of the Hamilton Harbour Remedial Action Plan suggested that the local community does not consider itself to be adequately protected from harmful emissions from the steel manufacturing sector. The representative also raised concerns about the federal government's ability to evaluate the effectiveness of the recommendations by 1999.

A representative of the City of Hamilton provided a summary of public comments which include the following major points: the Hamilton Beach Residents' Association wants stringent regulations especially for companies that are in their back yards, instead of a voluntary approach; particulates should be addressed by the SOP because of their health effects (respirable and inhalable), and substances of local concern should be assessed to determine which ones pose the highest risk, and then controlled in order of priority.

A Hamilton resident suggested that the SOR is another form of "self regulation" benefiting industry. The citizen also expressed skepticism about the voluntary process and asked for a stricter enforcement.

A university member suggested that the steel industry has been a major contributor to the releases of toxics into the Hamilton air, according to a Hamilton Air Quality Initiative study. The member further suggested that the quality of Hamilton air will improve proportionally if the recommendations for benzene and PAH emission reductions are implemented by the two major mills.

S.10 Socio-Economic Implications of Recommendations

The costs of the Recommendations of the SOR are difficult to estimate due to uncertainties in program design and implementations. Over an eight year period, capital costs of approximately $75 million and average annual operating costs of $15 million have been estimated. This represents about 0.15% of typical annual sales for the sector. The impact on direct employment within an industry which employed 33,600 in 1995, is estimated at approximately 60 additional direct jobs. There are no overall negative impacts on the competitiveness of the steel manufacturing sector from the implementation of the Recommendations.

Benefits of implementing the recommendations include: reductions in releases of toxic substances from the sector and associated reductions in exposures and risks to the environment and humans, enhancement of ambient environmental quality in the vicinity of steel mills, reductions in occupational exposure of steel workers, continuous

improvements in the environmental performance of the sector, and, consistency with potential national and international trade and environmental requirements.

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1.0 INTRODUCTION

Environment Canada and Health Canada have joint responsibility for the management of toxic substances under the *Canadian Environmental Protection Act (CEPA)*[1], which provides for actions, including regulations, relating to the quantity or concentration of a toxic substance that may be released to the environment.

Responsibilities under the Act include identifying substances that may be toxic, assessing them to determine whether they are toxic as defined in *CEPA* Section 11 and, for substances that are found to be toxic, establishing and applying controls to prevent harm to human health or the environment.

Section 11 of *CEPA* defines a substance as being toxic if it is entering or may enter the environment in quantity or concentration or under circumstances:

a) having or that may have an immediate or long-term harmful effect on the environment;

b) constituting or that may constitute a danger to the environment on which human life depends; or

c) constituting or that may constitute a danger in Canada to human life or health.

The first *CEPA* Priority Substances List (PSL 1), which identified 44 substances for priority assessment, was published in 1989[2]. Assessment of these substances was completed in 1994 and 25 were declared toxic as defined under Section 11 of *CEPA*.

Other substances, including mercury, PCBs and lead, had previously been listed as toxic under Schedule 1 of *CEPA*[3].

The process initiated to develop recommendations for the management of substances found to be toxic under Section 11 of *CEPA* is referred to as the "Strategic Options Process" (SOP)[4]. The purpose of the SOP is to reduce exposure of the environment and humans to contaminants through the development of control options for industry.

The SOP is a multi-stakeholder process, with representatives from industry, federal, provincial and municipal governments and non-governmental organizations who participate in an Issue Table to ensure that the most effective and efficient environmental management options to reduce releases of the toxic substances from various sources are addressed. The management of toxic substances is guided by the Toxic Substances Management Policy (TSMP)[5], within the context of pollution prevention and sustainable development. The Government of Canada's document, *"Pollution Prevention A Federal Strategy for Action"* [6], defines pollution prevention as *"The use of processes, practices, materials, products or energy that avoid or minimize*

the creation of pollutants and waste, and reduce overall risk to human health or the environment."

The SOP generally consists of two phases, i.e., (1) information gathering and (2) options identification and evaluation. The first phase involves collection of technical and socio-economic background information. The second phase involves using the best available information and advice from stakeholders to assess and recommend options for the management of releases to the environment from the sector, and to establish goals, targets and schedules, and mechanisms or programs for the reduction of these releases and the reduction of exposures and risks associated with these substances. The Strategic Options Report presents the recommendations of stakeholders to the Ministers of Environment and Health for their consideration.

2.0 ISSUE DESCRIPTION

Sixteen (16) *CEPA*-toxic substances[7] are released, produced or used by the Canadian Steel Manufacturing Sector. These substances are as follows:

Benzene
Polycyclic aromatic hydrocarbons (PAHs)
Inorganic arsenic compounds
Inorganic cadmium compounds
Hexavalent chromium compounds
Lead
Mercury
Oxidic, sulphidic and soluble, inorganic nickel compounds
Polychlorinated dibenzodioxins (PCDDs)
Polychlorinated dibenzofurans (PCDFs)
Dichloromethane (DM)
Tetrachloroethylene (PERC)
1,1,1-Trichloroethane (TCA)
Trichloroethylene (TCE)
Polychlorinated biphenyls (PCBs)
Inorganic fluorides

2.1 Environmental Concerns

Reported concentrations of some of these substances in the Canadian environment may be harmful to both the environment and human health. Industrial releases to air, water and land of arsenic, cadmium, nickel and chromium(VI) can cause elevated ambient levels in the Canadian environment. Elevated ambient levels of these substances are of concern in water, sediment and soil because of their effects on the growth and reproduction of a variety of organisms. Fluoride and volatile organic compounds (dichloromethane, tetrachloroethylene, 1,1,1-trichloroethane and trichloroethylene) released to air can result in the shrivelling of plant tissue and, in the case of fluoride only, deposition on plants may lead to the destruction of tooth enamel in mammals. Elevated levels of PAHs can result in concentrations that may be harmful to organisms living in sediments. Fluoride released to water can adversely affect aquatic biota if ambient levels become elevated. Mercury (methylated) and PCBs bioaccumulate and biomagnify up the food chain, and lead can bioaccumulate. The resulting increase in contaminant loads can result in adverse effects in a range of organisms, including humans.

2.2 Health Concerns

The general Canadian human population is exposed to these substances through all pathways, but air and food are the two of most significance. Air is a critical exposure pathway for benzene, dichloromethane, trichloroethylene and PAHs. The greatest intake of inorganic arsenic, total cadmium, total chromium and total nickel is through food. Air exposures of these metals to the general population, and to populations near sources, are also of concern because the weight of evidence indicates that some of these substances are carcinogens or probable carcinogens when inhaled. In the case of dioxins and furans, food is considered the primary pathway for the general population. These contaminants, released to air, water and land from industrial or other sources, can enter the food chain and contribute to increased levels in food and the contamination of natural ecosystems.

2.3 Other Substances of Concern

Other substances of concern are released from the Steel Manufacturing Sector. These include respirable particulates which are currently being assessed for toxicity under *CEPA PSL 2*[8], and which are associated with substances already declared toxic under the Act. Many of the substances already declared toxic under the Act and under consideration in the SOP can occur in association with, or in the form of, respirable particulates.

2.4 Environment Canada - Health Canada Perspectives

The presence of these *CEPA*-toxic substances in the Steel Manufacturing Sector (SMS) triggered a multi-stakeholder process to examine these and associated releases from the sector, and to make recommendations to Ministers for the management of *CEPA*-toxics from the sector, using best available information and advice.

Health Canada's focus is on reducing, to the extent practicable, the risk associated with human exposure to these substances.

Environment Canada’s focus is to identify and promote pollution prevention and control measures to manage toxic substances, taking into account technical, economic and social considerations.

3.0 THE STEEL MANUFACTURING SECTOR SOP

3.1 The Issue Table

For the Steel Manufacturing Sector SOP, industry stakeholders were invited to participate at an Issue Table for the sector in a letter of April 13, 1995 from H. A. Clarke, Assistant Deputy Minister, Environmental Protection Service, Environment Canada. Provincial representatives were invited through the *CEPA* Federal-Provincial Advisory Committee. The Canadian Environmental Network, various federal government departments, some municipal governments and other interested stakeholders were also invited to participate. A list of Issue Table participants is presented in Appendix A.

Issue Table members were tasked with evaluating available options to manage *CEPA*-toxics released by the steel manufacturing sector. Eight meetings of the Issue Table were held starting in July, 1995 with the final meeting held on November 25-26, 1996. The notes of each of these meetings are accessible through a public file. In addition, several teleconferences and meetings of Task Groups were held between meetings of the Issue Table.

3.2 The Strategic Options Report

This report presents the findings of the multi-stakeholder consultations and sets out options and recommendations for managing releases of the sixteen (16) toxic substances from the Steel Manufacturing Sector, taking into account:

- the most environmentally and cost-effective options to reduce releases of and exposure to the toxic substances released from this sector; and

- the best means and timing to implement the recommended options (regulatory, voluntary, codes, guidelines, market-based instruments, etc.).

The report includes a description of the sector (Section 4), followed by information on releases of substances from the sector (Sections 5 and 6). Relevant policies and programs are presented to provide context for the SOP initiative (Section 7). To reduce releases of toxics from the sector, technical options are outlined, together with their cost implications, and various regulatory and non-regulatory policy instruments or "strategic" options are evaluated generically (Section 8). Specific considerations raised by the range of stakeholders at the Issue Table are outlined (Section 9). Taking into account the information, views, and advice provided, conclusions and recommendations to Ministers were developed for the management of these substances (Section 10). Finally, the socio-economic implications of the recommendations are outlined (Section 11). A list of Issue Table participants is presented in Appendix A, and a glossary of terms is presented in Appendix B.

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4.0 SECTOR DESCRIPTION

The steel manufacturing sector comprises the 18 facilities listed in Table 4-1 and consists of: five integrated mills including QIT-Fer et Titane Inc.; twelve non-integrated mills (ten mini-mills and two specialty steel mills); and Algoma's stand-alone sinter plant in Wawa.

Ten of these facilities, including 4 integrated mills, are located in Ontario. There are four mills in Québec and one each in Alberta, Saskatchewan, Manitoba and Nova Scotia. Western Steel, an Alberta mini-mill, was closed permanently in 1995. Ontario accounts for about 70% of Canadian steel production capacity (See Figure 4-1).

In 1995, the eighteen plants shipped 14.7 million tonnes of steel, employed approximately 33,600 individuals and contributed $11.0 billion in sales to the Canadian economy.[9]

Internationally, Canada is a major player in steel trade, exporting 4.9 million tonnes ($3.4 billion) and importing 4.3 million tonnes in 1994. The United States, Canada's traditional major trade partner in steel, accounted for 94% of Canada's exports and 48% of imports. International competitiveness is a significant issue with the industry.

Steel-making is a very complex and energy intensive operation involving a progression of manufacturing processes which transform raw materials into iron and steel products.[10, 11] Figure 4-2 illustrates the iron and steel manufacturing processes.

Steel production in Canada is made by two main steel-making processes: basic oxygen furnaces and electric arc furnaces. The basic oxygen furnace process is used in integrated mills in conjunction with coke-making, sintering and blast furnace iron-making operations. The integrated mills, which smelt ore and melt scrap, produce the greatest diversity of product including bars, rods, rails, structural shapes, plates, sheets, pipe and tubes, and wire rod. While electric arc furnace technology is gaining importance, it is usually used in non-integrated mills (mini-mills or specialty steel mills) fed by scrap or direct reduced iron (DRI) to produce carbon and alloy steels. Sidbec-Dosco is also the only steel mill that uses the Midland-Ross (Midrex) Process to produce direct reduced iron.

Ancillary or secondary steel-making processes that are common to both integrated and non-integrated steel-making include ladle metallurgy, continuous casting, hot forming and cold forming or finishing operations. Finishing operations which may include acid pickling, pickle acid regeneration, cold rolling, annealing and coating are used at three integrated mills, but not at Stelco Lake Erie Works. Only two non-integrated mills (Sidbec-Dosco (Ispat) Inc. and Atlas Stainless Steels) have some finishing operations (acid pickling, cold rolling and annealing).

QIT-Fer et Titane Inc. was grouped together with the integrated mills because it operates a basic oxygen furnace, a ladle metallurgy station and a continuous casting machine for secondary steel-making[12]. QIT-Fer et Titane Inc. also produces a titanium (TiO_2) slag and a high quality pig iron from smelting of calcined ilmenite ore ($FeO.TiO_2$) and coal in rectangular electric arc furnaces. The iron oxide slag from the electric arc furnaces is fed to a basic oxygen furnace to produce high quality steel billets.

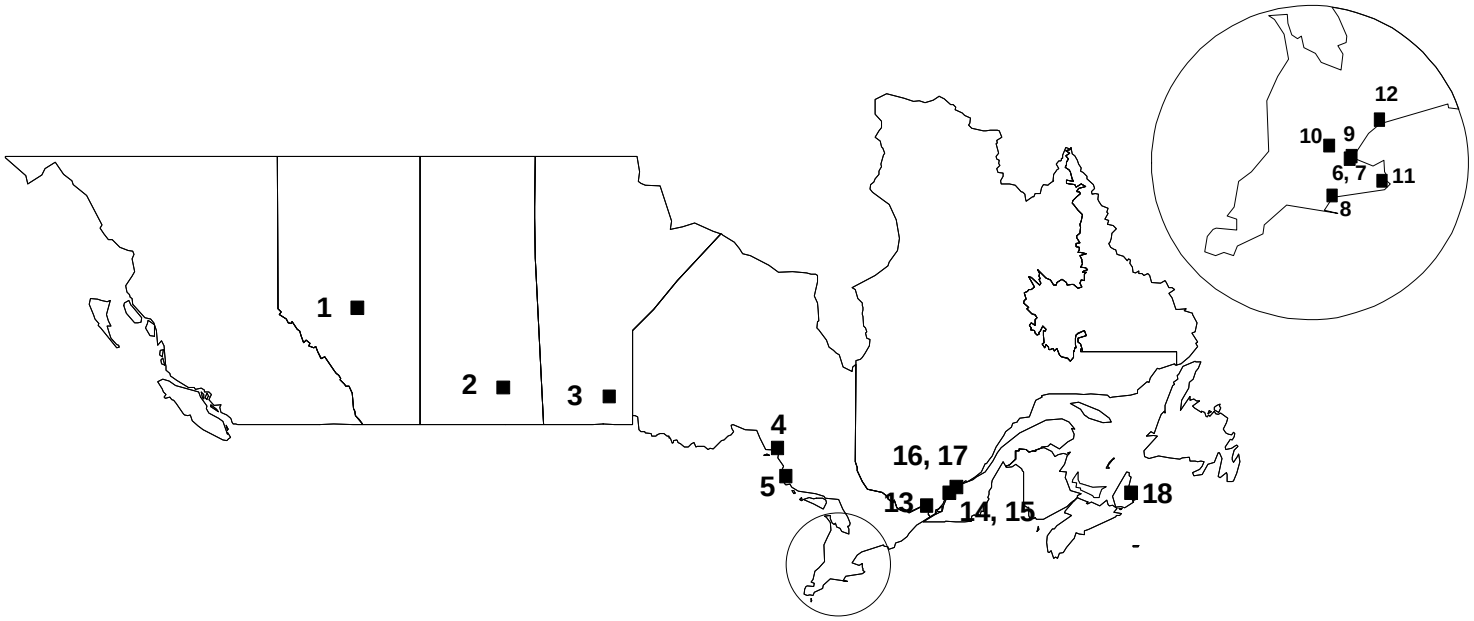
The basic raw materials for iron- and steel-making are iron ore (mainly in the form of pellets), direct reduced iron, scrap, coal and fluxes such as limestone, calcined lime and dolomite. Other materials used in the manufacturing process include alloying materials, additives, rolling oils, acids, solvents, cleaning solutions, oils and greases. Varying amounts of these materials or chemical substances are subsequently released into the environment during processing.

TABLE 4-1 CANADIAN STEEL PLANT CAPACITY (1993) [13]

Plant No./Type	Plant Name	Location	Capacity (tonnes/year)
5 (IM)	Algoma Steel Inc.	Sault Ste. Marie, Ont.	2,025,000 steel
6 (IM)	Dofasco Inc.	Hamilton, Ontario	2,722,000 steel
7 (IM)	Stelco Inc.	Hamilton, Ontario	2,449,000 steel
8 (IM)	Stelco Inc.	Nanticoke, Ontario	1,569,000 steel
17 (IM)	QIT-Fer et Titane Inc.	Sorel, Québec	400,000 steel
1 (MM)	AltaSteel Ltd.	Edmonton, Alberta	295,000 steel
2 (MM)	IPSCO Inc.	Regina, Sask.	907,000 steel
3 (MM)	Gerdau MRM Steel Inc.	Selkirk, Manitoba	282,000 steel
9 (MM)	Slater Steels	Burlington, Ontario	310,000 steel
10 (MM)	Gerdau Courtice Steel Inc.	Cambridge, Ontario	254,000 steel
12 (MM)	Co-Steel Lasco	Whitby, Ontario	817,000 steel
13 (MM)	Ivaco Rolling Mills Limited Partnership	L'Orignal, Ontario	408,000 steel
15 (MM)	Stelco McMaster Ltée	Contrecoeur, Québec	436,000 steel
18 (MM)	Sydney Steel Corporation	Sydney, Nova Scotia	545,000 steel
14 (DRM)	Sidbec-Dosco (Ispat) Inc.	Contrecoeur, Québec	1,461,000 steel
11 (SS)	Atlas Specialty Steels	Welland, Ontario	151,000 steel
16 (SS)	Atlas Stainless Steels	Tracy, Québec	105,000 steel
4 (SP)	Algoma Steel Inc.	Wawa, Ontario	1,134,000 sinter

Note: Numbers refer to locations on Figure 4-1
DRM: Direct Reduction Mini-mill
IM: Integrated Mill
MM: Mini-Mill
SP: Sinter Plant
SS: Specialty Steel

FIGURE 4-1 STEEL PLANT CAPACITY BY PROVINCE (1993)



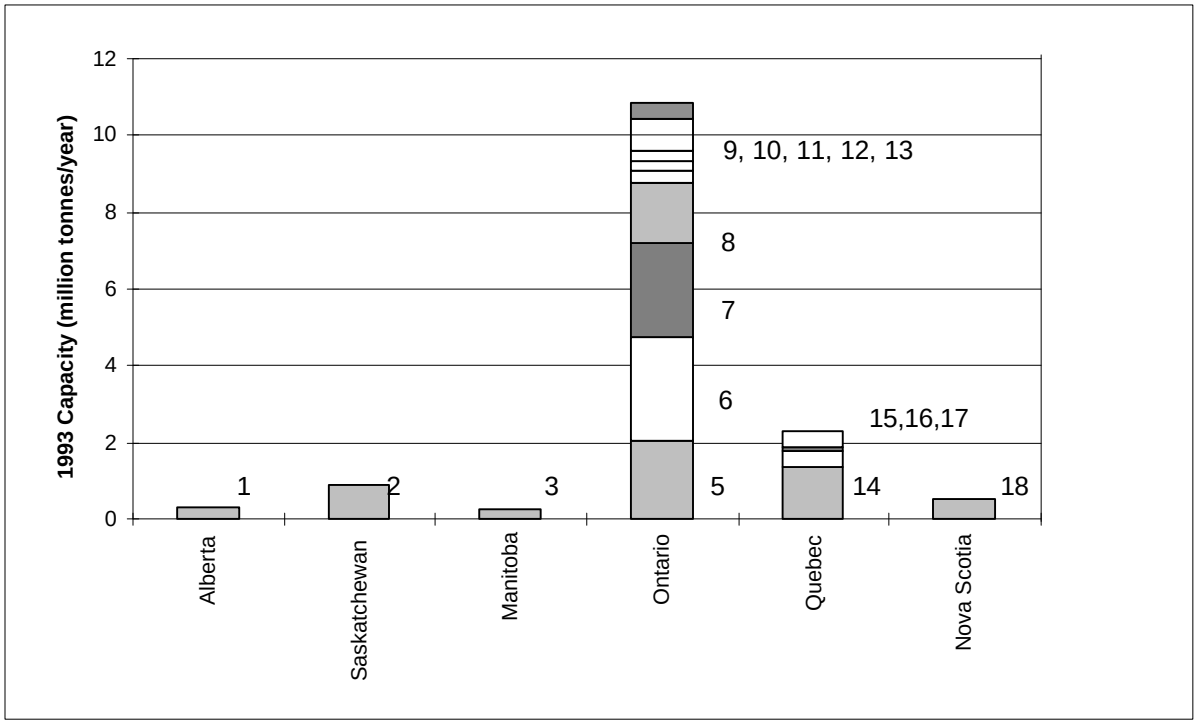
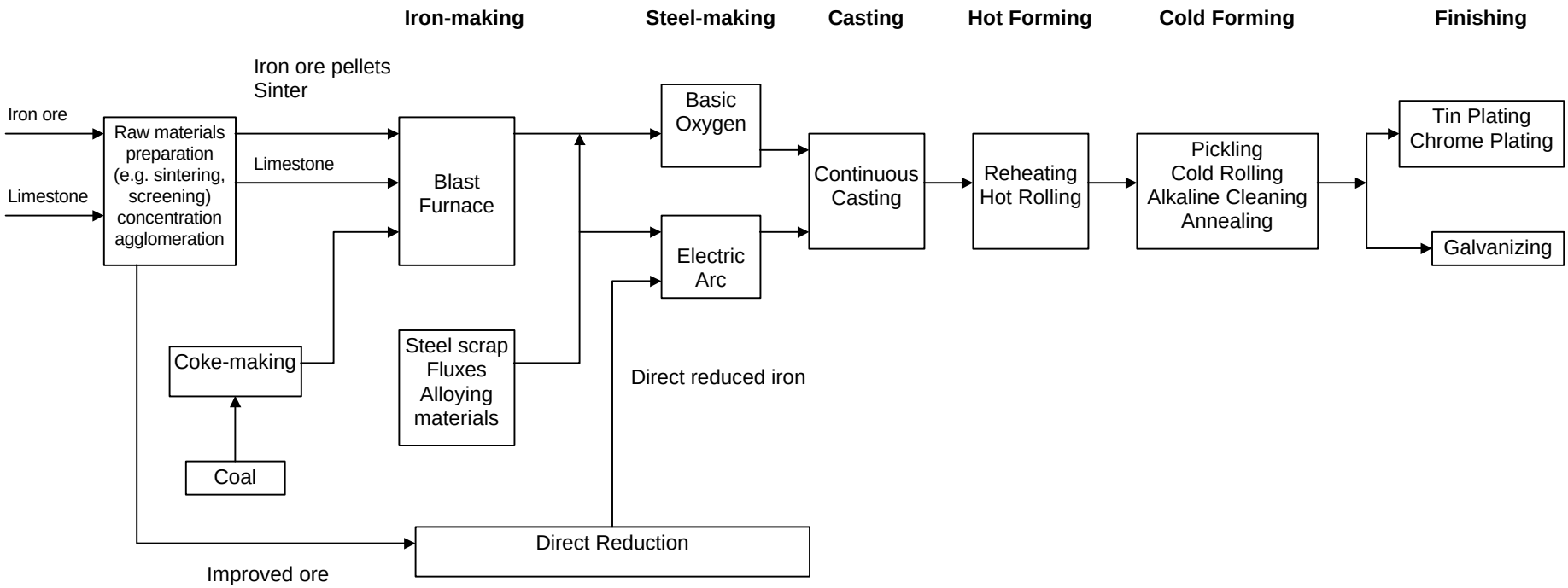


FIGURE 4-2 SIMPLIFIED STEEL MANUFACTURING FLOWSHEET



5.0 SUBSTANCES AND SOURCES

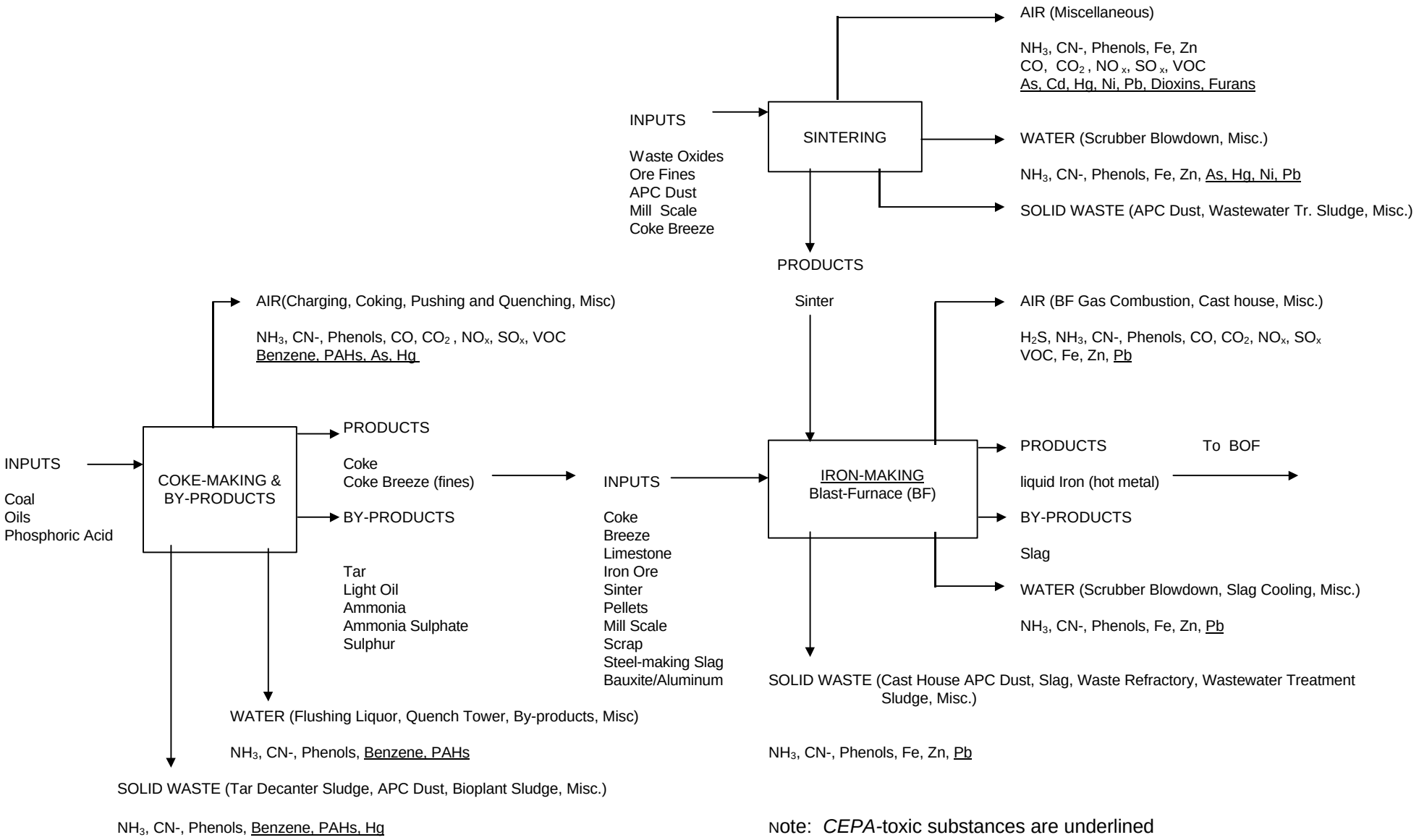
After discussion by the Issue Table, it was decided that the **focus** of this SOP, would be **on air and water releases, and not on process residues, recycling, and waste disposal.** It was recognized that while some solid waste issues were of federal interest (e.g., transboundary transport), most were primarily of provincial and municipal interest. Also, the air and water pathways are generally the most significant pathways of release exposures to humans and ecosystems. However, it was also recognized that siting and integrity of landfills are important factors in minimizing exposure to solid wastes, and audits of solid waste processes (i.e., landfill, on-site storage, recycling) were encouraged to verify that appropriate pollution prevention and solid waste management practices are being followed.

The 16 *CEPA*-toxic substances being considered in this SOP represent different types and groups of chemical substances: organics, metals, solvents, etc. Some of these substances are associated with only certain manufacturing processes and media[11, 14, 15]. The processes where they could be used, produced or released are described below, and are illustrated in Figures 5-1, 5-2 and 5-3. A summary of the estimated sector-wide land release of these substances, based on 1993 NPRI data[16], is presented in Table 5-1. Air and water release data are presented and discussed in Section 6.0.

TABLE 5-1 SUMMARY OF ESTIMATED LAND RELEASES FROM THE STEEL MANUFACTURING SECTOR IN 1993 (BASED ON 1993 NPRI DATA)

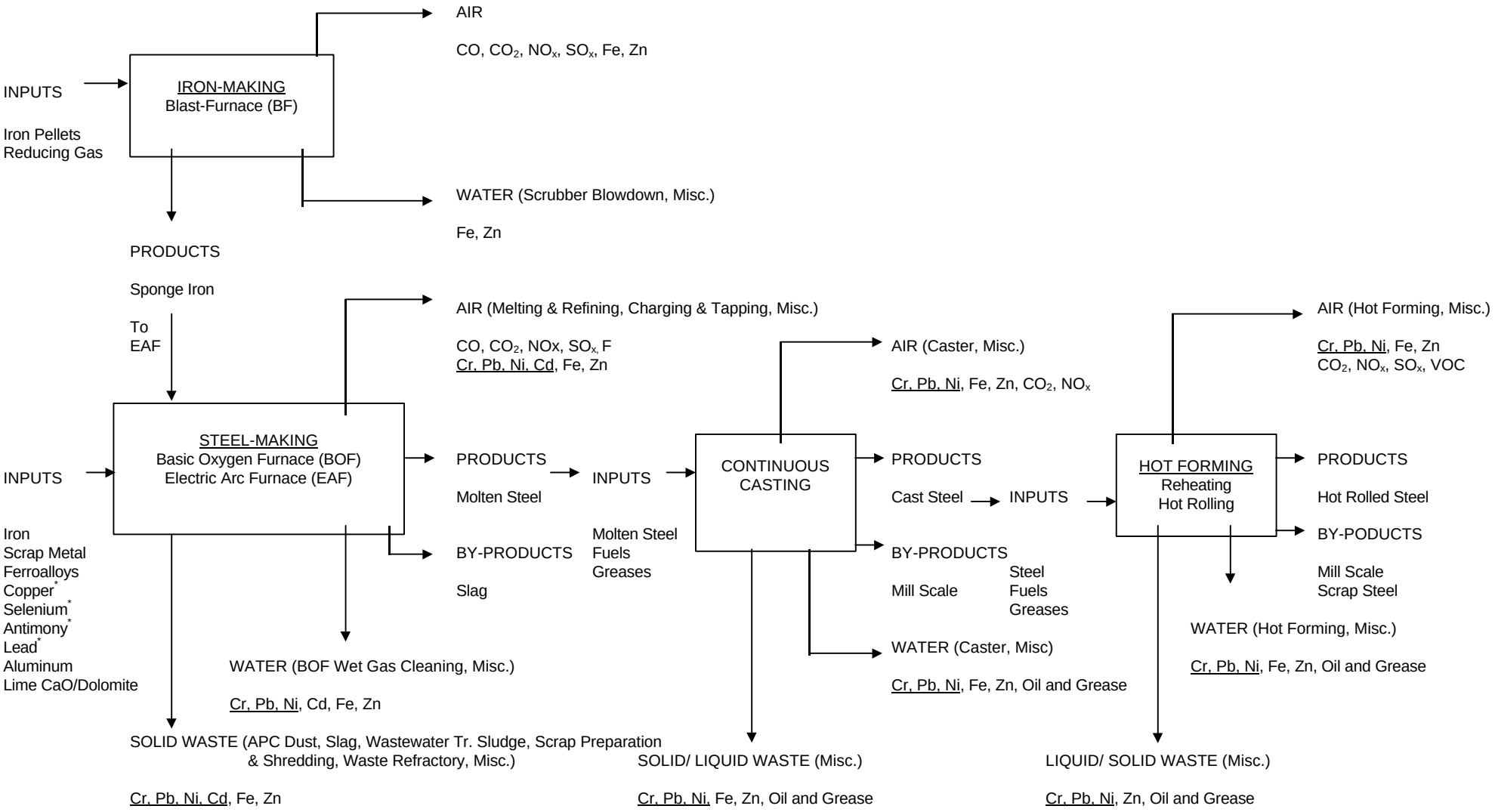
Substance	Total Estimated Release (tonnes)
Benzene	0.25
Polycyclic Aromatic Hydrocarbons (PAHs)	0.11
Inorganic Fluorides	No estimate available
Arsenic and its compounds	No estimate available
Cadmium and its compounds	13.50
Chromium and its compounds	196.7
Lead	361.4
Mercury	No estimate available
Nickel (total)	7.24
Chlorinated solvents	No estimate available
Polychlorinated biphenyls (PCBs)	No estimate available
Dioxins and furans	No estimate available

FIGURE 5-1 COKE-MAKING AND BLAST FURNACE IRON-MAKING



Note: *CEPA*-toxic substances are underlined

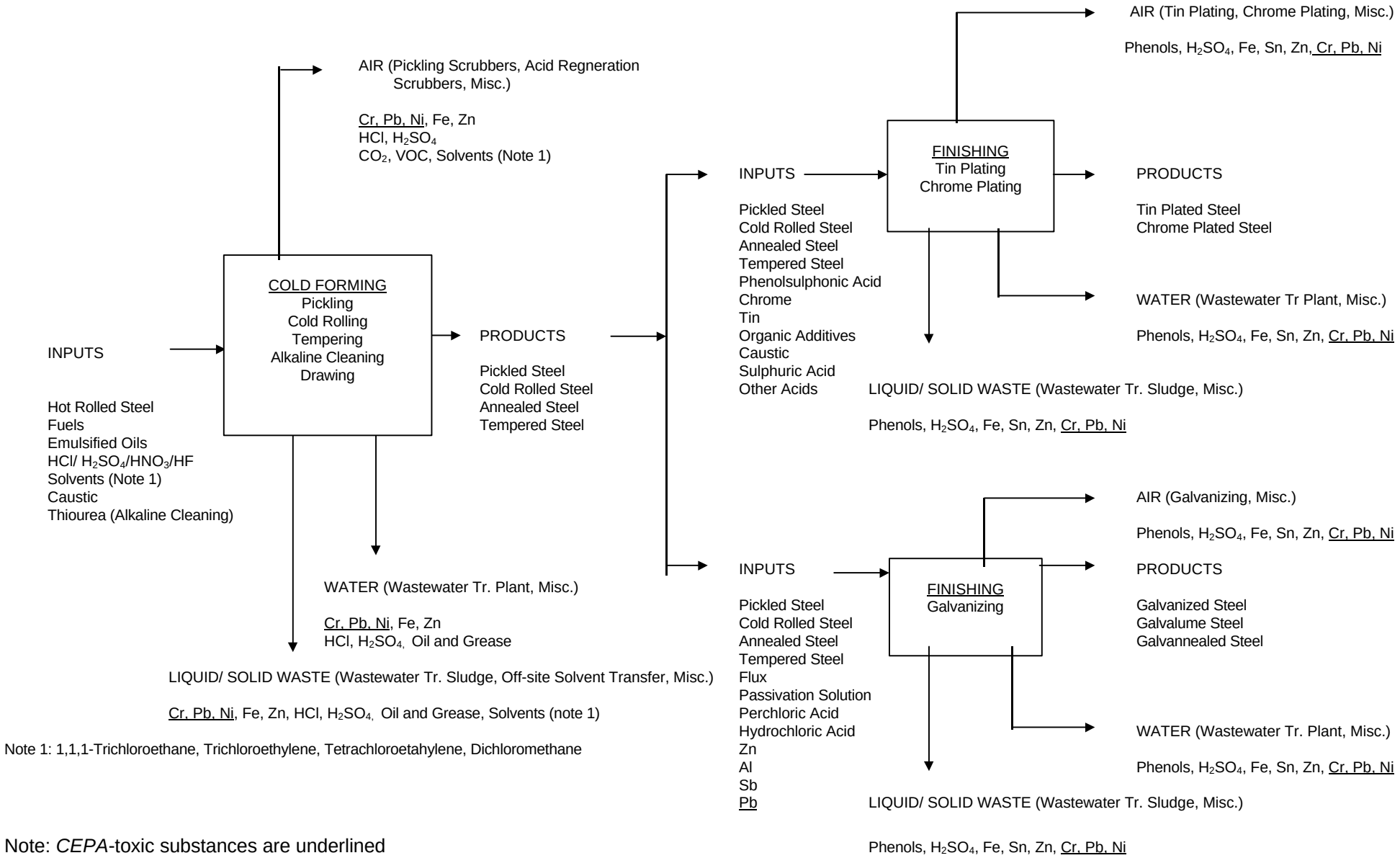
FIGURE 5-2 DIRECT REDUCTION IRON-MAKING, STEEL-MAKING AND HOT FORMING



* trace elements in scrap metal

Note: *CEPA*-toxic substances are underlined

FIGURE 5-3 COLD FORMING AND FINISHING



Note 1: 1,1,1-Trichloroethane, Trichloroethylene, Tetrachloroetahylene, Dichloromethane

Note: *CEPA*-toxic substances are underlined

5.1 Benzene and Polycyclic Aromatic Hydrocarbons (PAHs)

Coke is used in the blast furnace as a reductant as well as the energy source for the conversion of iron ore to molten pig iron in an integrated steel mill. Coke production and the processing of coke oven off-gases for the recovery of coal chemicals in the by-product recovery plant are associated with the releases of benzene and polycyclic aromatic hydrocarbons (PAHs).

Benzene air emissions, which are generally fugitive in nature, are released in varying amounts from numerous sources at a typical by-product plant[11, 14, 17]. The largest benzene release sources are: (1) tar separation and processing; (2) naphthalene separation and processing; (3) light-oil recovery; and (4) leaks from pumps, valves, exhausters, and other equipment components. Some benzene is also released from coke batteries during coal charging, coking, pushing and quenching operations. When hot coke is quenched by water sprays, the resulting wastewater is contaminated with particulates and organics such as benzene.

PAHs are mainly released from the coke batteries in the form of fugitive air emissions from coke oven charging and topside leaks and door leaks. Small amounts of PAHs are discharged with the effluent from the by-product wastewater treatment plant.

5.2 Metals

All six metals (arsenic, cadmium, chromium, lead, mercury and nickel) can be present as trace elements in the raw materials such as coal, iron ores and scrap used in iron-making and steel-making processes.

Most of the chromium releases are in the trivalent or "total" form[15]. The potential for releases of hexavalent chromium is mainly found in wastewaters from galvanizing and tin plating and chrome plating operations in integrated mills. Cadmium is present in the zinc used for hot dip galvanizing and electro galvanizing.

Chromium and nickel are added as alloying elements in specialty, high alloy and certain grades of low alloy steels. Soluble nickel is found in steel-finishing wastewater where stainless or nickel-containing alloy steels are pickled or acid-cleaned with combinations of hydrofluoric and nitric acids. Nickel air emissions from steel-making operations are generally in the "total" or particulate form, with some small fraction which may be soluble in water.

5.2.1 Metals from Integrated Mills

The following operations are potential sources of metal releases:

Sintering

The sintering process converts a variety of steel mill materials such as sludges, flue dust, mill scale and other finely divided iron-bearing materials into a clinker-type aggregate product that is suitable for charging to the blast furnace. In the sinter plant, the iron bearing material mixed with coke breeze or coal and limestone or dolomite is spread on a continuous travelling grate (sinter strand) where combustion air is drawn in, and the mixture is ignited by natural gas or fuel oil. The major sources of air emissions are associated with the burning process, which carries substantial quantities of particulates out of the windbox, and the cooling air circulating through the sinter strand and discharge. The major source of fugitive emissions are the material handling operations, emissions from the sinter line (if effective secondary emission control systems are not used), screening and crushing of sinter, and wind-blown emissions from storage piles.

The sintering process is used at both Stelco and Algoma. The sinter plant at Stelco Hilton Works is considered a part of their blast furnace iron making operation, and processes by-product wastes from Stelco operations[18]. Wastewater effluents from the air pollution control equipment are combined and treated with those from the blast furnace operations. The Algoma sinter plant, which is a stand-alone operation located at Wawa, Ontario, processes virgin iron ores and waste iron oxides from the Algoma integrated mill and other steel mill sources. The operation is unique in Canada because some of the local siderite ore has a relatively high arsenic content and, likely, mercury in small but significant amounts. As the dry air pollution control system consists of relatively low collection efficiency multi-clones, this plant is currently a significant source of arsenic and other air emissions in Canada.

Coke-making

Emissions from coke ovens are mostly fugitive emissions from the charging of coal into the coke ovens, leaks from doors, topside lids and other coke oven sources, and pushing (i.e., discharge) of the hot coke. Emission control technology has been developed for charging and pushing emissions which utilize wet scrubbing, electrostatic precipitators and fabric filters. Emission control of leaks involves appropriate operating and maintenance management practices.

Other sources of air emissions include the coke oven heating stacks (minimal toxic substance emissions with modern combustion control systems), quenching of the coke with baffle-type particulate control, and fugitive emissions from coal handling operations, coke crushing and screening, and wind-blown emissions from storage piles.

The major source of wastewater discharge is the flushing liquor generated by the off-gas and the coke quenching station. The coke quench water discharge is treated by settlement of solids and sent to the by-product plant for final treatment. The coke

breeze (undersize coke) from the crushing and screening operation is either recycled to the coke ovens or sold.

Wastes from the coke oven operations are treated in the by-product plant prior to discharge. The wastewater stream is treated in a series of chemical processes, is subjected to biological treatment and clarification, and is often directed to a lagoon before being discharged to the environment. By-products which are produced include coal tar, ammonia, sulphur and light oil (benzene, toluene and xylene) for sale. Sludges from the wastewater processing are generally sent to landfill.

Blast Furnace Iron-making

The gases from the blast furnace are cleaned in a pollution control system consisting of a dry dust catcher and a high energy wet venturi scrubber prior to distribution as a fuel in boilers, blast furnace stoves and coke oven flue heating. As the blast furnace is a totally enclosed system, there are no emissions during normal operation. However, emissions can occur during blast furnace slips or irregularities. The major source of metal emissions is associated with tapping (casting) operations when metal and slag are run off from the furnace in runners extending from tap-holes to receiving ladles. Emissions from the cast house are normally evacuated to a baghouse before release to the environment.

Blast furnace scrubber wastewater is treated in a clarifier thickener with the sludge dewatered in a lagoon or by mechanical dewatering. The clarified effluent is recycled back to the blast furnace (93-98% recycle). Blowdown is treated for removal of metals prior to discharge.

The major sources of fugitive emissions are the material handling operations, cast house and tapping operations if effective secondary control systems are not used, blast furnace slips, cooling, crushing and screening of slag, transfer of molten iron, and wind-blown emissions from storage piles.

The major solid waste is slag which is pelletized or crushed and screened for sale in construction or other uses. Iron oxides recovered from the emission control system and sludges from the wastewater treatment system are stockpiled, recycled by sintering, or sent to landfill.

Basic Oxygen Furnace Steel-making

Three of the four Canadian basic oxygen furnace melt shops are equipped with either wet-suppressed combustion or wet-open combustion emission control systems for primary emissions. The fourth shop (Stelco Hilton) is a dry-open combustion system equipped with an electrostatic precipitator[18]. Wastewater from the basic oxygen furnace scrubber is clarified and recycled. Approximately 2% of the effluent is treated

chemically for metals removal followed by clarification and filtration before discharge as blowdown.

Fugitive emission sources are molten pig iron transfer, furnace charging, metal tapping and slag tapping. The extent to which these emissions are captured depend upon the efficiency of the secondary control systems.

The major solid waste is slag, which is cooled, crushed and screened. Metal recovered from the slag is recycled to the iron-making process while the slag is either sold for construction or other uses or landfilled. Iron oxides recovered from the emission control system and sludges from the wastewater treatment system are stockpiled, recycled by sintering, or sent to landfill.

Ladle Metallurgy, Continuous Casting and Hot Forming

Ladle metallurgy, which may include several secondary refining processes such as vacuum degassing and alloy additions, is carried out at a ladle metallurgy station. Because ladle metallurgy is a more recent technology and the steel mills are equipped with local tight fitting hoods for collection, air emissions are minimal.

Air emissions from continuous casting operations, which are produced during pouring of molten steel from the ladle to the tundish and from the tundish to the casting machine, are essentially all fugitive. Secondary control systems are often used to minimize these emissions.

Air emissions from hot forming operations, which include hot rolling of steel into the desired shape and size, are minimal.

Spray water used for cooling of both continuous casting and hot rolling operations is treated in lagoons or pits with scale settling out and oil skimmed from the surface, followed by filtration. This water is recycled, except for a small blowdown which is usually treated before discharge.

Cold Forming and Finishing

Cold forming and finishing operations include acid pickling, cold rolling, tempering, cleaning, annealing and coating operations.

The oxide scale on hot rolled steel strip, and some sheets, is removed in the acid pickling operation. The strip is passed through a series of sealed and enclosed tanks containing acid or rinse water. Either hydrochloric acid or sulphuric acid is used for carbon steel while solutions of nitric acid and hydrofluoric acid are used to descale stainless steel. Acid vapours evaporated from the exposed acid baths are evacuated to packed bed scrubbers before discharge to the environment.

Spent pickle liquor, containing weak acids and iron compounds, is generally processed in an on-site acid regeneration plant that recycles the regenerated acid to the pickling operation and iron oxide to steel-making or sale. The acid vapours, mists and particulate air emissions from the acid regeneration process are cleaned by high efficiency absorbing/scrubbing control systems that minimize the discharge of toxic emissions.

Rinse water and scrubber wastewater containing metals are treated by neutralization, oil and grease separation, clarification and filtration before recycling or discharge.

Annealing is a process involving heating and cooling of steel coils, bars or rods to remove stresses and alter the mechanical and physical properties of steel. Since this is a combustion process using mainly natural gas, air toxic emissions are negligible.

The major coating operations involve galvanizing, chrome plating and tin plating of finished steel. The galvanized steel is treated by washing with dilute solutions of sodium silicate and sodium dichromate, chromic acid, and phosphoric acid. In plating, the tin coated steel is dipped in a closed dip tank containing chromate solution. Low levels of hexavalent chromium emissions from the acid baths are captured by mist eliminators.

Spent chrome containing process solutions are typically sent for off-site disposal to secure hazardous waste landfills. Chrome plating wastewaters are normally treated by ion exchange. The chrome-free treated water product from the ion exchange process is recycled back to the plating line. Chrome which has been captured by ion exchange is processed through a volume reduction concentrator. The concentrated chrome product is typically sent off-site for disposal at a secure hazardous waste landfill.

The major source of fugitive emissions are zinc fumes from hot-dip galvanizing, acid fumes from acid pickling, and chlorinated solvents from cleaning and degreasing operations. Most of these sources have secondary control systems to minimize emissions.

5.2.2 Metals from Non-integrated Mills

Electric Arc Furnace Steel-making

All non-integrated mills with the exception of the Sidbec-Dosco facility use scrap as the primary basic raw material for their electric arc furnaces. Sidbec-Dosco (Ispat) Inc., on the other hand, charges its electric arc furnace with a combination of direct reduced iron and scrap. The direct reduced iron comes from the direct reduction iron-making operation where iron pellets are reduced in a shaft furnace using reformed natural gas.

Metals released from electric arc furnace steel-making operations are either present in the scrap as contaminants, direct reduced iron or added as alloying elements.

Chromium and nickel are the principal alloy elements used for the manufacture of high alloy specialty and stainless steel (e.g., Atlas Specialty Steels, Atlas Stainless Steels).

They may also be used in lesser quantities to produce high alloy and certain grades of low alloy steel. Lead is used as an alloying element to produce leaded steel for machining applications.

Air emissions mainly result from various electric arc furnace operations. The off-gases from the electric arc furnace are typically vented to dry fabric filters through a water cooled elbow mounted on the fourth hole on the furnace roof. Secondary emissions, which are generally intermittent, may be captured by a canopy hood or furnace enclosure and exhausted to fabric filters.

The major fugitive emission sources are associated with furnace charging and tapping operations and furnace puffs. The magnitude of these emissions depends upon the effectiveness of the mill's secondary control systems.

There are no process wastewaters associated with electric arc furnace steel-making operations in Canada as all electric arc furnaces are controlled by dry fabric filter air cleaning systems. Wastewaters originate from vacuum degassing refining, continuous casting, hot forming and finishing operations. These are typically treated for removal of mill scale, oil and grease in scale pits followed by clarification and/or filtration. Up to 98% of the treated wastewater may be recycled. A small blowdown may be treated for metal removal by filtration or precipitation before discharge.

The volume of electric arc furnace slag is less than that of the basic oxygen furnace, but the approach to treatment and disposal is similar.

Fugitive emissions from ladle metallurgy, continuous casting and hot forming are similar to those for the integrated mills and are controlled in a similar manner.

Direct Reduction Iron-making

In the direct reduction iron-making operation, where iron pellets are reduced to sponge iron in a shaft furnace using reformed natural gas, about 70% of the off-gas from the shaft furnace is recycled. The remaining off-gas is burned to provide the necessary heat for gas reforming and preheating of combustion air. The particulates contained in the off-gas from the shaft furnace are collected by wet scrubbing and recycled in the process[10].

5.3 Dioxins and Furans

Polychlorinated dibenzodioxins (dioxins) and polychlorinated dibenzofurans (furans) are two related families of highly persistent chlorinated organic chemicals[7]. In total, there

are 210 dioxins and furans: 75 from the dioxin group and 135 from the furan group. The most hazardous dioxins and furans are those with chlorine atoms attached to positions 2, 3, 7 and 8. There are 17 dioxins and furans attached to the 2, 3, 7 and 8 positions.

In sintering and electric arc furnace steel-making operations, dioxins and furans may be formed as unwanted by-products during high temperature decomposition and combustion of raw materials containing chlorine and organic compounds. The raw materials processed in the sinter plants include air pollution control dusts, wastewater treatment sludge, ore fines, coke fines and limestone. Scrap melted in the electric arc furnaces may contain plastic residues and chlorinated cutting oils.

5.4 Polychlorinated Biphenyls (PCBs)

PCBs are not directly used in any steel production process, but are used as industrial coolants and are contained in electrical equipment such as transformers and capacitors used in steel mills. When properly maintained, there is little potential for release of PCBs from electrical equipment in service. The principal concern is that PCBs can be released to the environment from accidents that may include physical damage to equipment and fires.

Production of PCBs was banned in 1977 by Environment Canada. These substances are highly regulated by federal and provincial agencies. Regulations require contemporary inventories of in-service PCB equipment and secure storage for PCB waste and PCB equipment taken out of service.

5.5 Chlorinated Solvents

Chlorinated solvents are typically used in the steel sector for maintenance and cleaning operations external to the process (e.g., parts cleaning in roll shops, motor repair shops and other maintenance stations), and as degreasing agents to clean the steel prior to further finishing[7, 14]. At Atlas Stainless Steels, trichloroethylene is used for surface cleaning of high quality flat-rolled specialty steels prior to bright annealing operations. De-oiling with this solvent is generally performed in closed tanks equipped with vapour condensers where only two slots permit the entry and exit of the steel sheet or strip. At other mills, the solvents are applied manually or used in standard vapour degreasing stations in other applications. The solvents are mainly lost to air as volatile organic emissions, and to water due to leaks and spillage or as degreasing sludges.

5.6 Inorganic Fluorides

Inorganic fluorides are contained in raw materials (such as coal, iron ore and fluxes) used in various processes including by-product coke-making, sintering, iron-making, steel-making, ladle metallurgy, continuous casting, acid pickling and electroplating. The major release sources are the solid mould powder containing inorganic fluoride used as a lubricant in continuous casting of molten steel, and the fluorspar used as a flux material in iron-making and steel-making. Emissions of inorganic fluorides are

controlled by the primary and secondary emission control systems of the various steel-making processes. The degree of control may be lower than that for particulates since some of the fluoride emission may be in a fume or gaseous form. Inorganic fluorides captured by wet emission control systems are controlled by wastewater treatment systems.

6.0 RELEASE DATA

The reported releases of the steel manufacturing sector, relative to other sectors, are tabulated below. These data are derived from the National Pollutant Release Inventory (NPRI) data for 1993[16] and other references as indicated:

Substance	***Percentage of Total***
Benzene	42.97*
Polycyclic aromatic Hydrocarbons (PAHs)	No estimate available
Arsenic and its compounds	27.2*
Cadmium and its compounds	7.3*
Chromium and its compounds	63.7*
Lead and its compounds	11.9*
Mercury and its compounds	29.5*
Nickel and its compounds	4.9*
Dioxins and Furans	No estimate available
Polychlorinated Biphenyls (PCBs)	No estimate available
Chlorinated Solvents	0.8*
Fluorides	No estimate available

** Percentages based on air and water release data only.*

Additional Sources: 1994 Stack Testing Information for the Algoma Sintering Plant
Apogee Research Final Phase I Report, January 1997

The estimated air and water releases of the sixteen substances from the Canadian steel manufacturing sector are shown in Tables 6-1 and 6-2 below.

As indicated in Tables 6-1 and 6-2, some of the sixteen substances are reported to be released in small quantities, and some are only from certain manufacturing processes. Some of these substances are also released into only one medium, such as air or water. The source process of releases can be prioritized for evaluation as shown in Table 6-3[3].

TABLE 6-1 SUMMARY OF RELEASE ESTIMATES OF BASE YEAR AIR EMISSIONS FROM THE CANADIAN STEEL MANUFACTURING SECTOR(15)

Summary of Release Estimates of 1993 Air Emissions (tonnes/year)					
Substance	**Integrated Mills and QIT**	**Algoma Sinter Plant**	**Mini-Mills**	**Specialty Steel Mills**	**Totals**
Benzene	1,237	NEA	NEA	NEA	1,237
PAHs	186	NEA	NEA	NEA	186
Inorganic fluorides	28.4	NEA	NEA	NEA	>28.4
Arsenic and its compounds	0.02	24.4	0.09	0.005	24.5
Cadmium and its compounds	0.21	0.13	0.79	0.07	1.20
Chromium and its compounds (total)	1.03	0.11	2.13	0.99	4.26
Chromium, hexavalent	NEA	NEA	NEA	NEA	NEA
Lead and its compounds	0.76	55.3	22.86	0.30	79.22
Mercury	0.02	0.60	0.01	0.001	0.63
Nickel and its compounds (total)	0.12	0.16	0.19	0.39	0.86
Nickel, soluble	NEA	NEA	NEA	NEA	NEA
Chlorinated solvents	35	NEA	16	34	>85
PCBs	NEA	NEA	NEA	NEA	NEA
Dioxins and Furans (grams/year TEQ)	NEA	19.4	NEA	NEA	NEA

NEA: No estimate available

TEQ: Toxic equivalent

References:

All data is based on 1993 NPRI and Apogee Research estimates with the following exceptions:

- PAH data for integrated mills by W. Lemmon, Charles E. Napier Co. Ltd.
- Atlas Specialty Steels emissions corrected based on follow-up submission to NPRI by Atlas.
- Algoma Sintering Plant data based on 1994 stack test data.

TABLE 6-2 SUMMARY OF RELEASE ESTIMATES OF 1993 WASTEWATER DISCHARGES FROM THE CANADIAN STEEL MANUFACTURING SECTOR(15)

Summary of Release Estimates of 1993 Wastewater Discharges (tonnes/year)					
Substance	**Integrated Mills and QIT**	**Algoma Sinter Plant**	**Mini-Mills**	**Specialty Steel Mills**	**Totals**
Benzene	0.08	NEA	NEA	NEA	>0.08
PAHs	0.17	NEA	NEA	NEA	>0.17
Inorganic fluorides	178.2	NEA	NEA	NEA	>178
Arsenic and its compounds	1.42	NEA	0.0004	NEA	>1.42
Cadmium and its compounds	0.15	NEA	NEA	NEA	>0.15
Chromium and its compounds (total)	0.91	NEA	0.26	30.1	>31.3
Chromium, hexavalent	1.58	NEA	0.04	0.6	>2.22
Lead and its compounds	0.53	NEA	3.87	0.03	>4.42
Mercury	0.008	NEA	NEA	NEA	>0.008
Nickel and its compounds (total)	0.67	NEA	0.98	23.6	>25.28
Nickel, soluble	0.016	NEA	0.004	0.003	>0.023
Chlorinated Solvents	0.001	NEA	NEA	NEA	>0.001
PCBs	NEA	NEA	NEA	NEA	NEA
Dioxins and Furans	NEA	NEA	NEA	NEA	NEA

NEA: No estimate available
Source: NPRI 1993 and Apogee Research Estimates

TABLE 6-3 PRIORITIES FOR EVALUATION OF *CEPA*-TOXIC RELEASES FROM THE STEEL MANUFACTURING SECTOR

Substance	Media	Process
Polycyclic Aromatic Hydrocarbons (PAHs)	Air/Water	Coke ovens
Benzene	Air/Water	By-product coke plants
Metals	Air/Water	Integrated steel mills, mini-mills, specialty mills
Dioxins and Furans	Air	Non-integrated steel mills, sintering plants
Arsenic	Air	Sintering plants
Polychlorinated Biphenyls (PCBs)	Air/Water	All categories
Chlorinated Solvents	Air	All categories
Fluorides	Air/Water	Integrated steel-making

7.0 CURRENT POLICY AND PROGRAM FRAMEWORK

Various regional, national and international environmental policies, programs and commitments provide a context for the management of toxic substances. Some of these initiatives provide a context for goals, targets and schedules for the steel manufacturing sector.

"Goals" are the broad, ultimate objectives for managing the 16 toxic substances, and are guided by the Toxic Substances Management Policy [5]. Considerations and criteria which are relevant to the establishment of goals, targets and schedules are described below.

7.1 Toxic Substances Management Policy (TSMP)

The federal government's TSMP provides the broad framework for addressing the 16 toxic substances. The TSMP defines separate goals for two types of substances, "Virtual Elimination" for Track 1 substances, and "Life-Cycle Management" for Track 2 substances, as outlined in Table 7-1.

TABLE 7-1 TSMP GOALS FOR TRACK 1 AND TRACK 2 SUBSTANCES

Track	Substance Criteria	TSMP
1	*CEPA*-Toxic or Equivalent Predominantly Anthropogenic Bioaccumulative Persistent	Virtual elimination (VE) from the environment
2	Not All Track 1 Criteria Met	Life-cycle management (LCM) to prevent or minimize release

Three of the sixteen substances are classified by Environment Canada as Track 1 substances, as shown in Table 7-2.

TABLE 7-2 TRACK 1 AND TRACK 2 SUBSTANCES

Track 1	Track 2
PCBs Dioxins (PCDDs) Furans (PCDFs)	Inorganic arsenic compounds* Inorganic cadmium compounds* Hexavalent chromium compounds (Cr^{+6})* Lead Mercury Oxidic, sulphidic and soluble, inorganic nickel compounds* Inorganic fluorides Benzene* Polycyclic aromatic hydrocarbons (PAHs)* Dichloromethane* Tetrachloroethylene 1,1,1-Trichloroethane Trichloroethylene*

* Substances marked with an asterisk were declared human carcinogens or possible carcinogens in the *Canadian Environment Protection Act* Priority Substances List Assessments[19].

The goal for Track I substances is **"*virtual elimination*"** and will be based on strategies to prevent the measurable release of the substances into the environment. There is an onus on potential emitters of Track 1 substances, to report and reduce or eliminate their releases, taking into account technical and economic considerations. To determine ✌measurable releases", "Levels of Quantification (LOQ)" will be established, based on accepted sampling and analytical techniques.

For Track 2 substances, the goal is **"*life-cycle management*"** to minimize environmental and health and environmental risks, by reducing exposure to, and/or the release of the substances into the environment. The reduction of releases, to the extent practicable, is to be based on technical and economic considerations.

As indicated, the toxics management strategies and timelines for implementation for both Track 1 and Track 2 substances should take account of technical and economic considerations. Also pollution prevention principles are to be followed.

7.2 Canada-Ontario Agreement (COA)

The Canada-Ontario Agreement[20] is an agreement between the Federal Government of Canada and the Province of Ontario to help meet Canada's obligations under the Canada-U.S. Great Lakes Water Quality Agreement. In 1994, the Agreement was renewed and called for co-ordinated action to restore, protect, and sustain the Great Lakes Basin Ecosystem. In developing goals and targets for the steel manufacturing sector, both COA and TSMP are considered.

Two of the three COA objectives are most relevant to the Steel Manufacturing Sector Strategic Options Process (SMSSOP):

- Restore Degraded Areas which committed the two governments to restore degraded areas through remedial action plans (RAPs) in 17 areas of concern (AOC). RAPs have been initiated at several sites, including Hamilton Harbour and the St. Mary's River, where steel mills are significant sources of pollutants; and

- Prevent and Control Pollution which requires immediate action leading to the virtual elimination of persistent, bioaccumulative and toxic substances from the Great Lakes Basin Ecosystem. These substances are referred to as Tier 1 and Tier 2 substances.

For Tier 1 substances, the approach to achieving virtual elimination is to encourage and implement strategies consistent with the philosophy of zero discharge, with a short-term target of 90% reduction by the year 2000. For Tier 2 substances, the approach to achieving virtual elimination is to encourage and implement strategies consistent with the philosophy of zero discharge, with a short-term target of significant reductions by the year 2000. Specific timelines and targets for achieving virtual elimination are to be established for all of these substances.

The toxic substances covered by both the Steel Manufacturing Sector Strategic Options Process (SSOP) and Canada-Ontario Agreement (COA) are listed in Table 7-3, and a comparison of COA and TSMP objectives is presented in Table 7-4.

TABLE 7-3 TIER 1 AND TIER 2 SUBSTANCES

COA	Substance of Concern	COA Commitment
Tier 1	Benzo[a]pyrene (PAH)* Dioxins* Furans* Mercury* High level PCBs in use**	* 90% reduction in use, generation or release by year 2000 **Decommission 90% currently in use, destroy 50% currently in storage by year 2000
Tier 2	Cadmium Anthracene and 17 other PAHs	Significant reductions by year 2000

TABLE 7-4 COMPARISON OF COA AND TSMP OBJECTIVES FOR TOXICS

	TSMP Objective	COA Objective
Goal	Track 1 - Virtual elimination Track 2 - Life-cycle management Timelines to be established	Tier 1 - Virtual elimination Tier 2 - Virtual elimination Timelines to be established
Interim Targets	As recommended by strategic options process	Tier 1 - 90% reduction in use, generation and release by year 2000. Tier 2 - Significant reduction by year 2000.
Approach	Pollution prevention Non measurable at source	Pollution prevention Eliminate formation

7.3 Canada-United States of America Great Lakes Water Quality Agreement

The first Great Lakes Water Quality Agreement (GLWQA)[11, 21] was signed by Canada and the United States in 1972. This agreement focused on controlling phosphorus, and between 1975 and 1989, municipal and agricultural inputs of phosphorus to Lake Erie dropped by 70 per cent.

By the mid-1970's, elevated concentrations of toxic substances found in fish shifted the focus to the threat toxic chemicals posed to the Great Lakes ecosystem. In 1978, the second GLWQA was signed to prohibit the discharge of toxic substances in toxic amounts and to virtually eliminate the discharge of persistent toxic substances. By the early 1980's, levels of synthetic organic chemicals and heavy metals, and levels of PCBs and DDT in lake trout, showed a decline.

In 1987, Canada and the United States renewed their commitment to eliminate persistent toxic substances in a Protocol to the 1978 Agreement. The 1987 Protocol endorsed the development of Remedial Action Plans (RAPs) to clean up 43 designated Areas of Concern, 17 of which are in Canada. The Protocol also called for the development of Lakewide Management Plans for each of the lakes with greater emphasis on airborne pollution, polluted run-off from land, leakage from toxic chemical dumps, and contamination of lake sediments. In keeping with the objective of the 1987 Protocol, a Binational Strategy has been proposed to co-ordinate Canada-U.S. efforts for the virtual elimination of persistent toxic substances.

7.4 St. Lawrence Action Plan

The St. Lawrence Action Plan, established in 1988[22], seeks to reduce liquid releases of toxic substances and virtually eliminate persistent toxic releases. Between 1988 and 1995, 50 plants reduced their toxic releases by 96%. The “Saint-Laurent Vision 2000” program continues these efforts.

7.5 Accelerated Reduction or Elimination of Toxics (ARET)

ARET [23] aims to quickly reduce or eliminate toxic substance releases through voluntary action. It seeks virtual elimination of releases of 14 persistent, bioaccumulative and toxic substances and substance groups (List A-1), with a 90% reduction by the year 2000. Four of the sixteen *CEPA*-toxic substances from the steel manufacturing sector (i.e., PCBs, PCDDs, PCDFs, and benzo[a]pyrene, anthracene and 17 PAHs as a group) are on List A-1, while eleven toxics are on List A-2, List B-2 or List B-3. For 87 less hazardous listed substances (e.g., substances not on List A-1), it seeks release reductions to levels that are insufficient to cause harm, with a short-term reduction of 50% by the year 2000 (See Table 7-5 below).

7.6 Canadian Chemicals Producers’ Association (CCPA) Benzene Reduction Program

The CCPA has entered into discussions with Environment Canada concerning the development and implementation of a voluntary benzene reduction program under the auspices of the *"Canadian Chemical Producers' Association (CCPA) and Government of Canada Memorandum of Understanding for Environmental Protection Through Action Under CCPA Responsible Care"* [24]. Although details are still being developed, the main features of the proposal are well defined reduction targets and schedules, community involvement, and public accountability. It calls for a 68% reduction in benzene emissions by 1999 as compared to the 1994 base year. Relevant Codes and Guidelines will be used as additional benchmarks for determining performance levels.

It is expected that the program will be initiated by the end of 1996.

7.7 North America Free Trade Agreement (NAFTA) Commission for Environmental Co-operation (NACEC)

In cooperation with the USA and Mexico, Canada, under NACEC is developing a regional action plan for dealing with mercury issues in North America. The ultimate result will be the development of a tri-national plan for the reduction and/or elimination of anthropogenic sources of mercury on a continental scale. Industry representation of successful reduction programs will be highlighted as a technology transfer initiative with Mexico.

7.8 United Nations Economic Commission for Europe (UN ECE) Convention on Long Range Transboundary Air Pollution (LRTAP)

Canada is currently engaged in discussions to develop a Protocol on Persistent Organic Pollutants (POPs) under the UN ECE LRTAP Convention. The Protocol will aim to reduce or eliminate emissions of a list of POPs which include pesticides, industrial chemicals and unintentional by-products. The following substances will likely be included on the list of substances for inclusion in the initial Protocol: aldrin, chlordane, dieldrin, endrin, DDT, hexabromobiphenyl, hexachlorobenzene, mirex, PAHs, PCBs, dioxins, furans, toxaphene, pentachlorophenol, and possibly heptachlor and short chain chlorinated paraffins. Some of these POPs are of interest to the steel sector. In addition, a process will be put in place for adding additional substances to the Protocol in the future.

Canada is also engaged in discussions to develop a Protocol on Heavy Metals under the LRTAP Convention. This Protocol will promote reduction of transboundary emissions of, initially, three heavy metals (cadmium, lead and mercury). The Protocol direction is focused on reducing heavy metals from major new and existing stationary sources.

7.9 Existing Goals, Targets and Schedules

Approach

The federal TSMP provides the general framework for developing goals, targets and schedules.

Three of the sixteen substances, namely, polychlorinated biphenyls (PCBs), polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) are Track 1 substances. PCBs, PCDDs and PCFDs are Track 1 substances according to TSMP, since they are persistent, predominantly anthropogenic bioaccumulative and *CEPA*-toxic or equivalent. The key management goal of this SOP for Track I substances is ✌virtual elimination✍ and is based on strategies to prevent the measurable release of the substances into the environment.

The other thirteen toxic substances are Track 2 substances according to the TSMP, since they are not considered bioaccumulative. The long term goal of this SOP is, therefore, guided by the Track 2 substance management objective, namely, managing the substances through their life cycle to prevent or minimize their release into the environment. Several of the Track 2 substances are also recognized as probable human carcinogens. The goal for these substances is also consistent with the approach adopted in the Carcinogen Assessment prepared by Health Canada [(19)] which states that for those carcinogens, exposure should be reduced to the maximum extent practicable.

Summary of Existing Targets and Schedules

The following targets and schedules[5,20, 23] for the sixteen toxic substances (Table 7-5), from various federal and provincial programs activities related to the steel manufacturing sector, were taken into consideration.

TABLE 7-5 EXISTING TARGET AND SCHEDULES

Substance	Substance Category			Reduction Targets and Schedules		
	ARET List	COA List	TSMP Track	ARET	COA	TSMP
Base Year Target Year				1988 2000	1988 2000	Not Specified
PCBs	List A-1	Tier 1	Track 1	VE (90%)	VE (90%)	VE
Dioxins	List A-1	Tier 1	Track 1	VE (90%)	VE (90%)	VE
Furans	List A-1	Tier 1	Track 1	VE (90%)	VE (90%)	VE
Benzo[a]pyrene	List A-1	Tier 1	Track 2	VE (90%)	VE (90%)	LCM
Benzene	List B-3		Track 2	50%		LCM
PAHs*	List A-1	Tier 2	Track 2	VE (90%)	VE (>50%)	LCM
Anthracene	List B-2	Tier 2	Track 2	50%	VE (>50%)	LCM
Arsenic	List B-2		Track 2	50%		LCM
Cadmium	List A-2	Tier 2	Track 2	50%	VE (>50%)	LCM
Chromium	List B-2		Track 2	50%		LCM
Lead	List B-2		Track 2	VE (90%)		LCM
Mercury	List B-2	Tier 1	Track 2	50%	VE (90%)	LCM
Nickel	List B-2		Track 2			LCM
Fluorides	List B-2		Track 2	50%		LCM
Dichloromethane	List B-2		Track 2	50%		LCM
Tetrachloroethylene	List B-2		Track 2	50%		LCM
1,1,1-Trichloroethane			Track 2			LCM
Trichloroethylene	List B-3		Track 2	50%		LCM

* Includes 17 PAHs as a group, reduction plans are to be implemented by 1998.

VE: Virtual elimination
LCM: Life-cycle management

7.10 Provincial Programs

There are currently no federal regulatory or non-regulatory standards specifically for the steel sector. However, a number of provincial programs are particularly relevant to the management of some *CEPA*-toxic substances. Some of these provincial regulations are the mechanism through which joint co-operative federal-provincial programs are implemented.

Ontario

The Ontario Municipal/Industrial Strategy for Abatement (MISA) Regulations, which address levels of persistent toxic substances in industrial direct discharges entering Ontario's waterways, were promulgated between 1993 and 1995 for nine industrial sectors[18], including the iron and steel sector. The Regulations include source performance based limits derived from analyses of best available technology economically achievable (BATEA) and production levels. MISA limits for the iron and steel sector will become enforceable on April 13, 1998.

The Ontario *General Air Pollution Regulation (Regulation 346)*[25] is designed to regulate air pollution from most stationary sources and includes the iron and steel sector. The regulated party is required to meet point of impingement limits at an ambient location by installing control equipment at the source and/or switching to less innocuous substances. Interim standards and Approvals Screening Levels (ASLs) for substances not included in the one hundred substances listed in the Regulation can be included in Certificates of Approval.

Québec

Québec has air and water technology based source control regulations. For example, *"Le Règlement sur la qualité de l'atmosphère"* has emission stack limits for many sources. In addition to current requirements, *"Le Programme de réduction des rejets industriels"* is being developed for various industrial sectors, including the steel sector. Regulatory standards which are generally more comprehensive and stringent than current requirements are being developed, based on consideration of standards and practices in various jurisdictions and organizations.

Other Provinces

Manitoba, Saskatchewan, Alberta and Nova Scotia have various environmental regulatory frameworks which do or could include requirements for the management of *CEPA*-toxics.

8.0 ASSESSMENT OF OPTIONS

To assist the Issue Table in undertaking the Strategic Options Process for the Steel Manufacturing Sector, a contract was awarded to Apogee Research in association with Amendola Engineering, Charles E. Napier Company Ltd., GlobalTox and Jacobson Consulting Inc[15]. This consultant group developed a report which includes information on the sector technical processes and associated releases of substances.

For various priority substance/process combinations, technical options to reduce releases were identified and assessed. Six strategic management options to encourage adoption of the technical options were also assessed. These strategic options covered a range of non-regulatory options, recognizing existing voluntary and regulatory programs[15].

8.1 Technical Options and Cost Implications

The *CEPA*-toxic substance emission reduction estimates apply across the steel sector unless otherwise specified. The agreements on issues resulting from the Issue Table deliberations are reflected in the technical options. The Apogee Research Phase 1 Report, Section 5.1 is the primary background document for the technical options and is supplemented by other information sources as noted.

The discharge estimates of *CEPA*-toxic substances are primarily based on company submissions to the ARET and NPRI programs. Not all of the steel companies participated in either of these programs. The methodology which the companies used to develop their discharge estimates is not available. Some of the reporting companies did not provide estimates for all substances. Where appropriate the discharge estimates were assessed and modified in the Apogee Research Phase 1 Report. Also, where new information was provided to the Issue Table discharge estimates were modified. Consequently, more information needs to be obtained from the companies to validate the discharge estimates.

8.1.1 Benzene

8.1.1.1 Air Emissions

Short-term Technical Option - Phase 1 (to be completed by 2000)

This technical option is based on the addition of improved emission control technology for process vessels and storage tanks, coal tar and light oil pumping, distribution and loading systems and other benzene emission sources, and the implementation of enhanced management, operating and maintenance practices with the objective of substantially reducing fugitive emissions and spills.

The estimated reduction in benzene air emissions (coke by-products recovery plant

only) from the 1993 base year is 59%[1]. Note that there would also be a reduction in benzene emissions from the coke ovens due to the PAH technical option. Therefore, the reduction would be 57% from the total coke plant operations.

The estimated incremental capital expenditures to achieve this reduction are $25 million.

The estimated incremental annual operating expenditures to achieve this reduction are $3.75 million.[2]

Short-term Technical Option - Phase 2 (to be completed by 2005)

This phase will complete the companies benzene emission control programs initiated in Phase 1.

The estimated reduction in benzene air emissions (coke by-products recovery plant only) from the 1993 base year is 85%. Note that there would also be a reduction in benzene emissions from the coke ovens due to the PAH technical option. Therefore, the reduction would be 83% from the total coke plant operations.

The median estimated benzene emissions were 32 grams per tonne of coke from nine U.S. steel plants that had implemented emission control programs to meet the U.S. National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. The estimated benzene emissions of 54 grams per tonne of coke from the Canadian plants in 2005 is approaching the performance of U.S. mills.

The estimated incremental capital expenditures to achieve this additional reduction are $15 million.

The estimated incremental annual operating expenditures to achieve this reduction are $2.25 million.[3]

[1] The estimated reductions in benzene emissions by company are: Algoma 75% as com mitted under ARET, Dofasco 80% as committed to the Deputy Prime Minister of Canada; Stelco, Hilton Works 47% including the closure of No. 3, 4 and 5 coke oven batteries; and Stelco, Lake Erie Works 75% as committed under the CCPA voluntary benzene emission reduction initiative. This would reduce benzene emissions from 1,110 tonnes in 1993 to 456 tonnes in 2000 or a reduction of 59% total.

[2] The estimate for capital expenditures is based on the estimated expenditures for Dofasco's benzene emission reduction program or $10 per tonne of coke capacity. The estimate for annual operating expenditures is based on 15% of the capital expenditures considering the greater labour intensity required for the reduction of fugitive emissions and spills from this operation.

[3] The estimate for capital expenditures is based on additional expenditures for the completion of the benzene emission reduction program. The estimate for annual operating expenditures is based on 15% of the capital expenditures considering the

Medium-term Technical Option (to be completed by 2015)

The objectives of this medium-term option would be to continue the environmental management program initiated in the short-term technical option and to avoid the construction of new by-product coke batteries to replace existing coke batteries as they reach the end of their operational lives. Some of the coke batteries will have reached or will be approaching the end of their operational lives by 2015. The emission estimates for 2015 in this technical option do not include emission reductions resulting from closure of coke ovens. However, as coke ovens are closed the benzene emissions will be further reduced provided that no new by-product coke ovens are built. It is assumed that some of the coke oven closures may be replaced by some purchases of coke or by non-benzene emitting coke production processes. Also, it is assumed that there will be a reduction in coke demand in the future as existing iron-making processes are replaced by new iron-making processes (e.g., Corex or similar)[(11)].

The estimated reduction in sector benzene emissions from the 1993 base year is 89%.

Long-term Technical Option

The objective of this long-term option would be to phase out the balance of the by-product coke oven batteries. For economic reasons this will most likely occur through the adoption of new iron-making or steel-making processes.

The estimated reduction in sector benzene emissions from the 1993 base year is close to 100%.

It is estimated that no incremental capital or annual operating expenditures will be required to achieve this option.[4]

It is estimated that no incremental capital or annual operating expenditures will be required to achieve this option.

greater labour intensity required for the reduction of fugitive emissions and spills from this operation.

[4] The estimated incremental capital expenditures to achieve this reduction are less than the cost of replacing the coke ovens at the end of their operational life, which is part of the normal cost of doing business. It is likely that both the capital and operating expenditures for a non-coke based iron-making process will be lower than that of building new by-product coke ovens at that time.

8.1.1.2 Wastewater Effluents

No technical options have been included for wastewater effluents because the Ontario MISA regulation[18] will result in discharges of benzene similar to or lower than the U.S.

BATEA effluent limitations guidelines.

References: (15) Apogee Research Final Phase 1 Report, Section 5.1
(29) Charles E. Napier Co., Benzene, Analysis of Emission Options for the Steel Strategic Option Process

8.1.2 Polycyclic Aromatic Hydrocarbons (PAHs)

8.1.2.1 Air Emissions

Short-term Technical Option - Phase 1 (to be completed by 2000)

This phase of the short-term technical option is based on improvements to emission control technology, upgrading the coke ovens through design improvements (e.g., improved door designs) and implementing best management operating and maintenance practices designed to reduce PAH air emissions. The development of these recommended practices would consider the requirements of the US EPA[5] [26], German[6] and other standards. An outside compliance monitoring audit would be included to assess the reduction program achievements.

The estimated emission reduction in this phase includes the impact of the idling of Stelco's numbers 3, 4 and 5 coke oven batteries in 1995. It is assumed that these idled batteries will not be replaced by new or re-built by-product coke oven batteries.

The estimated reduction in sector PAH air emissions from the 1993 base year is 44%.

The estimated incremental capital expenditures to achieve this reduction are $8 to $10 million.

The estimated incremental annual operating expenditures to achieve this reduction are $4 to $6 million[7].

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5 *US EPA, National Emission Standards for Coke Oven Batteries*, 58 FR 57911, October 27, 1993.

6 German EPA, First General Administrative Regulation Pertaining to the Federal Immision Control Law (Tech Instructions on Air Quality Control - TA Luft), 27 February 1986, Section 3.3.1.11.1.

7 The estimate for capital expenditures is based on the assumption that all four plants have many of the major emission control facilities in place and that some of the capital expenditures will be for modifications and design improvements. The estimate for annual operating expenditures is based on the addition of one person per shift to the coke oven topside operations for most batteries, increased maintenance labour and materials for an enhanced maintenance program and early replacement of damaged doors or lids.

Short-term Technical Option - Phase 2 (to be completed by 2005)

This phase will continue the emission reduction program initiated in phase one to achieve a level playing field in terms of grams of PAH emissions per tonne of coke produced. The estimated emission reduction in this phase assumes that the idled coke batteries will not be replaced by new or re-built by-product coke oven batteries.

The estimated reduction in sector PAH air emissions from the 1993 base year is 64%.

The estimated incremental capital expenditures to achieve this reduction are $10 to $12 million (in addition to phase one expenditures).

The estimated incremental annual operating expenditures to achieve this reduction are $3 to $5 million[8] (in addition to phase one expenditures).

Medium-term Technical Option (to be completed by 2015)

The objective of this medium-term option would be to continue the environmental management program initiated in the short-term option and to avoid the construction of new by-product coke batteries to replace existing coke batteries as they reach the end of their operational life. Some of the coke batteries will have reached or will be approaching the end of their operational lives by 2015. The emission estimates for 2015 in this technical option do not include emission reductions resulting from closure of coke ovens. However, as coke ovens are closed the PAH emissions will be further reduced provided that no new by-product coke ovens are built. It is assumed that some of the coke oven closures may be replaced by some purchases of coke or non-PAH emitting coke production processes. Also, it is assumed that there will be a reduction in coke demand in the future as existing iron-making processes are replaced by new iron-making processes (e.g., Corex or similar).

The estimated reduction in sector PAH emissions from the 1993 base year is 70%.

It is estimated that no incremental capital or annual operating expenditures will be required to achieve this option.[9]

Long-term Technical Option

[8] The estimate for capital expenditures is based on the assumption that capital expenditures will be for on-going modifications and design improvements. The estimate for annual operating expenditures is based on increased maintenance labour and materials for the enhanced maintenance program, continuation of the replacement program of damaged doors or lids and increased monitoring and compliance auditing expenses.

[9] The estimated incremental capital expenditures to achieve this reduction are less than the cost of replacing the coke ovens at the end of their operational life, which is part of the normal cost of doing business. It is likely that both the capital and operating expenditures for a non-coke based iron-making process will be lower than that of building new by-product coke ovens at that time.

The objective of this long-term option would phase out the balance of the by-product coke oven batteries. This will most likely occur through the adoption of new iron-making or steel-making processes for economic reasons.

The estimated reduction in sector PAH emissions from the 1993 base year is close to 100%.

It is estimated that no incremental capital or annual operating expenditures will be required to achieve this option.[10]

8.1.2.2 Wastewater Effluents

No technical options have been included for wastewater effluents because the Ontario MISA regulation(18) will result in discharges of PAHs similar to or lower than the U.S. BATEA effluent limitations regulations.

References: (15) Apogee Research Final Phase 1 Report, Section 5.1
(30) Charles E. Napier Co., Polycyclic Aromatic Hydrocarbons, Analysis of Emission Reduction Options for the Steel SOP

8.1.3 Metals from Integrated Mills

8.1.3.1 Air Emissions

Short-term Technical Option (to be completed by 2000)

This technical option is based on incremental reductions achieved through the application of best management practices, on a site-specific basis, to the operation of primary and fugitive emission secondary control systems, to design improvements, to preventive maintenance and to production facility and emission control system operating practices. Recent air emission reductions have been achieved by some plants through upgrading of environmental control systems. The air emissions remaining after the implementation of this short-term technical option would be similar to those resulting from the application of an appropriate BATEA regime. Without detailed site-specific assessments it is difficult to quantify accurate reductions of air emissions.

The estimated reduction in air emissions of metals from the 1993 base year resulting from emission control improvements carried out since 1993 is about 10%. It is assumed that only minor improvements to the primary emission control systems are required and that some improvements to the capture effectiveness of the fugitive emission control systems will be required.

No capital or operating expenditure estimates are made for these emission control improvements since they are considered to be part of the normal environmental improvement expenditures.

[10] Ibid.

8.1.3.2 Wastewater Effluents

No technical option is provided since all of the integrated mills are subject to the MISA effluent limits regulation. The 1990 MISA monitoring results and the 1993 NPRI/ARET data indicate that all of these mills will meet the MISA regulation in 1998. Other *CEPA* metals discharges based on the 1990 MISA monitoring results and the 1993 NPRI/ARET data meet the U.S. BATEA regulations.

Reference: (15) Apogee Research Final Phase 1 Report, Section 5.3

8.1.4 Metals from Non-integrated Mills

8.1.4.1 Air Emissions

Short-term Technical Option (to be completed by 2000)

This technical option is based on incremental reductions achieved through the application of best management practices, on a site-specific basis, to the operation of primary and fugitive emission secondary control systems, to design improvements, to preventive maintenance and to production facility and emission control system operating practices. Recent air emission reductions have been achieved by some plants through the upgrading of some of the environmental control systems. Examples are Ivaco's continuous casting improvements and Atlas Specialty Steels' electric arc furnace emission control improvements. The air emissions remaining after the implementation of this short-term technical option would be similar to those resulting from the application of an applicable BATEA regime. Without detailed site-specific assessments it is difficult to quantify accurate reductions of air emissions.

Based on the best available information, there has been an estimated 10% reduction in air emissions of metals from the 1993 base year for the non-integrated steel plants. A further reduction in air emissions of metals from the 1993 base year of up to 10% may be feasible based on the assumption that minor improvements to the primary emission control systems and some improvements to the capture effectiveness of the fugitive emission control systems will be made by a number of plants.

No capital or operating expenditure estimates are made for these improvements since they are considered to be part of the normal environmental improvement expenditures.

The one exception is the emissions from the electric furnace steel-making facilities of Sidbec-Dosco. This plant reported lead emissions of 19 tonnes and chromium

emissions of 1.7 tonnes in the 1993 NPRI inventory. Subsequent emission testing in 1995 indicate the emissions to be 12.7 tonnes of lead and 0.8 tonnes of chromium.[11]

Improvements to Sidbec-Dosco's fugitive emission control system including increased air flow and advanced hood design, should increase the fugitive emission capture effectiveness and control, resulting in a 70% reduction of metals emissions from the present emissions or 80% reduction from the 1993 reported emissions. The estimated capital cost of these improvements is $10 million and the estimated annual operating cost, excluding depreciation is $1 million (10% of the capital cost).[12]

Potential Future Air Emission Initiatives

Further reductions in the air emissions of *CEPA*-toxic metals may be achieved, on a site-specific basis through programs for improving the quality of steel scrap and through scrap management and preparation practices. The reduction of air emissions of *CEPA*-toxic metals cannot be estimated without site-specific reviews and assessments. No cost estimates are available.

The replacement of part of the scrap charge to the EAFs with virgin materials (e.g., direct reduced iron, iron carbide or pig iron) that have lower concentrations of *CEPA*-toxic metals would result in a further reduction of emissions of these metals. Any decision to replace scrap with virgin materials would likely be based on economic and product quality considerations. The reduction of air emissions of *CEPA*-toxic metals would be dependant on the quantity and quality of scrap that was replaced and cannot be estimated without site-specific review and assessment. No cost estimates are available. Note that the production of the replacement materials would result in some emissions of the *CEPA*-toxic metals which may be equal to or greater than the electric furnace emissions.

8.1.4.2 Wastewater Effluents

a) All of the non-integrated mills in Ontario are subject to the MISA effluent limits regulation. The 1990 MISA monitoring results and the 1993 NPRI/ARET data indicate that all of these mills will meet the MISA regulation in 1998. According to the 1990 MISA monitoring results and the 1993 NPRI/ARET data, other *CEPA*-toxic metals discharges should meet the US EPA BATEA regulations with the implementation of the MISA regulation.

b) The ARET estimates of *CEPA*-toxic metals discharge of most of the non-integrated mills outside Ontario indicate that these mills have similar discharges to those in Ontario. Two mills in Québec, Sidbec-Dosco (Ispat) and Atlas Stainless Steels, which reported high *CEPA*-toxic metal discharges in 1993, have constructed new

[11] Robert Santerre, Sidbec-Dosco (Ispat) Inc., letter to Jean Lavergne, Ministère de l'Environnement et de la Faune de Québec, November 29, 1996.

[12] Ibid.

wastewater treatment plants to meet the requirements of the St. Lawrence Action Plan. These two plants meet discharge requirements that are similar to the MISA requirements.

Information from the non-integrated mills on their toxic metals discharge since 1993 is required before an accurate estimate of the recent reductions of *CEPA*-toxic metal discharges can be made.

Short-term Technical Option (to be completed by 2000)

This technical option is based on incremental reductions achieved through the application of best management practices, on a site-specific basis, to the operation of wastewater treatment systems, to design improvements, to preventive maintenance and to production facility and wastewater control system operating practices to achieve *CEPA*-toxic metals discharges similar to those in the MISA regulation or the U.S. EPA BATEA requirements.

Recent wastewater discharge reductions have been achieved by some plants through upgrading of wastewater treatment systems. Examples are the Sidbec-Dosco (Ispat) and Atlas Tracy Stainless Steels new wastewater treatment plants to meet Québec's commitment under the St. Lawrence Action Plan. The *CEPA*-toxic metals discharges remaining after the implementation of this short-term technical option would be similar to those resulting from the application of an appropriate BATEA regime. Also, several plants have set targets of zero discharge by the year 2000. The estimated reduction in discharges of *CEPA*-toxic metals, including actions already taken, from the 1993 base year is about 90%. This estimate cannot be fully validated without site-specific reviews and assessments.

No capital or operating expenditure estimates are made for these improvements since they are considered to be part of their normal environmental improvement expenditures.

Reference: (15) Apogee Research Final Phase 1 Report, Section 5.4

8.1.5 Dioxins and Furans

There do not appear to be any published site-specific dioxins and furans emission data or materials describing dioxins and furans control efforts for North American electric arc furnaces (EAFs) and sintering plants (other than the 1994 emission test data for the Algoma Steel Inc. sinter plant at Wawa, Ontario). Consequently, it is not possible either to develop mill-specific emission inventories or to identify appropriate emission control technology. The Toxic Substances Management Policy (TSMP) states "*The onus will be on those who generate or use a Track 1 substance to demonstrate that the substance will not be released into the environment in measurable concentrations at any point of its life cycle*."

Short-term Technical Option No. 1

Conduct a structured, multi-phase research program to characterize stack and fugitive emissions from potential Canadian sources, including sintering plants and electric arc furnaces (EAFs) under current operating conditions and with current feed materials. Methods published or approved by Environment Canada will be used in the measurement of dioxins and furans emissions. Identify the source materials contributing to the formation of dioxins and furans and investigate means of removing, minimizing or treating these undesirable source materials to reduce or eliminate the discharge of dioxins and furans. At the end of Option 1, the need to continue with Option 2 would be assessed.

It must be noted, however, that any management options will be developed only after taking into account the findings from the broader study on characterization, quantification and prioritization, which will be undertaken by the Federal-Provincial Task Force on Dioxins and Furans. In order to develop these various strategies, targets and timelines will be set taking into consideration analyses of environmental and human health risks as well as social, economic and technical considerations (TSMP, 1995).

There is no reduction of sector dioxin and furan emissions.

The estimated cost of the research program is $0.5 million.

Short-term Technical Option No. 2

This technical option will be necessary if research results under Option 1 confirm the need to further investigate control options for steel sector dioxin/furan emissions. Investigate pollution prevention strategies to prevent the measurable release of dioxins and furans. Also investigate control technology for the suppression or removal of dioxins/furans from the source discharges. Develop short-term and long-term strategies directed toward the goal of virtual elimination.

It must be noted, however, that these strategies will be developed only after taking into account the findings from the broader study on characterization, quantification and prioritization which will be undertaken by the Federal-Provincial Task Force on Dioxins/Furans under Short-term Technical Option No. 1. In order to develop these various strategies, targets and timelines will be set taking into consideration analyses of environmental and human health risks as well as social, economic and technical considerations (TSMP, 1995).

There is no reduction of sector dioxin and furan emissions resulting from the first phase of this technical option.

The estimated cost of the research program is $1.0 to $2.0 million.

References: (15) Apogee Research Final Phase 1 Report, Section 5.2
(33) Charles E. Napier Co., Polychlorinated Dibenzo-*p*-dioxins and Polychlorinated Dibenzofurans Analysis of Emission Reduction Options for the Steel SOP

8.1.6 Emissions from Sintering Plants

Short-term Technical Option No. 1

This technical option involves characterizing and upgrading the existing facilities and environmental controls to reduce the emissions of *CEPA*-toxic metals. This would include the enhancement of Algoma's existing emission control program, an emission characterization program for *CEPA*-toxic substances and development of an emission control improvement program for the sinter plant in Stelco's Hilton Works. The adoption of this program would result in an estimated reduction of 10% of the emissions of *CEPA*-toxic metals. The percent reduction of mercury and arsenic emissions which are present in the Wawa emissions would be less since these *CEPA*-toxic substances would be present in gaseous form.

The estimated reduction in air emissions of metals from the 1993 base year is in excess of 10%.

The estimated capital expenditures to achieve this reduction are $5 to $10 million.

The estimated incremental annual operating expenditures to achieve this reduction are $0.8 to 1.3 million.[13]

Long-term Technical Option No. 1

This technical option would include new emission controls at Wawa only to reduce the emissions of toxic metals by at least 90%. The use of hot electrostatic precipitator emission technology has been proven for sinter plants and can be applied to the Wawa sinter plant for most toxic metals. Since both arsenic and mercury would be in gaseous form at these operating temperatures, this technology would not significantly reduce arsenic and mercury emissions. Emission control technology for arsenic has been developed and proven for other metallurgical applications including the roasting of gold ore concentrates. One variation, rapid air quench of the hot electrostatic precipitator exhaust gases followed by a high efficiency fabric filter, has achieved arsenic emission reductions in excess of 90% and has been used by several Canadian gold mines. Although no technology for mercury has been developed for sinter plants, mercury adsorption technology has been used by some non-ferrous smelters to remove mercury

[13] The estimate for capital expenditures is based on the on-going improvement program of Algoma and the assumption that only minor capital expenditures are required for the Stelco, Hilton Works sinter plant. The estimate for annual operating expenditures is 10% of the capital expenditures plus expenditures of ongoing emission control improvement programs.

from waste gases prior to capturing sulphur dioxide in a sulphuric acid plant. Unfortunately, the presence of oil-bearing materials in the steel plant waste oxide feed and the production of super-fluxed sinter may create technical problems in the electrostatic precipitator that may prevent the use of this emission technology. In that case, a wet scrubber system would have to be designed and tested for application to this unique sinter plant. An engineering feasibility study would be necessary to determine the technical feasibility and cost of emission control.

The estimated reduction in air emissions of *CEPA*-toxic metals from the 1993 base year is about 90%.

The estimated capital expenditures for either design approach to achieve this reduction could be up to or greater than $50 million.

The estimated incremental annual operating expenditures to achieve this reduction could be up to or greater than $5 million.[14]

Long-term Technical Option No. 2

This option would further increase the selection of ores for mining that are low in arsenic and mercury. Since Algoma has been using selective mining for many years, it is likely that only a minimal increase, if any, in selection of ores is feasible either technically or economically.

The reduction in air emissions of metals from the 1993 base year cannot be readily estimated.

The capital expenditures and annual operating expenditures for this option cannot be estimated before a feasibility study is completed.

References: (15) Apogee Research Final Phase 1 Report, Section 5.5
(34) Charles E. Napier Co., Sinter Plants, Analysis of Emission Reduction Options for the Steel SOP

[14] The estimate for capital expenditures is based on the installation of a new emission control system with reasonably high removal efficiency. No definitive estimate can be made without carrying out an engineering feasibility study. The estimate for annual operating expenses is 10% of the capital expenditures.

8.1.7 Mercury

8.1.7.1 Integrated Mills

Mercury is naturally occurring in metallurgical coals in trace concentrations and the amount varies for the blend of coal used for each coke oven battery. Little is known about the fate of mercury in integrated iron- and steel-making. No technology for the removal of mercury has been developed for the coke oven process.

Short-term Technical Option

The short-term technical option is a research program to determine the amount of mercury entering the coke ovens in the coal and to determine the fate of the mercury in the coke ovens and downstream processes and the discharges to the environment for the four coke plants.

If the research program identifies significant mercury discharges to the environment, a second phase would be required to develop feasible technical options for additional controls for these discharges.

There are no reduction estimates for mercury emissions although the benzene and PAH release reduction programs should result in some reduction in mercury emissions.

The estimated cost of the first phase of the research program is $0.2 to $0.3 million.

Long-term Technical Option

The long-term option is the adoption of new iron-making processes that do not require coke. Since most of these processes use coal as a raw material, a research program would be required to determine the potential releases of mercury. Refer to Section 8.1.2 for process change options for PAHs.

No estimate of mercury reductions can be provided for this option.

Reference: (31) Charles E. Napier Co., Mercury, Analysis of Emission Reduction Options for the Steel SOP

8.1.7.2 Sinter Plants (processing ore)

Short-term Technical Option

The short-term technical option is a research program to determine the source and quantity of mercury entering the Wawa sinter plant. If warranted, a second phase would be required to develop feasible technical options for additional controls for these discharges.

There is no reduction estimate for mercury emissions.

The estimated cost of the first phase of the research program is $0.1 to $0.2 million.

Reference: (31) Charles E. Napier Co., Mercury, Analysis of Emission Reduction Options for the Steel SOP

8.1.8 Polychlorinated Biphenyls (PCBs)

No technical options are presented since the current regulatory program is judged to be effective for preventing environmental releases of PCBs from existing operations. This includes the removal of all PCB equipment items from active service to assure virtual elimination provided secure disposal and effective destruction methods are implemented.

Table 8-1.1 Contains data on inventory of PCBs in storage by the integrated mills.[15]

TABLE 8-1.1 PCB STORAGE INVENTORY FOR INTEGRATED STEEL PLANTS

Company	Location	Quantity (tonnes)
Algoma Steel Inc.	Sault Ste. Marie	29.6
Dofasco Inc.	Hamilton	15.5
Stelco Inc., Hilton Works	Hamilton	112.5
Stelco Inc., Lake Erie Works	Nanticoke	nil

Reference: (15) Apogee Research Final Phase 1 Report, Section 5.8

8.1.9 Chlorinated Solvents

No technical options have been developed for chlorinated solvents since solvent degreasing is being evaluated under a separate SOP.[16]

Reference: (15) Apogee Research Final Phase 1 Report, Section 5.7

8.1.10 Fluorides

No technical options are presented for fluorides because the release of fluorides from the steel sector is not considered to be a major concern. Most of the fluorides enter the

[15] Anita Wong, Environment Canada, Ontario Region, letter to Patrick Finlay, Environment Canada, December 6, 1996.

[16] Strategic Options for the Management of Toxic Substances, Trichloroethylene and Tetrachloroethylene in solvent degreasing, Report of Stakeholder Consultations, Environment Canada, February 1996.

process as minor impurities in some of the raw materials. The MISA wastewater regulations will result in an estimated 50% reduction in fluoride discharges in wastewater effluents from the integrated steel mills. Other emission control and wastewater treatment systems currently in place or required to meet other technical options will provide additional reductions of fluoride discharges. Economical prevention and control technologies specifically for fluoride discharges in the steel industry are not currently available.

Reference: (15) Apogee Research Final Phase 1 Report, Section 5.6

TABLE 8-1.2 SUMMARY OF TECHNICAL OPTIONS AND THEIR COST IMPLICATIONS

Toxic Substance and Source	Option Type	Technical Option	Emission Inventory (tonnes/year)			Estimated Costs ($ million)	
			Base year	% Reduct.	Tonnes	Capital	Annual Oper.
8.1.1 Benzene	Short-term Phase 1	Emission control improvements and implementation of best practices.	1,237	57	527	25	3.75
	Short-term Phase 2	Continue Phase 1.	1,237	83	212	15	2.25
	Medium-term	Continue environmental management improvement program.	1,237	89	141	nil	nil
	Long-term	Replace coke by-product batteries as they reach the end of their operational lives with non-by-product coke process or new iron-making processes.	1,237	~ 100	~ nil	n/a	n/a
8.1.2 Polycyclic Aromatic Hydrocarbons (PAHs)	Short-term Phase 1	Upgrade coke ovens and use best management practices.	186.4	44	104.1	8 - 10	4 - 6
	Short-term Phase 2	Continue Phase 1.	186.4	64	66.8	10 - 12	3 - 5
	Medium-term	Continue environmental management improvement program.	186.4	70	55.0	n/a	n/a
	Long-term	Replace coke by-product batteries as they reach the end of their operational lives with non-by-product coke process or new iron-making processes.	186.4	~ 100	~ nil	n/a	n/a
8.1.3 Metals from Integrated Mills	Short-term - air emissions	Application of best management practices and emission control system design improvements.	2.2	<10	2	-	-
8.1.4 Metals from Non-integrated Mills	Short-term - air emissions	Application of best management practices and emission control system design improvements.	27.9	50	14.0	10	1
	Short-term wastewater	Application of best management practices and wastewater control system design improvements.	59	>90	<6	-	-
8.1.5 Dioxins and Furans	Short-term no. 1	Research program to determine and characterize sources of CDD/CDF emissions from EAFs, sintering plants and other potential sources.	NEA	nil	NEA	nil	0.5 (one time)
	Short-term	Investigate control technology for CDD/CDF emission					

TABLE 8-1.2 SUMMARY OF TECHNICAL OPTIONS AND THEIR COST IMPLICATIONS

Toxic Substance and Source	Option Type	Technical Option	Emission Inventory (tonnes/year)			Estimated Costs ($ million)	
			Base year	% Reduct.	Tonnes	Capital	Annual Oper.
	no. 2	reduction.	NEA	nil	NEA	nil	1-2 (one time)
8.1.6 Emissions from Sintering Plants	Short-term	Benchmarking and upgrading of emission control systems.	> 80	10	72	5-10	0.8-1.35
	Long-term	New emission control system for Wawa only.	80.7	90	8	< 50	< 5
8.1.7 Mercury							
8.1.7.1 Integrated Mills	Short-term	Program to determine the fate of mercury from coal.	> 0.1	nil	> 0.1	nil	0.2 - 0.3 (one time)
8.1.7.2 Sinter Plants	Short-term	Research program to determine the source and quantify the mercury entering the process.	0.7	nil	0.7	nil	0.1 - 0.2 (one time)
8.1.8 Polychlorinated Biphenyls (PCBs)	None						
8.1.9 Chlorinated Solvents	None						
8.1.10 Fluorides	None						

NEA: No estimate available
N/A: Not applicable

8.2 Strategic Options

For this SOP, the basic approach for options evaluation was to use best available information and advice to make timely recommendations to Ministers to reduce and/or eliminate releases of *CEPA*-toxic substances to the environment. The goals of the SOP are considered to be the key management objectives defined in the Toxics Substances Management Policy, i.e.:

② ***virtual elimination from the environment of toxic substances that result predominantly from human activity and that are persistent and bioaccumulative; and***

② ***management of other toxic substances and substances of concern, throughout their entire life cycles, to prevent or minimize their release into the environment taking into account technical, economic and sociological considerations.***

To provide a framework and help focus discussions of the Issue Table, the advantages and disadvantages of six major strategic options were identified and assessed by the Apogee team for various process and substance combinations. Apogee assessments considered a number of criteria which included:

- environmental effectiveness;
- speed;
- cost effectiveness;
- competitiveness impacts;
- incentives;
- growth;
- intrusiveness/flexibility;
- fairness;
- enforceability/compliance;
- data requirements;
- compatibility with existing initiatives;
- future flexibility; and
- public acceptability.

Excerpts from the Apogee assessments[15] are provided below:

Option 1 Current Regulations

This option adopts existing environmental regulatory requirements, compliance levels and programs, e.g., existing provincial release guidelines, standards and regulations, the requirements of Ontario's MISA program, etc.

Advantages

- Ontario's MISA program and actions arising from the St. Lawrence Action Plan will result in the control of wastewater effluents from Ontario and Québec steel mills to standards which meet or exceed U.S. EPA BATEA requirements.
- Economic achievability has been demonstrated.
- Impacts on competitiveness are minimal.
- Facilities generally have flexibility in responding to the requirements of the regulations.

Disadvantages

- Uncertain if all mills located outside of Ontario and Québec are meeting BATEA-based standards for wastewater releases.
- No source-based regulations currently exist for air releases of PAHs, benzene or toxic metals from the steel sector.
- Provincial ambient air quality regulations do not address emissions of many *CEPA*-toxics.

Conclusion

- Effective for water releases in Ontario and Québec but uncertain capability in other jurisdictions and may not be effective for air releases - other strategic options are required.

Option 2 Current Voluntary Programs

This option adopts existing voluntary and corporate programs such as ARET.

Advantages

- Allows industry to meet commitments in the most cost-effective manner.
- Likely no significant impact on competitiveness since commitments are voluntary.
- Minimal government involvement required.

Disadvantages

- Current programs do not address all *CEPA*-toxics of concern.
- Commitments are not legally binding.
- Not all mills have committed to voluntary action.
- Voluntary programs may be seen as unfair since they do not impose minimum environmental standards for all facilities in the sector and thus can create an uneven playing field.
- Public reaction to voluntary programs varies widely, particularly in the context of local concerns.

Conclusion

- Will not likely meet SOP goals - other strategic options required.

Option 3 Enhanced Voluntary Programs

This option calls for additional requirements and commitments upon current ARET commitments. Other enhanced voluntary programs include Memorandums of Understanding (MOU), adoption of environmental performance standards, etc.

Advantages

- Probably faster to implement than other options.
- ARET already addresses many of the issues of concern - further commitments would be relatively simple to add.
- Industry is afforded flexibility in developing cost effective control options.
- Government involvement and associated costs would be relatively low compared to other options.
- Would not constrain future growth or significantly impact competitiveness.
- Compatible with other initiatives.

Disadvantages

- Programs would still not be legally binding.
- No certainty of achieving recommended release reductions.
- Programs may not address the monitoring of progress in meeting commitments.
- Potential for non-participation and/or uneven commitments and thus may be viewed as being unfair.
- Could meet with public resistance.

Conclusion

- A promising option which should be pursued.

Option 4 Enhanced National and Provincial Programs

This option calls for national Environmental Codes of Practice and technology-based performance Release Guidelines to be considered by the federal government, provinces and industry. The U.S. Environmental Protection Agency, European Union and other standards are considered in the development of this option.

Advantages

- Guidelines could help to level the domestic playing field by encouraging similar levels of environmental performance by similar mills.
- Guidelines and Codes of Practice could be designed to allow flexibility.
- Adoption of Codes of Practice could be a component of enhanced voluntary programs.
- Guidelines and Codes could provide a basis for establishing legally binding requirements if voluntary initiatives were not effective.

Disadvantages

- Since Codes of Practice are not legally binding, their effectiveness will depend upon the extent to which they are adopted by industry.
- Since the recommended practices and guidelines are not imposed, they might be viewed as unfair to some mills.
- Based on past participation in ARET, it is uncertain whether all mills would be willing to adopt Codes of Practice on a voluntary basis.
- Some (notably industry) stakeholders feel that Codes of Practice have the potential to be overly intrusive.
- Public acceptability of Codes of Practice is uncertain, particularly if they are developed outside of *CEPA*.

Conclusion

- A promising option which should be pursued.

Option 5 Market-Based Instruments

This option refers to market intervention designed to modify prices and thus behaviour, and includes trading programs, environmental release charges/taxes, economic incentives, environmental liability and deposit-refund systems.

Advantages

- Charges could provide an on-going incentive to reduce releases to the lowest level that is cost-effective, relative to the charges.
- Charges could be offset by rebates for adopting technical control options.
- Could encourage mills to invest in alternative, lower release steel-making processes more quickly than they otherwise would.
- Establishes legally binding requirements.

Disadvantages

- Determining appropriate level and application of charges is difficult and could be very time consuming.
- Considerable uncertainty surrounds the choice of charges which will result in the achievement of specific environmental goals.
- Trading credits may not protect human health and the environment equally in all areas.
- Could have significant impact on competitiveness depending on the nature and level of the charges. There is no equivalent requirement for U.S. competitors.
- Would require involvement of federal and provincial finance ministries whose acceptance of the concept is unknown.
- No support for the concept from industry at this time.
- Public reaction to charges is very uneven - encouraged by some environmental groups but viewed as a "licence to pollute" by others.

Conclusion

- Considerable uncertainty as to capability to be effective and strong opposition from some - not a promising option at this time.

Option 6 Federal Regulations

This option requires the development of regulations under the Canadian Environmental Protection Act (*CEPA*), Fisheries Act or special Act.

Advantages

- Would impose legally binding requirements that could be monitored and enforced.
- A schedule for achieving goals could be set in the regulation.
- Would help ensure a level domestic playing field by requiring similar environmental performance from similar mills.
- Could be designed such that performance of Canadian mills could be equivalent to U.S. and European mills.
- Could be designed to afford flexibility in terms of mill-specific response to the regulatory requirements.
- Strong support for this approach from the environmental community since it provides relative certainty and equity.

Disadvantages

- May be time consuming to develop and promulgate and might, therefore, be a relatively slow option for achieving reductions.
- Relatively expensive for government to implement compared to other options.
- No assurance of compatibility with provincial initiatives or acceptance by provincial agencies.
- Regulations are often difficult and expensive to change.
- Could be impacts on competitiveness, depending on compatibility with regulatory requirements in other jurisdictions (most notably the U.S.).
- Cost effectiveness varies depending upon type of regulation - performance-oriented regulations are generally more cost effective than measure-oriented regulations.
- Apparent opposition by Provinces and industry to development of a federal regulation at this time.

Conclusion

- Would likely achieve SOP goals but strong opposition from some Issue Table members and uncertain response by provinces - should be considered as a backstop for other

measures.

8.3 Socio-Economic Impacts

The socio-economic impacts are based on the capital and operating costs for the various technical options developed in Section 8.1 and socio-economic information from the Socio-economic Background Report for the Canadian Primary Steel Sub-sector[17] (35) and Industry Canada.[18]

The following assumptions apply to the socio-economic impacts:

- No sales or market forecasts are made for the Canadian industry for this study. Industry Canada did not provide sales or market forecasts in their Sector Competitiveness Study.[19] The present global over capacity is expected to continue for some time. The demand for steel will continue to grow more slowly in the industrialized countries than in the rest of the world.[20] The North American steel market is considered to be a mature market so has only a small growth potential. It is accepted that demand cycles will continue. However, it is not feasible to forecast future demand for the purpose of this analysis.

- United States trade actions will continue to be a significant concern to both the Canadian steel producers and the Canadian government.[21]

- All dollar values are in 1995 dollars because the most recent corporate and industry financial information is for 1995.

- Capital expenditures are assumed to be expended over a three-year period although capital expenditure comparisons are based on the average annual capital expenditures of the period 1993 to 1995.

- The socio-economic impacts apply only to the steel sector (integrated or non-integrated as applicable) since, with a few exceptions, it has not been feasible to develop the socio-economic impacts at the company or plant level.

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17 Socio-economic Background Report for the Canadian Primary Steel Sub-sector for Steel Manufacturing Sector Strategic Options Report, Charles E. Napier Company Ltd., December 9, 1996.

18 Sector Competitiveness Frameworks, Primary Steel Overview and Prospects, Industry Canada, 1996.

19 Primary Steel Industry, Sector Competitiveness Framework Report, Metals and Minerals Processing Branch, Industry Canada, March 29, 1996.

20 While Steel Demand Is to Set Record in 1997, Overcapacity Continues to be a Threat, OECD Steel Committee, Posted to Internet, November 6, 1996.

21 Sector Competitiveness Frameworks, Primary Steel Overview and Prospects, page 18, Industry Canada, 1996.

8.3.1 Benzene[22]

The socio-economic impacts for the benzene technical options apply only to the integrated steel sub-sector.

8.3.1.1 Short-term Technical Option - Phase 1 (to be completed by 2000)

This technical option is based on upgrading emission controls in the coke by-products recovery plants. Estimated capital costs are $25 million and estimated operating costs excluding depreciation are $3.75 million per year.

Table 8-3.1 shows what the socio-economic impacts would have been if the estimated incremental operating costs including depreciation had been expended during the period of 1993 to 1995. The cost of producing a tonne of steel would have increased an average of $0.67 or about 0.1%. The average sale price per tonne of steel ranged from $587 to $762 during the 1993 to 1995 period.

During this same period income after taxes ranged from 2.7 to 8.5% on sales and would have been reduced by an average of 1.6% by the additional costs of this technical option. Note that the steel companies were recovering from the recessionary period in 1993 and profitability for that year was still depressed.

The estimated capital expenditures of $25 million are 3.7% of the average annual capital expenditures for this sub-sector for the years 1993 to 1995. The benzene emission reduction cost is 3.8 cents per gram for capital expenditures and 0.8 cents per gram for operating expenditures as a result of this technical option.

An estimated 10 to 20 employees would be required for the increased operating and maintenance activities. No employment reduction in other areas of the plant is anticipated.

Some increased economic activity may result from the increase in construction and materials supply for the capital expenditures and the spin-off from the minor increase in employment. Some capital expenditures for other purposes may be postponed as a result of the additional environmental expenditures. No decrease in production is anticipated. The socio-economic impact would vary between companies depending on the site-specific requirements for improvements and the company-specific financial circumstances.

Benzene emissions for the integrated plants would be reduced by 57% from 1993. This is a 25% reduction in Canadian benzene emissions and a 32% decrease in Ontario benzene emissions. There would be considerable improvement in industrial hygiene and a reduction in ambient benzene levels.

[22] Technical option details and cost estimates are contained in Section 8.1.1 of this report.

8.3.1.2 Short-term Technical Option - Phase 2 (to be completed by 2005)

This technical option phase is based on completing the upgrade of emission controls in the coke by-products recovery plant. Estimated capital costs are an additional $15 million and additional estimated operating costs excluding depreciation are $2.25 million per year. The following analysis is for the combined costs and impacts of the two phases of this technical option.

Table 8-3.1 shows what the socio-economic impacts would have been if the estimated incremental operating costs including depreciation had been expended during the period of 1993 to 1995. The cost of producing a tonne of steel would have increased an average of $1.07 or about 0.16%. The average sale price per tonne of steel ranged from $587 to $762 during the 1993 to 1995 period.

During this same period income after taxes ranged from 2.7 to 8.5% on sales and would have been reduced by 1.8 to 6.5% by the additional costs of this technical option.

The estimated capital expenditures of $25 million for phase one and $15 million for phase two are 5.9% of the average annual capital expenditures for this sub-sector for the years 1993 to 1995. The benzene emission reduction cost is 4.2 cents per gram for capital expenditures and 0.9 cents per gram for operating expenditures as a result of the two phases of this technical option.

An estimated additional 15 to 25 (25 to 45 for the two phases) employees would be required for the increased operating and maintenance activities. No employment reduction in other areas of the plant is anticipated.

Some increased economic activity may result from the increase in construction and materials supply for the capital expenditures and the spin-off from the minor increase in employment. Some capital expenditures for other purposes may be postponed as a result of the additional environmental expenditures. No decrease in production is anticipated. The socio-economic impact would vary between companies depending on the site-specific requirements for improvements and the company-specific financial circumstances.

Benzene emissions for the integrated plants would be reduced by 83% from 1993. This is a reduction of 36% of Canadian benzene emissions and 47% of Ontario benzene emissions. There would be considerable improvement in industrial hygiene and a substantial reduction in ambient benzene levels.

8.3.1.3 Medium-term Technical Option (to be completed by 2015)

This technical option is based on the continuation of the environmental management improvement program initiated in the short-term technical option. Some coke ovens

may close as they near or reach the end of their operating life. In these cases benzene emissions would be reduced further if they are not replaced with by-product coke ovens.

TABLE 8-3.1 SOCIO-ECONOMIC IMPACTS OF BENZENE TECHNICAL OPTIONS ON THE INTEGRATED STEEL SUB-SECTOR (1)

	1993	1994	1995	Average 1993 to 1995
Short-term Technical Option - Phase 1 (to be completed by 2000) (2)				
Incremental operating cost as a percent of sales	0.11	0.10	0.09	0.10
Incremental operating cost as cost per tonne shipped	$0.65	$0.68	$0.68	$0.67
Incremental operating cost as percent of cost of sales	0.13	0.12	0.11	0.12
Incremental operating cost as percent of operating income	3.9	1.03	0.79	1.21
Incremental operating cost as percent of income before income taxes	4.0	0.92	0.96	1.26
Incremental operating cost as percent of income after income taxes	4.1	1.13	1.36	1.61
Short-term Technical Option - Phases 1 and 2 (to be completed by 2005) (3)				
Incremental operating cost as a percent of sales	0.18	0.15	0.14	0.16
Incremental operating cost as cost per tonne shipped	$1.04	$1.08	$1.09	$1.07
Incremental operating cost as percent of cost of sales	0.21	0.19	0.18	0.19
Incremental operating cost as percent of operating income	6.3	1.65	1.26	1.93
Incremental operating cost as percent of income before income taxes	6.5	1.47	1.53	2.02
Incremental operating cost as percent of income after income taxes	6.5	1.80	2.18	2.57

(1) Estimated socio-economic impacts are calculated for the financial results of the integrated steel sub-sector for the years 1993 to 1995. These were derived from Tables 3.1 to 3.4 in the Socio-economic Background Report for the Canadian Primary Steel Sub-sector, Charles E. Napier Company Ltd., December 9, 1996.

(2) Incremental operating costs include estimated operating costs of $3.75 million per year and 7% depreciation charges for the estimated capital charges of $25 million. Refer to Section 8.1.1 for details.

(3) Incremental operating costs include estimated operating costs of $6 million per year and 7% depreciation charges for the estimated capital charges of $40 million (combined Phases 1 and 2). Refer to Section 8.1.1 for details.

In the longer term benzene emissions will be reduced still further as new iron-making processes are adopted by the integrated steel plants. The decision to change the iron-making process will be based on economic rather than environmental grounds since it is likely that the capital and operating costs of the new processes will be lower than those of the coke oven/blast furnace process. Also, environmental improvement should be associated with these processes.

A more detailed discussion of process change is contained in Section 8.3.2.3.

8.3.2 Polycyclic Aromatic Hydrocarbons (PAHs)[23]

The socio-economic impacts for the PAH technical options apply only to the integrated steel sub-sector.

8.3.2.1 Short-term Technical Option - Phase 1 (to be completed by 2000)

This technical option is based on upgrading emission controls and enhancing operating and maintenance practices for the coke ovens. Estimated capital costs are $8 to $10 million and estimated operating costs excluding depreciation are $4 to $6 million per year.

Table 8-3.2 shows what the socio-economic impacts would have been if the estimated incremental operating costs including depreciation had been expended during the period of 1993 to 1995. The cost of producing a tonne of steel would have increased an average of $0.69 or about 0.1%. The average sale price per tonne of steel ranged from $587 to $762 during this period.

During this same period income after taxes ranged from 2.7 to 8.5% on sales and would have been reduced by 1.2 to 4.2% by the additional costs of this phase of this technical option. Note that the steel companies were recovering from the recessionary period in 1993 and profitability was still depressed.

The estimated capital expenditures of $8 to $10 million are 5% of the average annual capital expenditures for this sub-sector for the years 1993 to 1995. The PAH emission reduction cost is 10.9 cents per gram for capital expenditures and 6.8 cents per gram for operating expenditures as a result of this phase of this technical option.

An estimated 20 to 25 persons would be required, mostly in the coke oven area, due to the increased operating and maintenance labour requirements and the increased emission monitoring. No employment reduction in other areas of the plant is anticipated.

[23] Technical option details and cost estimates are contained in Section 8.1.2 of this report.

Some increased economic activity may result from the increase in construction and materials supply for the capital expenditures and the spin-off from the minor increase in employment. Some capital expenditures for other purposes may be postponed as a result of the additional environmental expenditures. No decrease in production is anticipated. The socio-economic impact would vary between companies depending on the site-specific requirements for improvements and the company-specific financial circumstances.

PAH emissions for the integrated plants would be reduced by 44% from 1993. There would be considerable improvement in industrial hygiene and a reduction in ambient PAH levels.

8.3.2.2 Short-term Technical Option - Phase 2 (to be completed by 2005)

This phase of the short-term technical option is based on completion of the upgrade of emission controls and further enhancement of operating and maintenance practices for the coke ovens. Estimated capital costs are an additional $10 to $12 million and estimated operating costs excluding depreciation are an additional $3 to 5 million per year. The following analysis is for the combined costs and impacts of the two phases of this technical option.

Table 8-3.2 shows what the socio-economic impacts would have been if the estimated incremental operating costs including depreciation had been expended during the period of 1993 to 1995. The cost of producing a tonne of steel would have increased an average of $1.27 or about 0.19%. The average sale price per tonne of steel ranged from $587 to $762 during this period.

During this same period income after taxes ranged from 2.7 to 8.5% on sales and would have been reduced by 2.1 to 7.7% by the additional costs of the two phases of this technical option.

The estimated capital expenditures of $8 to $10 million for phase one and $10 to $12 million for phase two are 11% of the average annual capital expenditures for this sub-sector for the years 1993 to 1995. The PAH emission reduction cost is 16.7 cents per gram for capital expenditures and 8.7 cents per gram for operating expenditures as a result of the two phases of this technical option.

An estimated 30 to 40 additional employees would be required for the two phases for the increased operating and maintenance activities. No employment reduction in other areas of the plant is anticipated.

Some increased economic activity may result from the increase in construction and materials supply for the capital expenditures and the spin-off from the minor increase in employment. Some capital expenditures for other purposes may be postponed as a result of the additional environmental expenditures. No decrease in production is anticipated. The socio-economic impact would vary between companies depending on the site-specific requirements for improvements and the company-specific financial

circumstances.

PAH emissions for the integrated plants would be reduced by 64% from 1993. There would be considerable improvement in industrial hygiene and a substantial reduction in ambient PAH levels.

TABLE 8-3.2 SOCIO-ECONOMIC IMPACTS OF PAH TECHNICAL OPTIONS FOR THE INTEGRATED STEEL SUB-SECTOR (1)

	1993	1994	1995	Average 1993 to 1995
Short-term Technical Option - Phase 1 (to be completed by 2000) (2)				
Incremental operating cost as a percent of sales	0.11	0.10	0.09	0.10
Incremental operating cost as cost per tonne shipped	$0.67	$0.69	$0.70	$0.69
Incremental operating cost as percent of cost of sales	0.13	0.12	0.12	0.12
Incremental operating cost as percent of operating income	4.0	1.06	0.81	1.23
Incremental operating cost as percent of income before income taxes	4.1	0.94	0.98	1.29
Incremental operating cost as percent of income after income taxes	4.2	1.15	1.39	1.64
Short-term Technical Option - Phase 1 and 2 (to be completed by 2005) (3)				
Incremental operating cost as a percent of sales	0.21	0.18	0.17	0.19
Incremental operating cost as cost per tonne shipped	$1.23	$1.28	$1.29	$1.27
Incremental operating cost as percent of cost of sales	0.24	0.22	0.21	0.23
Incremental operating cost as percent of operating income	7.4	1.95	1.49	2.28
Incremental operating cost as percent of income before income taxes	7.6	1.74	1.81	2.39
Incremental operating cost as percent of income after income taxes	7.7	2.13	2.57	3.04

(1) Estimated socio-economic impacts are calculated for the financial results of the integrated steel sub-sector for the years 1993 to 1995. These were derived from Tables 3.1 to 3.4 in the Socio-economic Background Report for the Canadian Primary Steel Sub-sector, Charles E. Napier Company Ltd., December 9, 1996.

(2) Incremental operating costs include estimated operating costs of $5 million per year and 7% depreciation charges for the estimated capital charges of $9 million. Refer to Section 8.1.2 for details.

(3) Incremental operating costs include estimated operating costs of $9 million per year and 7% depreciation charges for the estimated capital charges of $20 million (combined Phases 1 and 2). Refer to Section 8.1.2 for details.

8.3.2.3 Medium-term Technical Option (to be completed by 2015)

This technical option is based on the continuation of the environmental management improvement program initiated in the short-term technical option. Some coke ovens may close as they near or reach the end of their operating life. In these cases PAH emissions would be reduced further if they are not replaced with by-product coke ovens.

The capital cost of a new by-product coke oven battery with a capacity of one million tonnes of coke per year is in the range of $425 to 450 million[24]. The cost will vary depending on the availability of space at the specific plant and the degree to which existing equipment and service infrastructure can be utilized. If the steel companies were to replace their total coke oven capacity, the capital cost would be in the order of $1.6 to 2 billion. Even with an expenditure of this magnitude it is unlikely that PAH emissions would be reduced by over 85% from the 1993 emission level.

The capital cost of non-recovery coke ovens would be less and PAH emissions would be reduced. Considering the level of acceptance of the non-recovery coke oven process by the North American steel industry, it is unlikely that the steel plants would opt for this technology.

For comparison, Dofasco's budget for its new electric arc furnace and thin-slab caster was $200 million, with a capacity of 1.225 million tonnes per year.[25] If Dofasco had opted for the conventional integrated steel plant steel-making technology for this project, the coke oven capacity required to support this capacity would have been approximately 350,000 tonnes. The capital cost for this coke capacity would have been approximately $180 million or almost as much as the electric furnace steel-making capacity but no iron making capacity. Using 5% straight line, the depreciation cost for this coke capacity would be $9 million per year. For Dofasco in 1995, this would have been an increase of $2.82 per tonne of steel shipped, 0.34% of sales or 4.6% of net income after taxes which demonstrates the cost impact of a new by-product coke oven battery.

8.3.3 Metals from Integrated Mills[26]

8.3.3.1 Air Emissions - Short-term Technical Option (to be completed by 2000)

This technical option is based on upgrading the emission controls, including operating and maintenance practices. No estimate of capital operating costs is made since it is assumed that these expenditures are part of the companies' ongoing environmental

[24] Hogan, William T., Capital Investment in Steel, A World Plan for the 1990s, Lexington Books, New York, N.Y., 1992.

[25] Dofasco, Inc. 1995 Annual Report.

[26] Technical option details are contained in Section 8.1.3 of this report.

improvement programs. Thus no socio-economic analysis has been made for this technical option.

8.3.4 Metals from Non-integrated Mills[27]

8.3.4.1 Air Emissions - Short-term Technical Option (to be completed by 2000)

This technical option is based on upgrading the emission controls including operating and maintenance practices. No estimate of capital operating costs is made since it is assumed that these expenditures are part of the companies' ongoing environmental improvement programs with the exception of one non-integrated mill. Therefore, a socio-economic analysis has been made for one non-integrated mill only.[28]

The non-integrated mill metals emission reduction would be nearly 80%. The estimated capital costs for the only non-integrated mill are $10 million and estimated operating costs excluding depreciation are $1.0 million per year.

The following analysis shows what the socio-economic impacts would have been on the non-integrated mill if the estimated incremental operating costs including depreciation had been expended during 1995. The cost of producing a tonne of steel would have increased $1.35 or about 0.21%. The average sales price per tonne of steel was $646 in 1995.

Income after taxes was 12.8% on sales and would have been reduced by 1.6% by the additional costs of this technical option.

The estimated capital expenditures of $10 million are 23% of the 1995 capital expenditures for the non-integrated mill. The metals emission reduction cost is 61 cents per gram for capital expenditures and 10.4 cents per gram for operating expenditures as a result of this technical option.

An estimated 1 to 2 additional employees would be required for the increased operating and maintenance activities. No employment reduction in other areas of the plant is anticipated.

Some increased economic activity may result from the increase in construction and materials supply for the capital expenditures and the spin-off from the minor increase in employment. Some capital expenditures for other purposes may be postponed as a result of the additional environmental expenditures. No decrease in production is anticipated.

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[27] Technical option details and cost estimates are contained in Section 8.1.4 of this report.

[28] John LeBoutillier, CEO, Sidbec-Dosco (Ispat) Inc., Press release, March 25, 1996.

This technical option would lead to a reduction of 15 tonnes of lead from the non-integrated mill. This would be a 50% reduction in lead emissions for the steel plants or a 17% reduction from the steel sector including the Wawa sinter plant. There would be some improvement in industrial hygiene and a reduction in ambient lead levels.

8.3.4.2 Wastewater Effluents - Short-term Technical Option (to be completed by 2000)

This technical option is based on upgrading the wastewater control facilities including operating and maintenance practices. No estimate of capital operating costs is made since it is assumed that these expenditures are part of the companies' ongoing environmental improvement programs. Therefore no socio-economic analysis has been made for this technical option.

8.3.5 Dioxins and Furans[29]

The short-term technical options are based on a phased research program to characterize and quantify the emissions, to identify source materials and prioritize steel sector emissions in relation to other potential sector sources. In the later phase the problem will be assessed and pollution prevention/control measures identified as appropriate. The estimated cost is $1.5 to $2.5 million.

This one-time cost will apply to potential sources including mini-mills, sintering plants and the new EAF facility at an integrated mill. This is less than 0.05% of the non-integrated steel plants' 1995 sales and is less than $0.50 per tonne shipped in 1995. It is considered that the socio-economic impact is negligible especially since it will be spread over two years or more.

No socio-economic impact can be developed for the longer-term technical options since no cost estimate can be made until Short-term Technical Option No. 2 has been completed.

8.3.6 Emissions from Sintering Plants[30]

8.3.6.1 Short-term Technical Option (to be completed by 2000)

This technical option is based on upgrading the emission controls including operating and maintenance practices in the two sinter plants. It was not possible to make an estimate of capital or operating costs for the Stelco sinter plant in their Hilton Works due to a lack of information on the sinter plant.

[29] Technical option details and cost estimates are contained in Section 8.1.5 of this report.

[30] Technical option details and cost estimates are contained in Section 8.1.6 of this report.

Estimated capital costs for the Algoma Steel sinter plant at Wawa are $5 to 10 million and estimated operating cost excluding depreciation are $0.84 to 1.3 million per year.

The following discussion, in lieu of a table, estimates what the socio-economic impacts would have been on Algoma if the estimated incremental operating costs, including depreciation, had been expended during the period of 1993 to 1995.

The cost of producing a tonne of steel would have increased an average of $0.84 or about 0.14%. The average sale price per tonne of steel ranged from $492 to $662 during this period. The additional sinter production cost would have been $2.38 per tonne of sinter or over 5% of the price of agglomerated iron ore imported from the United States.

Income after taxes was an average of 9.0% on sales for the period 1993 to 1995 and would have been reduced by 1.6% by the additional costs of this technical option.

The estimated capital expenditures of $5 to 10 million (in any one year) range from 3.7 to 36% of Algoma's average annual capital expenditures for the years 1993 to 1995. The company is in the midst of a major capital expenditure program to replace their existing slab caster and hot strip mill with a new thin slab caster and hot strip mill. This project may constrain their ability to finance an environmental control capital expenditure. The metals emissions reduction cost is 46 to 93 cents per gram for capital expenditures and 10 to 20 cents per gram for operating expenditures as a result of this technical option.

An estimated 5 to 10 additional employees would be required for the increased operating and maintenance activities. No employment reduction in other areas of the plant and no decrease in production is anticipated.

Some additional economic activity may result from the increase in construction and materials supply for the capital expenditures and from the spin-off from the minor increase in employment but this increase would likely be offset by a reduction of other capital expenditures.

Metals emissions would be reduced by:

- arsenic 4%, 4% of the steel sector total or 1% of the Canadian total in 1993;
- mercury 3%, 4% of the steel sector total or 2% of the Canadian total in 1993; and
- lead 13%, 8% of the steel sector total or 1% of the Canadian total in 1993.

There would be some improvement in industrial hygiene and a reduction in ambient metals levels.

8.3.6.2 Long-term Technical Option No. 2

This technical option is based on adding new, high-efficiency emission controls to the Wawa sinter plant. Estimated capital costs are up to $50 million and estimated operating costs excluding depreciation are up to $5 million per year.

The following discussion, again in lieu of a table, estimates what the socio-economic impacts would have been on Algoma if the estimated incremental operating costs including depreciation had been expended during the period of 1993 to 1995.

The cost of producing a tonne of steel would have increased an average of $4.67 or about 0.8% of the sale price. The average sale price per tonne of steel ranged from $492 to $662 during this period. The cost of agglomerated iron ore from the United States was $43.89 in 1995[31] and the technical option would have increased the Wawa sinter plant operating costs by about $13.30 per tonne or over 30% of the import value. Given the competitive nature of the steel marketplace it would be difficult if not impossible to recoup more than a small portion of the costs by price increases for steel products.

During this same period income after taxes ranged from 2.7 to 13.2% on sales and would have been reduced by 7 to 35% by the additional costs of this technical option. Note that Algoma was recovering from the recessionary period in 1993 and profitability was still depressed in that year.

The estimated metal emission reduction cost for this technical option is 69 cents per gram for capital expenditures and 12 cents per gram for operating expenditures as a result of this technical option.

The estimated capital cost of this technical option (in any one year) would have ranged from 72 to 238% of Algoma's capital costs for the period 1993 to 1995. The company is in the midst of a major capital expenditure program to replace their existing slab caster and hot strip mill with a new thin slab caster and hot strip mill.[32] This project is considered essential by Algoma to enable the plant to increase quality, reduce costs and widen their flat rolled product line in order to remain competitive in the North American and international markets. However, Algoma would likely have to borrow additional funds to finance this sinter plant environmental control capital expenditure even with the postponement of other critical capital projects.

An estimated additional 15 to 20 persons would be required depending on the emission reduction system that is installed.

[31] Imports by Commodity, September, 1995, Catalogue 65-007, Statistics Canada.

[32] Algoma Steel Inc., 1995 Annual Report.

Metals emissions would be reduced by:

- arsenic 86%, 85% of the steel sector total or 26% of the Canadian total in 1993;
- mercury 80%, 76% of the steel sector total or 26% of the Canadian total in 1993; and
- lead 92%, 60% of the steel sector total or 9% of the Canadian total in 1993.

Other socio-economic benefits cannot be quantified. The reduction in metals emissions would substantially improve industrial hygiene and reduce ambient pollution levels.

The magnitude of the economic impact of this technical option would force the company to consider the closure of the Wawa sinter plant. If the sinter plant were closed, there would be a significant socio-economic impact as well. There are an estimated 500 to 700 employees in the Wawa Iron Ore Division who would lose employment. Since this plant is the largest employer in the area, there would be no alternate employment opportunities. The indirect impacts would include the reduction of indirect employment in the area, a substantial reduction in the freight revenue of the railway serving the Wawa sinter plant and a reduction of business for the local service organizations that rely on this operation.

The company would have the expenses of employee severance commitments, cleanup of the sinter plant site, the cost of replacing the Wawa sinter with agglomerated iron ore from other sources and the treatment or recycling of the waste iron oxides from their steel plant.

There would be a potential negative trade impact depending on whether Algoma sourced the replacement iron ore from Canada or imports and the cessation of the processing of waste iron oxides from U.S. steel companies.

There would be a negative impact on government revenues and expenses related to the loss of employment and some taxation revenue.

It is beyond the scope of this study to carry out a more detailed socio-economic impact study of this technical option.

8.3.7 Mercury[33]

This technical option is based on a research program to identify and characterize mercury discharges. The estimated cost of the short-term technical option is $0.2 to $0.5 million.

[33] Technical Option details and cost estimates are contained in Section 8.1.7 of this report.

The cost will apply to the coke ovens and sinter plants in the integrated steel plants. It is less than 0.01% of the integrated steel plants' 1995 sales and is less than $0.06 per tonne shipped in 1995. The socio-economic impact is considered to be negligible.

No socio-economic impact is anticipated for the long-term technical option since the process changes would be carried out for economic reasons.

8.3.8 Polychlorinated Biphenyls (PCBs)[34]

There is no socio-economic impact from the Steel SOR for PCBs.

8.3.9 Chlorinated Solvents[35]

There is no socio-economic impact from the Steel SOR for chlorinated solvents.

8.3.10 Fluorides[36]

There is no socio-economic impact from the Steel SOR for fluorides.

8.3.11 Summary of Socio-Economic Impacts

This section summarizes the socio-economic impacts of the technical options as discussed above. The capital and operating cost impacts are based on the average annual capital expenditures and average annual income after taxes for the years 1993 to 1995. This time period has been chosen since it is the most recent time period for which company-specific information is readily available. As noted earlier, the capital and operating costs of the technical options are taken from Section 8.1 of this report and socio-economic information is taken from the Socio-economic Background Report for the Canadian Primary Steel Sub-sector.[37]

Cost impacts could not be developed for individual companies or plants since sufficient information on the present status of environmental controls for most plants was not available. Financial information in sufficient detail was not available for many companies and plants.

Table 8-3.3 summarizes the estimated capital cost impacts on the industry. The capital cost impact on the integrated mills for the 2000 target date is 23% of the average annual capital expenditures for the period 1993 to 1995. The capital cost impact for the

34 Technical Option details and cost estimates are contained in Section 8.1.8 of this report.

35 Technical Option details and cost estimates are contained in Section 8.1.9 of this report.

36 Technical Option details and cost estimates are contained in Section 8.1.10 of this report.

37 Socio-economic Background Report for the Canadian Primary Steel Sub-sector for Steel Manufacturing Sector Strategic Options Report, Charles E. Napier Company Ltd., November 18, 1996.

2005 target date is an additional 15% for a total of 38%. These capital expenditures would normally be spread over more than one year. The capital cost impacts for metals air emissions are 23% for a non-integrated mill for the 2000 and 2005 target dates and 8% for Algoma for the 2000 target date. These are the only firms affected.

Table 8-3.4 summarizes the estimated operating cost impacts on the industry. The operating cost impact on the integrated mills for the 2000 target date is 4.0% of the average annual operating expenditures for the period 1993 to 1995. The operating cost impact for the 2005 target date is 6.1%. The operating cost impacts for metals air emissions are 0.4% for the 2000 and 2005 target dates for a non-integrated mill and 1.7% for Algoma for the 2000 target date. They are the only firms affected.

Table 8-3.5 shows the estimated operating cost per tonne of steel shipped and as a percent of the average sales price.

Table 8-3.6 shows the estimated emission reductions from the 1993 baseline emissions for the technical options and the cost per gram for the emission reductions for both capital and operating costs.

Table 8-3.7 shows the estimated emission reductions from the 1993 NPRI emission inventory for the technical options.

TABLE 8-3.3 ESTIMATED CAPITAL COST IMPACT OF TECHNICAL OPTIONS

Substance	Option/ Phase	Explanation	Integrated Mills	Algoma	Non-integrated Mills	Total Steel Sector
Benzene	Option 1 Ph. 1	Capital cost ($million) % of avg. capital expend. (1) % of avg. income after tax (2)	25.0 13.9 7.3			25.0 7.5 NEA
	Option 1 Ph. 1+2	Capital cost ($million) % of avg. capital expend. (1) % of avg. income after tax (2)	40.0 22.3 11.7			40.0 12.0 NEA
PAHs	Option 1 Ph. 1	Capital cost ($million) % of avg. capital expend. (1) % of avg. income after tax (2)	9.0 5.0 2.6			9.0 2.7 NEA
	Option 1 Ph. 1+2	Capital cost ($million) % of avg. capital expend. (1) % of avg. income after tax (2)	20.0 11.1 5.8			20.0 6.0 NEA
Metals - Air	Option 1 (3)	Capital cost ($million) % of avg. capital expend. (1) % of avg. income after tax (2)			10.0 6.7 NEA	10.0 3.0 NEA
Metals - Water	(4)					
Metals - Sintering	Option 1	Capital cost ($million) % of avg. capital expend. (1) % of avg. income after tax (2)		7.5 8.3 7.9		7.5 2.3 NEA
	Option 2	Capital cost ($million) % of avg. capital expend. (1) % of avg. income after tax (2)		50.0 109.6 52.4		50.0 15.0 NEA
Total	Year 2000	Capital cost ($million) % of avg. capital expend. (1) % of avg. income after tax (2)	41.5 23.1 12.1	NEA	10.0 6.4 NEA	51.5 15.5 NEA
	Year 2005	Capital cost ($million) (5) % of avg. capital expend. (1) % of avg. income after tax	67.5 37.6 19.7	NEA	2.5 1.7 NEA	77.5 23.3 NEA

NEA: No estimate available

(1) Average annual capital expenditures for the years 1993 to 1995.
(2) Average annual income after tax for the years 1993 to 1995.
(3) No technical option was developed, other than for an non-integrated mill, since available information indicated that most, if not all, plants would achieve a BATEA level of metals emissions by 2000.
(4) No technical option was developed since available information indicated that most, if not all, plants would achieve a BATEA level of metals discharges by 2000.
(5) Does not include Option No. 2 for Metals - Sintering.

TABLE 8-3.4 ESTIMATED ANNUAL OPERATING COST IMPACT OF TECHNICAL OPTIONS ON NET INCOME AFTER TAXES

Substance	Option/ Phase	Explanation	Integrated Mills	Algoma	Non-integrated Mills	Total Steel Sector
Benzene	Option 1 Ph. 1	Operating cost ($million) (1) % of avg. income after tax (2)	5.50 1.6			5.50 NEA
	Option 1 Ph.1+2	Operating cost ($million) (1) % of avg. income after tax (2)	8.80 2.6			8.80 NEA
PAHs	Option 1 Ph. 1	Operating cost ($million) (1) % of avg. income after tax (2)	5.63 1.6			5.63 NEA
	Option 1 Ph. 1+2	Operating cost ($million) (1) % of avg. income after tax (2)	10.40 3.0			10.40 NEA
Metals - Air	Option 1 (3)	Operating cost ($million) (1) % of avg. income after tax (2)			1.70 0.40	1.70 NEA
Metals - Water	(4)					
Dioxins & Furans	Options 1 and 2	Operating cost ($million) (5) % of avg. income after tax (2)	0.6 0.2		1.4 0.14	2.0 NEA
Metals - Sintering	Option 1	Operating cost ($million) (1) % of avg. income after tax (2)		1.60 1.7		1.60 NEA
	Option 2	Operating cost ($million) (1) % of avg. income after tax (2)		8.50 13.4		8.50 NEA
Mercury	Option 1	Operating cost ($million) (5) % of avg. income after tax (2)	0.4 0.1			0.4 NEA
Total	Year 2000	Operating cost ($million) (1) % of avg. income after tax (2)	13.73 4.0	NEA	3.10 NEA	16.83 NEA
	Year 2005	Operating cost ($million) (1)(6) % of avg. income after tax (2)	20.80 6.1	NEA	1.70 NEA	22.50 NEA

NEA: No estimate available

(1) Includes 7% depreciation of capital expenditures.
(2) Average annual income after tax for the years 1993-1995.
(3) No technical option was developed, other than for an non-integrated mill, since available information indicated that most, if not all, plants would achieve a BATEA level of metals emissions by 2000.
(4) No technical option was developed since available information indicated that most, if not all, plants would achieve a BATEA level of metals discharges by 2000.
(5) Operating programs and costs for dioxins and furans and mercury are for one-time research are only included in the 2000 totals.
(6) Does not include Option No. 2 for Metals - Sintering.

TABLE 8-3.5 ESTIMATED ANNUAL OPERATING COST IMPACT OF TECHNICAL OPTIONS ON STEEL PRICE

Substance	Option/ Phase	Explanation	Integrated Mills	Algoma	Non-integrated Mills	Total Steel Sector
Benzene	Option 1 Ph. 1	Average steel price ($/tonne) (1) Operating cost ($/tonne) (2) % of avg. steel price	682 0.67 0.10			675 0.41 0.06
	Option 1 Ph.1+2	Average steel price ($/tonne) (1) Operating cost ($/tonne) (2) % of avg. steel price	682 1.07 0.16			675 0.66 0.10
PAHs	Option 1 Ph. 1	Average steel price ($/tonne) (1) Operating cost ($/tonne) (2) % of avg. steel price	682 0.69 0.10			675 0.42 0.06
	Option 1 Ph.1+2	Average steel price ($/tonne) (1) Operating cost ($/tonne) (2) % of avg. steel price	682 1.27 0.19			675 0.78 0.12
Metals - Air	Option 1 (3)	Average steel price ($/tonne) (1) Operating cost ($/tonne) (2) % of avg. steel price			663 0.33 0.05	675 0.13 0.02
Metals - Water	(4)					
Dioxins & Furans	Options 1 and 2	Average steel price ($/tonne) (1) Operating cost ($/tonne) (2) % of avg. steel price	682 0.07 0.01		663 0.22 0.03	675 0.14 0.02
Metals - Sintering	Option 1	Average steel price ($/tonne) (1) Operating cost ($/tonne) (2) % of avg. steel price		584 0.88 0.15		675 0.12 0.02
	Option 2	Average steel price ($/tonne) (1) Operating cost ($/tonne) (2) % of avg. steel price		584 4.67 0.80		675 0.64 0.09
Mercury	Option 1	Average steel price ($/tonne) (1) Operating cost ($/tonne) (2) % of avg. steel price	682 0.05 0.01			675 0.03 0.00
Total	Year 2000	Average steel price ($/tonne) (1) Operating cost ($/tonne) (2) % of avg. steel price	682 1.67 0.24	NEA	663 0.60 0.09	675 1.26 0.19
	Year 2005 (6)	Average steel price ($/tonne) (1) Operating cost ($/tonne) (2)(5) % of avg. steel price	682 2.53 0.37	NEA	663 0.33 0.05	675 1.69 0.25

NEA: No estimate available

PH: Phase

(1) Average sales price of steel for the years 1993-1995.

(2) Includes 7% depreciation f capital expenditures.

(3) No technical option was developed, other than for an non-integrated mill, since available information indicated that most, if not all, plants would achieve a BATEA level of metals emissions by 2000.

(4) No technical option was developed since available information indicated that most, if not all, plants would achieve a BATEA level of metals discharges by 2000.

(5) Operating costs for dioxins and furans and mercury are for one-time research programs and are only included in the 2000 totals.

(6) Does not include Option No. 2 for Metals - Sintering.

TABLE 8-3.6 ESTIMATED EMISSION REDUCTION IMPACT OF TECHNICAL OPTIONS

Substance	Option/Phase	1993 Baseline Emissions (tonnes)	Emission Reduction		Cost per Gram Reduction ($)	
			(% from 1993)	(tonnes)	Capital Costs	Operating Costs
Benzene	Option 1 Ph. 1	1,237.4	57	710.1	0.035	0.008
	Option 1 Ph. 1+2	1,237.4	83	1,025.3	0.039	0.009
PAHs	Option 1 Ph. 1	186.4	44	82.3	0.109	0.068
	Option 1 Ph. 1+2	186.4	64	119.6	0.167	0.087
Metals - Air	Option 1 (1)	30.0	47	14.1	0.71	0.12
Metals - Water	(2)					
Metals - Sintering	Option 1	80.7	10	8.1	0.93	0.198
	Option 2	80.7	90	72.6	0.69	0.117
Total	Year 2000 (3)	1,538.8	53	816.5	0.051	0.021
	Year 2005	1,538.8	80	1,233.5	0.095	0.018

NEA: No estimate available

PH: Phase

(1) No technical option was developed, other than for an non-integrated mill, since available information indicated that most, if not all, plants would achieve a BATEA level of metals emissions by 2000. Does not include sinter plant emissions.

(2) No technical option was developed since available information indicated that most, if not all, plants would achieve a BATEA level of metals discharges by 2000.

(3) Includes cost of mercury and dioxn and furan short-term technical options.

TABLE 8-3.7 ESTIMATED EMISSION REDUCTIONS FROM 1993 NPRI

Substance	Option/Phase	1993 NPRI Emissions (Canada) [1] (tonnes)	Emission Reduction	
			(% from 1993 NPRI)	(tonnes)
Benzene	Option 1 Ph. 1	2,831.4	25	710.1
	Option 1 Ph. 1+2	2,831.4	36	1,025.3
PAHs	Option 1 Ph. 1	NEA	NEA	82.3
	Option 1 Ph. 1+2	NEA	NEA	119.6
Metals - Air	Option 1 [2]	1,147.9	1.4	16.0
Metals - Water	[3]			
Metals - Sintering	Option 1	1,147.9	0.7	8.1
	Option 2	1,147.9	6.3	72.6
Total [4]	Year 2000	3,979.3	18.5	734.2
	Year 2005	3,979.3	28.0	1,113.9

NEA: No estimate available

PH: Phase

(1) Include emissions from the Canadian Steel Manufacturing Sector and other industrial sources.
(2) No technical option was developed, other than for an non-integrated mill, since available information indicated that most, if not all, plants would achieve a BATEA level of metals emissions by 2000.
(3) No technical option was developed since available information indicated that most, if not all, plants would achieve a BATEA level of metals discharges by 2000.
(4) Does not include PAHs.

9.0 CONSIDERATIONS OF THE ISSUE TABLE

The Draft Phase 1 Strategic Options Study by Apogee and associated consultants, considered a wide range of technical options and strategic options. Apogee recommended further work on some of the options. These and other options were discussed by the Issue Table, and various members also raised other considerations and views. Based on best available information and advice, the following sections reflect the major discussions and conclusions of the Issue Table.

9.1 Canadian Environmental Protection Act (*CEPA*) Renewal

CEPA was proclaimed on June 28, 1988. It incorporates a provision for a review of the Act by a Committee of Parliament within five years and a report to Parliament on any suggested changes to the Act or its administration. The review, which began in June, 1994, resulted in a report to Parliament in June, 1995 by the Standing Committee on Environment and Sustainable Development. The Government Response to the Committee Report, tabled in the House of Commons in December, 1995, will form the basis for amendments to *CEPA* in early 1997.

The Government Response proposes to shift the focus of environmental protection activities towards pollution prevention, which it defines as ✌ *the use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste and reduce the overall risk to human health or the environment"* [6]. Given the significant risks posed to human health or the environment by *CEPA* toxic substances, the Government will amend *CEPA* to enable the Minister to require the preparation and implementation of pollution prevention plans for toxic substances.

The Government Response includes commitments to the use of a risk based approach and considerations to guide decision-making. This includes the assessment and management of toxic substances. It also commits the Government to retaining, in an amended *CEPA*, the current Section 11 definition of "toxic", and to incorporating key elements of the Toxic Substances Management Policy.

The Government Response commits to providing, in *CEPA*, an explicit statutory basis for the National Pollutant Release Inventory (NPRI) and to using a multi-stakeholder consultative process for implementing changes to NPRI or any other national inventory.

The current *CEPA* obligates the Minister of Environment to formulate Environmental Quality Objectives and Guidelines, Release Guidelines, and Environmental Codes of Practice. *CEPA* will be amended such that Objectives, Guidelines and Codes of Practice can relate to pollution prevention, as well as recycling, reusing, treating, storing, or disposing of substances, or reducing releases.

9.2 Toxic Substances Management Policy Implementation

Concerns were raised by some Issue Table members about some of the content and possible interpretation of the TSMP. The goal of ✌virtual elimination✍ and the onus on industry to provide data on Track 1 substances was of concern to industry, but was supported by environmental groups. The control of dioxin and furan emissions was the major issue discussed.

It was generally agreed that interpretation and implementation of the TSMP should be realistic, practical and fair.

9.3 Dioxins and Furans

The importance of an effective, co-ordinated, multi-sectoral, national approach for the assessment and management of dioxin and furan releases was discussed. The steel manufacturing sector is only one of a number of actual or potential sources of dioxin and furan emissions. It was considered important that all potential sources expend similar efforts to obtain data and then to develop appropriate management strategies to reduce and eliminate emissions of dioxins and furans. The Federal-Provincial Task Force on Dioxins and Furans provides a focal point which could ensure that all potential sources of these emissions are considered in a fair and equitable manner.

9.4 Precautionary Principle and Pollution Prevention Application

The concept of the precautionary approach and pollution prevention was considered in evaluating management options for reducing releases of *CEPA*-toxics. The precautionary approach is defined by the Rio Declaration on Environment and Development as follows: "*Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation*.✍

Pollution Prevention is defined in ✌P*ollution Prevention: A Federal Strategy for Action*✍ as follows: ✌*The use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste, and reduce the overall risk to human health or the environment*.✍[(6)]

The application of pollution prevention was discussed. A pilot Pollution Prevention planning project was initiated between Environment Canada and Dofasco, and this exercise was considered useful for future initiatives to implement pollution prevention.

9.5 Federal-Provincial Harmonization

The need to avoid duplication and ensure harmonization of federal programs and requirements[27, 28], was discussed. The Canada-Ontario Agreement, and the St. Lawrence Action Plan, were given as examples of harmonized programs. Steel mills have traditionally been regulated by provincial authorities with some federal regulatory requirements, e.g., PCBs and transboundary transport of hazardous wastes. Some significant regulatory gaps and opportunities for improvements were identified. The development of national baseline or minimum environmental performance standards across Canada, for implementation by the industry and provinces, was discussed as a means of enhancing harmonization.

9.6 Competitiveness

Concern was expressed that possible unreasonable environmental requirements might adversely affect the competitiveness of some companies, particularly those with older facilities that do not have current process and control technologies.

It was suggested that environmental standards should not unfairly target the steel industry or inadvertently punish good performers. The environmental performance of Canada's international trading partners and competitors, was also discussed.

It was suggested that government and industry should work together in designing and implementing new environmental requirements with a view towards maintaining a profitable and successful industry while providing appropriate environmental protection.

9.7 Fairness

The concept of a level playing field of environmental standards and actual environmental performance, among all sector companies was also discussed. The NPRI releases data, ARET commitments, and comparisons with similar facilities in various jurisdictions, indicate inconsistent environmental performances.

9.8 Voluntary Programs

The success of the voluntary ARET program was discussed. Although not all companies within the steel sector participated in ARET, some companies made very substantive commitments to voluntarily reduce releases. It was also recognized that some facilities have best available control technologies in place and could not significantly further reduce releases.

While it was acknowledged that improvements could be made, it was generally agreed (with dissension by the representative of the Canadian Environmental Network) that the

voluntary approach should be given the opportunity to demonstrate its effectiveness. Specific areas for improvement included reducing ✌free riders✍ in the sector who are not participating in ARET, having comparable and similar commitments by competitors, and providing credible and impartial verification mechanisms.

9.9 Regulations

The lack and the inconsistency of regulations for *CEPA*-toxics in various Canadian jurisdictions was discussed. Some suggested that federal national regulations were required soon. Others expressed concern about the time and cost involved in developing and implementing conventional regulations and the lack of a defined need for regulations.

It was generally agreed that national environmental performance non-regulatory standards, as a minimum, would be appropriate. These could be adopted voluntarily by industry or made to be provincial regulatory requirements.

9.10 COA and ARET Target Gaps

Concern was expressed regarding the fact that some of the release reduction targets which had been defined under the Canada-Ontario Agreement (COA) were not judged to be achievable. This led Environment Canada to sponsor the analysis of apparent gaps between COA, the ARET targets and actual commitments, and the targets which were judged to be technically and economically achievable for the steel manufacturing sector. Results of the gap analysis were considered by the Issue Table in the development of conclusions and recommendations.

9.11 Natural and Anthropogenic Releases

In the Toxic Substances Management Policy (TSMP), it is recognized that it would be impossible to eliminate all natural sources of *CEPA*-toxic substances. The TSMP further proposes that: ✌*Elements and naturally occurring substances that are used or released as a result of human activity may be targeted under Track 2 for reduction to naturally occurring levels.*"

The TSMP states that: ✌*The source of release is a fundamental consideration in selecting management strategies."* A substance will be considered predominantly anthropogenic if its concentration in an environmental medium is largely due to human activity, rather than to natural sources or releases. A substance that is predominantly anthropogenic in one part of Canada might not be so in another. Estimates of some natural emissions vary widely, as do estimates of emissions from some anthropogenic sources. Therefore, it may be necessary to rely on expert judgement when determining if a substance is predominantly anthropogenic.

Consideration of natural as well as anthropogenic sources may be appropriate to

ensure that action is focused where it will be most effective in improving and protecting the environment. However, it was also recognized that natural emissions could not be controlled, whereas anthropogenic emissions could be, and usually were controlled to some extent.

9.12 Release Data Quality and Reporting

The Priority Substances List Assessment found certain species of some substances to be toxic. Release data for some species are not available, and are difficult and costly to analyze. In addition, it was found that the existing reporting thresholds for NPRI data, inconsistent reporting methodologies, and inconsistencies between data reported to NPRI and ARET created difficulties in estimating releases, with little actual release data directly measured. Consequently, there are anomalies and inconsistencies within companies and between companies in their reporting of release data. The duplication and burden of reporting was also discussed, as was the public's right to know what pollutants are being released to the environment. The opportunity to have more reliable, consistent, and user friendly data in an era of electronic communication (e.g., via the Internet) was also identified.

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10.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the discussions of the Steel Manufacturing Sector Strategic Options Process Issue Table, on various associated background documents, and on the foregoing, the following conclusions and recommendations are offered to Ministers for the management of *CEPA*-toxics from the Steel Manufacturing Sector. These conclusions and recommendations reflect a number of considerations which include providing a framework for continuous improvements in the environmental performance of the steel manufacturing sector.

Specifically, the following recommendations call for enhanced voluntary programs, and non-regulatory environmental performance standards, backed up by possible regulatory requirements under *CEPA*. The recommendations are based on the following major considerations:

- recognition of existing regulations and regulatory regimes;
- harmonization of Federal-Provincial efforts to develop and implement environmental performance standards;
- recognition of existing voluntary commitments;
- focused improvements to the current voluntary programs through the development and implementation of Codes of Practice which include:
  a) transparent, public, consistent, and verifiable reporting of releases; and
  b) fair and equitable expectations of environmental performance within the sector.
- specific release reduction targets and schedules for *CEPA*-toxic substances for the sector which take into account the commitments of governments and industry to reductions; and
- a *CEPA* framework and contingent regulatory action to encourage participation in the recommended enhanced voluntary programs.

Generally, the release of all *CEPA*-toxic substances are not directly regulated at source under provincial Regulations, or by facility Approvals, Certificates of Approval, Operating Licenses, or similar instruments. Some jurisdictions in Canada and various jurisdictions in other countries have technology-based emission and effluent performance standards. These standards may be for new, modified or existing facilities and may include concentration limits and limits based on releases per unit of steel production.

Examples of standards which are relevant to the steel manufacturing sector include the

Province of Ontario's Municipal/Industrial Strategy for Abatement (MISA) standards, the U.S. Environmental Protection Agency's New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAPs), and the European Union's Emission Limit Values (ELVs).

These standards are derived, considering available process and control technologies, using various policy terminologies, e.g., Best Available Technology Economically Achievable (BATEA), Maximum Achievable Control Technology (MACT), Lowest Achievable Emission Reductions (LAER), Best Available Technology Not Entailing Excessive Cost (BATNEEC), etc.

It is important to note that many facilities have BATEA-equivalent process and control technologies in place, and that significant further reductions in releases of some *CEPA*-toxic substances (e.g., metals in wastewater effluents from integrated mills) are not practicable.

10.1 Federal-Provincial Harmonization

The environment is a shared federal and provincial responsibility. A framework for setting and attaining Canada-wide environmental standards has been developed under the auspices of the Canadian Council of Ministers of the Environment and is targeted for Ministerial ratification in May 1997. Federal-provincial-territorial discussions on a Canada-wide approach to the management of toxic substances have also been initiated.

For the steel manufacturing sector, all four integrated Canadian mills and most of the steel production are located in Ontario. Other provinces with steel manufacturing facilities are Nova Scotia, Québec, Manitoba. Saskatchewan, and Alberta.

RECOMMENDATION #1

It is recommended that toxic management initiatives for integrated steel mills be developed and implemented jointly and co-operatively by Environment Canada and Ontario Environment and Energy under the auspices of the Canada-Ontario Agreement, and that initiatives for the non-integrated steel mills in Canada be developed and implemented under the auspices of the CCME and the leadership of Environment Canada.

The Canada-Ontario Agreement provides a precedent and a framework for harmonized environmental initiatives. Ontario is also developing a Toxics Substances Management Strategy to establish a policy framework and strategic plans for toxics management. A new Memorandum of Understanding between Environment Canada and Ontario Environment and Energy is currently being considered and could include provisions which would ensure efficient, effective and timely development and implementation of toxics management in Ontario, consistent with the CEPA TSMP.

Nationally, the CCME has sponsored the development and implementation of a number of environmental initiatives, including Environmental Codes of Practice and various non-regulatory and regulatory standards.

10.2 Benzene

Benzene releases are primarily associated with the operation of the coke oven by-product handling systems at the four integrated mills in Ontario. Wastewater effluents from these systems will be effectively controlled by 1998 under the Ontario MISA program, resulting in a 98% reduction in benzene effluents. However, there are no regulatory requirements for the at-source control of atmospheric emissions.

Options to reduce benzene include enhanced voluntary programs, and possible provincial or federal regulations.

Canadian integrated steel mills have voluntarily made commitments to very significantly reduce benzene emissions. The reduction commitments, made before February, 1996 under the ARET 1 program, varied significantly among the four integrated mills but are reported to result in a 58% reduction of 1993 sector emissions by 2000. Further commitments have now been made by Dofasco in response to a challenge by the federal Minister of Environment. Stelco has proposed benzene reduction commitments under a proposed agreement between the Government of Canada and the Canadian Chemical Producers' Association.

RECOMMENDATION #2

It is recommended that an enhanced voluntary program be developed to reduce 1993 benzene releases from integrated mills by approximately 55% by 2000, 80% by 2005, and 90% by 2015. It is recommended that this program include the development and adoption of an Environment Canada-Ontario Environment and Energy Code of Practice by December, 1998 which includes: a) release guidelines for benzene emissions from new, existing and modified sources; b) standardized benzene emission measuring, monitoring and reporting practices; and c) best environmental management practices for coke-making by-product facilities.

This enhanced voluntary program would be developed by Environment Canada, Ontario Environment and Energy, members of the Canadian Steel Producers Association with integrated steel mills, and other stakeholders. The Code of Practice would be co-operatively developed by a Canada/Ontario/Industry/Public Task Force and used as appropriate by steel companies and Ontario Environment and Energy with the objective of achieving a similar level of environmental performance (in terms of grams of benzene emitted per tonne of production) from all facilities by 2005. Current emission estimates for 1993 would be refined in accordance with the monitoring and reporting methodologies which would be developed in the Code of Practice.

The targets and schedules are based on improvements at existing facilities and the assumption that a number of coke ovens may have reached the end of their viable life by 2015 and have been replaced with new technologies. Under the enhanced voluntary program, initially the emissions data will be independently audited and verified and the targets and schedules refined to ensure a level playing field in environmental performance by all four facilities.

The enhanced voluntary program could include voluntary adoption of the Code of Practice by companies. The Code of Practice could be an element of comprehensive Environmental Performance Agreements, Covenants or Memoranda of Understanding between Environment Canada, Ontario Environment and Energy, and Algoma, Dofasco, and Stelco. The program could make provisions for verification of releases and assessments of the ARET Action Plans by a credible and impartial mechanism (such as Ontario Environment and Energy or independent third parties) to encourage continuous improvements and consistency in the environmental performance of companies.

TABLE 10-1 TARGETS AND SCHEDULES FOR BENZENE EMISSION REDUCTIONS

Mill	1993 Emissions (tonnes)	2000 Emission Reductions (% from 1993)	2005 Emission Reductions (% from 1993)	2015 Emission Reductions (% from 1993)
Algoma Steel Inc.	314	73	92	94
Dofasco Inc.	454	48	71	83
Stelco Hilton Works	328	51	89	91
Stelco Lake Erie Works	141	66	86	89
Sector Totals	1,237	57	83	89

10.3 Polycyclic Aromatic Hydrocarbons (PAHs)

Releases of PAHs are primarily associated with the operation of coke ovens at the four integrated mills in Ontario. Wastewater effluents will be effectively controlled by 1998 under the Ontario MISA program, with a 70% reduction expected in PAH effluent releases. However, there are no regulatory requirements for the at-source control of atmospheric emissions of PAHs from coke ovens.

Options to reduce releases of PAHs from coke ovens include enhanced voluntary programs, and possible provincial or federal regulations.

The PAH data reported and the ARET commitments made by different facilities are inconsistent. It is recognized that estimating PAH emissions is particularly difficult.

RECOMMENDATION # 3

It is recommended that an enhanced voluntary program be developed to reduce 1993 PAH releases from integrated mills by approximately 45% by 2000, 65% by 2005 and 70% by 2015. It is recommended that this program include the development and adoption of an Environment Canada/Ontario Environment and Energy Code of Practice by December, 1998 which includes: a) release guidelines for PAH emissions from new, existing and modified sources; b) standardized PAH emissions monitoring and reporting practices; and c) best environmental management practices for coke-making facilities.

TABLE 10-2 TARGETS AND SCHEDULES FOR PAH EMISSION REDUCTIONS

Mill	1993 PAH Emissions (tonnes)	2000 Emission Reductions (% from 1993)	2005 Emission Reductions (% from 1993)	2015 Emission Reductions (% from 1993)
Algoma	80.3	51	79	83
Dofasco	45.4	27	44	54
Stelco Hilton Works	45.7e	56	66	72
Stelco Lake Erie Works	15.0e	21	39	50
Sector Totals	186.4	44	64	70

e: estimated, not reported.

This enhanced voluntary program would be developed by Environment Canada, Ontario Environment and Energy, members of the Canadian Steel Producers Association with integrated steel mills, and other stakeholders. The Code of Practice would be developed by a Canada/Ontario/Industry/Public Task Force, and used as appropriate by steel companies and Ontario Environment and Energy with the objective of achieving a similar level of environmental performance (in terms of grams of PAH emitted per tonne of production) from all facilities by 2005. Current emission estimates for 1993 would be refined in accordance with the monitoring and reporting methodologies which would be developed in the Code of Practice.

The targets and schedules are based on improvements at existing facilities and the assumption that a number of coke ovens may have reached the end of their viable life by 2015 and have been replaced with new technologies. Under the enhanced voluntary program, initially the emissions data will be independently audited and verified and the targets and schedules refined to ensure a level playing field in environmental performance by all four facilities.

The enhanced voluntary program could include voluntary adoption of the Code of Practice by companies. The Code of Practice could be an element of comprehensive Environmental Performance Agreements, Covenants or Memoranda of Understanding between Environment Canada, Ontario Environment and Energy, and Algoma, Dofasco, and Stelco. The program could make provisions for verification of releases by a credible and impartial mechanism (such as Ontario Environment and Energy or

independent third parties), and assessments of the ARET Action Plans and the relative environmental performance of individual companies.

10.4 Air Emissions of Metals

Although there are no specific technology-based regulatory standards and requirements to control air emissions at source, currently available release data indicates that the integrated mills and most non-integrated mills appear to have air pollution control systems that are consistent with accepted Best Available Technology Economically Achievable (BATEA) practices.

However, the reliability of available release data may be questionable in some cases. Also, the NPRI threshold quantity for reporting of releases (10 tonnes/annum) was considered to be too high for some substances. As shown by Table 10-3, high emissions of metals were reported for the Sidbec-Dosco mill in Québec and the Wawa sintering plant in Ontario. No details were available on the design and capture efficiency of primary and fugitive secondary control systems, or the operation and maintenance of these systems, at other facilities.

It is expected that further incremental, site-specific reductions are achievable through the application of best environmental management practices and continuous improvements related to the design, operation and maintenance of primary and secondary emission control systems.

TABLE 10-3 AIR EMISSIONS OF *CEPA*-TOXIC METALS FROM THE STEEL SECTOR (TONNES/YEAR)

Mill	As	Cd	Cr[1]	Hg	Ni[2]	Pb	Total	Percent
Wawa Sintering[3]	24.4	0.13	0.11	0.60	0.16	55.3	80.68	72.9
Sidbec-Dosco[4]	0	0	0.79	0	0	12.7	13.49	12.2
Others	0.12	1.07	3.36	0.03	0.70	11.2	16.48	14.9
Totals	24.5	1.20	4.26	0.63	0.86	79.2	110.65	100.0

Source: 1993 NPRI

As: Arsenic, Cd: Cadmium, Cr: Chromuim, Hg: Mercury, Ni: Nickel, Pb: Lead

(1) These data are for total chromium; data on *CEPA*-toxic Cr(VI) are not available.
(2) These data are for total nickel; data on *CEPA* toxic oxidic, sulphidic and soluble forms are not available.
(3) 1994 data based on emission test.
(4) Robert Santerre, Sidbec-Dosco (Ispat) Inc. letter to Jean Lavergne, Ministère de l'Environnement et de la Faune du Québec, le 29 novembre 1996.

RECOMMENDATION # 4

It is recommended that overall sector air emissions of CEPA-toxic metals be reduced through the development and adoption of a CCME Code of Practice by December, 1998 which includes: a) emission guidelines for new, existing and modified sources; b) standardized emissions measuring, monitoring and

reporting practices; and c) best management practices for achieving continuous improvement in the design, operation and maintenance of air pollution control systems. It is further recommended that source-specific targets and schedules be developed for the Wawa sintering plant and Sidbec-Dosco. (Refer also to Recommendation #7)

Emissions from the Wawa sintering plant and Sidbec-Dosco can be reduced significantly. Targets and schedules for emission reductions at Wawa would be developed by Ontario Environment and Energy in cooperation with Environment Canada (see Recommendation 7 below). Targets and schedules for Sidbec-Dosco would be developed by Québec Environment in cooperation with Environment Canada.

The Code of Practice would be developed by a Federal/Provincial/Industry/Public Task Force, and used as appropriate by steel companies and by provincial Departments of Environment in Ontario, Québec, Manitoba, Saskatchewan, Alberta and Nova Scotia. The performance-based guidelines embodied in the Code would take into account process differences associated with, for example, carbon steel, stainless steels and specialty steel products.

10.5 Water Releases of Metals

10.5.1 Integrated Mills

By 1998, wastewater effluents from all integrated mills will be effectively controlled, i.e., to levels which are consistent with accepted BATEA standards and practices, under the Ontario MISA program. It is expected that the MISA regulations will result in an estimated 50% reduction in metals releases from integrated mills.

No further recommendations are made to Ministers since MISA requirements are consistent with BATEA requirements, and available information, which is considered reliable, indicates that MISA requirements will be met in 1998.

10.5.2 Non-Integrated Mills

Wastewater effluents from most non-integrated mills in Ontario will be effectively controlled, i.e., to levels which are consistent with accepted BATEA requirements, by 1998 under that province's MISA program. Two mills which discharge into municipal sewers are not directly covered by the MISA steel sector regulations, but may be subject to municipal requirements.

Although mercury and cadmium are not specifically included in the MISA regulation, it is expected that the chemical/physical treatment systems required to control suspended solids, lead, chromium and nickel, will also control releases of other substances. Similarly, BATEA-equivalent results are being achieved by Québec steel mills as the result of the wastewater treatment plants which have been constructed to meet the

requirements of the St. Lawrence Action Plan. However, based on readily available information, the regulatory requirements and control practices for other Provinces are less well defined, and similar levels of environmental performance could not be confirmed for all non-integrated mills in Canada.

RECOMMENDATION # 5

It is recommended that overall sector reductions in wastewater releases of CEPA- toxic metals from non-integrated mills be targeted through the development and adoption of a CCME Code of Practice by December, 1998 which includes: a) effluent release guidelines for new, existing and modified sources; b) standardized effluent measuring, monitoring and reporting practices; and c) best management practices for achieving continuous improvement in the design, operation and maintenance of water pollution control systems.

The Code of Practice would be co-operatively developed by a Federal/Provincial/ Industry/Public Task Force. Effluent guidelines would take into account the requirements of the Ontario MISA Program and the St. Lawrence Action Plan as a basis for the Code, and could be either adopted voluntarily by steel companies or adopted as provincial regulations or conditions of facility-specific permits.

10.6 Dioxins and Furans

Dioxins and furans have been designated under the Toxics Substances Management Policy as Track 1 substances with a goal of "virtual elimination", taking into account technical and economic considerations in setting targets and schedules towards the achievement of the virtual elimination goal. The onus is on possible sources to provide data.

The presence of chlorinated compounds in feedstocks under certain combustion conditions may contribute to the formation of dioxins and furans. Based on German and Swedish data, some steel-making processes are potential sources of dioxins and furans. However, no data exists to confirm the presence or causes of dioxins and furans from the Canadian steel sector with the exception of the Algoma sintering plant at Wawa.

RECOMMENDATION # 6

It is recommended that, consistent with the work of the multi-sectoral Federal-Provincial Task Force on Dioxins and Furans, the steel sector participate with all other sectors now considered to be potential sources of dioxins and furans in a Research Program. The objective of this Program would be to characterize, quantify and prioritize emissions of dioxins and furans from these potential sector sources with the aim of developing appropriate management options.

A joint federal, provincial, industry partnership program is proposed, to provide information on releases of dioxins and furans from the steel sector, in the context of releases from all other currently known sources such as municipal incinerators. The partnership program would involve Environment Canada, Natural Resources Canada, other federal departments, interested provinces, the Canadian Steel Producers Association and members, the public, and the private sector. Findings of the program could be incorporated in an Environmental Code of Practice.

A subsequent comprehensive, multi-phase Research Program is envisaged, with the need to continue the Program being assessed after each phase. Activities to control dioxins and furans in various jurisdictions, and by international organizations, would also be taken into account. The ultimate objective of the program would be to develop short and long term strategies directed towards achieving the goal of virtual elimination.

To ensure equity among source sectors, periodic progress reports on the results of the Program would be provided by each potential source sector to the Co-Chairs of the Federal-Provincial Task Force on Dioxins and Furans.

10.7 Emissions from Sintering Plants

Available data indicates that the Algoma sintering plant at Wawa is by far the largest source of emissions of arsenic, mercury and lead emissions from the steel manufacturing sector (reference Table 10-3). Significant emissions of dioxins and furans have also been reported (reference Table 6-1) and are of particular concern since, as was noted previously, these are Track 1 substances under the Toxic Substances Management Policy and have been targeted for virtual elimination. No data are available for an assessment of the Stelco sintering plant at Hamilton.

The Wawa facility does not have particulate emission collection that reflects best available control technology. The estimated cost of retrofitting control equipment that would effect significant reductions in current emissions of arsenic, lead, and/or mercury from this facility may be as high as or greater than $50 million. Such costs could have potentially significant implications for the overall economic viability of the Algoma operation (reference Section 8.1.6). No information is currently available regarding the potential cost implications of controlling dioxin and furan emissions.

RECOMMENDATION # 7

It is recommended that an enhanced voluntary program be developed jointly by Algoma, Ontario Environment and Energy and Environment Canada to reduce emissions of dioxins and furans, arsenic, cadmium, lead and mercury at the Algoma Sintering Plant by December, 1997. This voluntary program would include emission reduction targets and schedules for these substances and would be consistent with the Toxics Substances Management Policy. It is recommended that an Emission Management Program be conducted at the Stelco Hilton Works Sintering Plant, that reports on the characteristics and controls of emissions be submitted by Ontario Environment and Energy to Environment Canada, and that the status be reviewed by December, 1997.

Ontario Environment and Energy is already working with Algoma, Wawa and Environment Canada to assess emission reduction measures for arsenic and COA substances. Human health, environmental, technical, economic and social considerations are being taken into account, and continuous improvements in the environmental performance at this facility are expected. An engineering feasibility study, the estimated duration of which is 6-9 months, should be undertaken to determine the applicability and estimated cost of retrofitting enhanced emission controls.

No emission data are currently available for the Stelco, Hamilton, sintering plant. This is considered a significant information deficiency which Ontario Environment and Energy, Stelco, and Environment Canada are addressing.

10.8 Mercury

Under the Canada-Ontario Agreement, mercury is a Tier 1 substance identified for "virtual elimination" and scheduled for a 90% reduction in releases from all sources by 2000. Trace amounts of mercury are present in coal used for coke-making but little is known about the behaviour of mercury in coke plant emissions, effluents and residues.

RECOMMENDATION # 8

It is recommended that a Mercury Release Assessment Program be established for the integrated mills and sintering plants (refer to Recommendation 7) at Algoma, Dofasco and Stelco, and that a report be submitted by Ontario Environment and Energy to Environment Canada by June, 1997.

Dofasco has begun a program to investigate mercury characteristics, and to evaluate the fate of mercury in coal and the associated coke-making process. These technical and economic considerations will help refine specific targets and schedules for mercury reductions for the steel manufacturing sector, considering the 90% COA reduction target. Findings of the program could be incorporated into an Environmental Code of

Practice or other appropriate tool.

10.9 Polychlorinated Biphenyls (PCBs)

PCBs are comprehensively regulated by the federal and provincial governments. PCB management practices seem to be well established and implemented by the Steel Sector, and are periodically audited by some companies (see Recommendation 11).

No recommendations to Ministers, specifically for the Steel Sector, for further PCB regulations or management actions, are proposed.

10.10 Chlorinated Solvents

Chlorinated solvents are either currently regulated or are being considered by other Strategic Options Issues Tables. Emerging recommendations from these Issue Tables seem to be appropriate for the Steel Sector, although special technical and economic considerations need to be further investigated for some applications at specific mills.

No recommendations to Ministers, specifically for the Steel Sector, for further regulations or management actions for chlorinated solvents, are proposed.

10.11 Fluorides

The magnitude and nature of fluoride releases from the steel sector was not considered to be a major concern. By 1998, wastewater effluents from all integrated mills will be effectively controlled, i.e., to levels which are consistent with accepted BATEA standards and practices, under the Ontario MISA program. It is expected that the MISA regulations will result in an estimated 40% reduction in fluoride releases from integrated mills. In addition, economical prevention and control technologies have not been demonstrated or applied to the steel sector.

No recommendations to Ministers, specifically for the Steel Sector, for the reduction of fluoride releases are proposed.

10.12 Contaminated Sites

Many residues are produced in the steel sector including furnace slags, air pollution control particulates and sludges, water pollution control sludges, etc. Some of the more inert residues are used for construction and other purposes. Other residues are classified as hazardous waste, and are transported and disposed under provincial regulatory requirements.

Significant contamination of the sites and areas near integrated steel mills has occurred during the past decades. This contamination includes *CEPA*-toxics such as PAHs and metals.

Dofasco has completed clean-up of portions of Hamilton Harbour. Atlas Specialty Steels has completed clean-up of a portion of the Welland River.

Federal/provincial/municipal/industry programs are being conducted to clean up such areas as Hamilton Harbour, Ontario (Slater Industries, Dofasco and Stelco), St. Mary's River, Ontario (Algoma, Sault Ste. Marie), and the Sysco tar ponds and coke oven site (Sydney Steel) in Nova Scotia. Concern was expressed about withdrawal of government and industry funding for these projects before their completion.

RECOMMENDATION # 9

It is recommended that the existing Canada-Ontario Remedial Action Plans for Hamilton Harbour and St. Mary's River continue their remediation efforts which contribute to the management of CEPA-toxic substances, using an equitable funding formula which includes participation by local industries.

It is recommended that Canada and Nova Scotia support an open and transparent community-based process to develop a Remediation Plan for the tar ponds and coke oven site in Sydney, Nova Scotia.

For the Sysco tar ponds, the need for a community based Remediation Plan, has been identified. Once a community-supported and technically feasible plan is in place, funding from the federal and provincial governments, as well as other stakeholders, will be required for implementation.

10.13 Pollution Prevention Plans

Pollution prevention planning is becoming a widely accepted environmental management tool with regard to evaluating and implementing opportunities for continuous improvement. For example, the renewed *CEPA* will have provisions for the preparation and implementation of pollution prevention plans for toxic substances.

The steel sector has further pollution prevention and control opportunities.

RECOMMENDATION # 10

It is recommenced that steel manufacturing sector facilities prepare and implement Pollution Prevention Plans.

Some companies in the steel sector have produced public plans for the management of

toxic and other substances. For example, Dofasco prepared a comprehensive document for the ARET program (Dofasco Inc., ARET Action Plan, 1995). This Plan includes progress and plans for the reduction of 23 substances, and the company's environmental policies and commitments. Dofasco also participated in a pilot project to explore pollution prevention opportunities.

Guidance and a template for the preparation of pollution prevention plans could be incorporated in the Codes of Practice recommended above.

10.14 Environmental Audits

Environmental audits are a useful tool to verify compliance with regulations and consistency with voluntary standards and commitments.

RECOMMENDATION # 11

It is recommended that periodic voluntary environmental audits be conducted to verify compliance with provincial and federal regulations, adequacy of internal environmental management systems, and consistency with voluntary commitments and applicable Codes of Practice. These audits would be in addition to the compulsory compliance testing required by provincial regulatory agencies.

Environmental audits would help to ensure compliance with regulatory requirements for air and water releases, and for solid waste disposal activities and the management of PCB materials and equipment.

10.15 Ministerial Review

The foregoing recommendations for the management of *CEPA*-toxics releases from the steel manufacturing sector recognize existing regulatory requirements and gaps, and, current voluntary programs and their effectiveness. The recommendations are primarily non-regulatory and are intended to enhance voluntary programs and commitments by targeting the identified weaknesses of voluntary programs.

Releases of benzene and PAHs from coke making facilities and releases of dioxins and furans, arsenic, cadmium, lead and mercury from the Wawa sintering plant are the priorities addressed in this report. However, there are opportunities for continuous improvements in the environmental performance of all steel mills.

The effectiveness of the foregoing recommendations will depend on the co-operation of all steel companies with provincial and federal Departments of Environment. It is

necessary to be prepared to have an appropriate regulatory framework and back stop if the enhanced voluntary programs recommended are not effective.

RECOMMENDATION # 12

It is recommended that a report, developed by Environment Canada and Health Canada staff, on the implementation and effectiveness of the SOR recommendations and relevant provincial toxics management programs, be submitted to the Ministers of Environment and Health by March 1999, so that regulatory action or further non-regulatory action can be taken, as appropriate.

The report to Ministers would be developed in consultation with provincial counterparts, the Canadian Steel Producers Association and industry representatives, other federal departments, and public interest groups. The report would include:

The commitments and performance of voluntary programs, particularly with regard to benzene, PAH and metal release reductions.

- *The status of the development, adoption and implementation of the Environmental Codes of Practice.*
- *A review of the release reduction targets and schedules recommended in this SOR.*
- *Progress in achieving reductions in emissions of CEPA-toxic substances at the Algoma sintering plant in Wawa.*
- *Status of the Dioxins and Furans Research Program.*
- *Trends in environmental releases from NPRI and ARET 1993 to 1997.*
- *The management of toxics from the sector with respect to any new substances that may have been declared toxic under CEPA, e.g., respirable particulates from CEPA Priority Substances List-2.*
- *Developments in provincial and municipal regulatory requirements and compliance activities.*
- *Environmental initiatives by members of the Canadian Steel Producers Association and the sector.*
- *Outstanding environmental and related economic issues within the steel manufacturing sector in Canada and internationally, e.g., site remediation, UN ECE LRTAP Protocols, Canada-U.S. GLWQA and COA implementation, etc.*
- *Recommendations for regulatory actions and further non-regulatory actions,*

as appropriate.

Based in part on the findings of this report, Ministers of Environment and Health may decide to regulate toxic releases from the Steel Manufacturing Sector under Part 2 of CEPA. Subsequent reports would be developed at a frequency deemed appropriate by the Ministers.

10.16 Other Views of Issue Table Members

The recommendations of the Strategic Options Report represent a very high degree of consensus among all members of the Issue Table, considering the wide range of perspectives and interests that were represented. However, some members wished to have their views on some topics documented in the Report.

Some members suggested having additional meetings and drafts of the report before issuing the report to stakeholders who did not participate in the Strategic Options Process. However, most members believed that further delays in issuing the report would not significantly enhance the quality of the report or substantively modify the recommendations.

The representative of the Hamilton Harbour Remedial Action Plan suggested that members of the local Hamilton community affected by the recommendations should have the opportunity to directly comment on the draft report. However, it was not possible to arrange a public meeting in Hamilton within the allowed time schedule of the Strategic Options Process.

The representative of the Canadian Environmental Network supported many of the recommendations including: the releases reduction targets and schedules of *CEPA*-toxics from the sector, the development of standardized release reporting procedures, the program for dioxins and furans, and pollution prevention plans.

However, they did not support the use of voluntary programs by industry instead of *CEPA* regulatory requirements. They did not support the selection of CCME Environmental Codes of Practice and Release Guidelines as the recommended policy instruments for the following reasons[38].

- *" the steel manufacturing sector has been identified as a major contributor to toxic pollution in Canada.*
- *CCME Codes of Practice and Release Guidelines have a poor track record in regards to their implementation and accomplishment.*

[38] S. Gingras, CEN, Letter to Chair, Steel Manufacturing Sector SOP Issue Table, November 28, 1996.

- *the proposed voluntary program do not offer any guarantee to Canadians that reduction targets and schedules will be met.*
- *the proposed voluntary programs have no legal implication and therefore will not apply to every steel-making process in Canada.*
- *the proposed voluntary programs do not penalize companies who do not wish to participate fully in the programs.*
- *the monitoring process is currently undertaken by industry without third party auditing and therefore do not provide any guarantee for the quality of the data.*
- *a regulated framework which would include Codes of Practice and Release Standards under CEPA would offer a level playing field for all steel making processes in Canada."*

It was recognized by the CEN representative that it was also recommended that the effectiveness of the enhanced voluntary programs proposed would be reviewed by federal Ministers of Environment and Health by March, 1999.

Stakeholders not represented at the Issue Table were invited to review the Report before February 21, 1997, so that any comments received could be taken into account by Ministers.

10.17 Public Comments on Issue Table Draft Strategic Options Report

Comments on the December 30, 1996 Strategic Options Report were provided by Issue Table members and others. These included representatives from steel mills, a provincial government and the Canadian Steel Producers Association.

A representative of an integrated mill agreed with the thrust of the recommendations of the Strategic Options Report and recognized the ongoing need to reduce toxic releases. The representative also indicated that the steel mill is taking steps to eliminate many of the 16 CEPA-toxic substances from their wastewater effluents, in addition to reducing emissions of benzene and PAHs from their coke-making operations through pollution prevention techniques.

A representative of the Canadian Steel Producers Association (CSPA) supported the need for responsible action in the management of releases of toxic substances. While not all its members participated in the Strategic Options Process, the CSPA and its members have established a working group to develop a comprehensive implementation plan which will demonstrate their commitment to protecting the environment through responsible voluntary action.

Another reviewer suggested that it is important getting large release sources such as steel mills to do stack testings for compounds such as particulates, PCBs, dioxins, furans, hexachlorobenzene (HCB), PAHs, mercury, cadmium and lead.

Additional comments were submitted by the public on Strategic Options Report from a public meeting held in Burlington, Ontario on January 30, 1997. This meeting was sponsored by the Hamilton Harbour Remedial Action Plan (RAP) for local citizens affected by the recommendations. The 48 people in attendance represented various affiliations including: community groups such as the Bay Area Restoration Council, City of Burlington, City of Hamilton, Regional Municipality of Hamilton-Wentworth, academics, steel mills management and workers, Ontario Ministry of Environment and Energy, etc.

A representative of the Hamilton Harbour Remedial Action Plan suggested that the local community does not consider itself to be adequately protected from harmful emissions from the steel manufacturing sector. The representative also raised concerns about the federal government's ability to evaluate the effectiveness of the recommendations by 1999.

A representative of the City of Hamilton provided a summary of public comments which include the following major points: the Hamilton Beach Residents' Association wants stringent regulations especially for companies that are in their back yards, instead of a voluntary approach; particulates should be addressed by the SOP because of their health effects (respirable and inhalable); substances of local concern should be assessed to determine which ones pose the highest risk, and then controlled in order of priority.

A Hamilton resident suggested that the SOR is another form of "self regulation" benefiting industry. The citizen also expressed skepticism about the voluntary process and asked for stricter regulations and enforcement.

A university member suggested that the steel industry has been a major contributor to the releases of air toxic's into the Hamilton air, according to a Hamilton Air Quality Initiative study. The member further suggested that the quality of Hamilton air will improve proportionally if the recommendations for benzene and PAH emission reductions are implemented by the two major mills.

Comments on the Issue Table Draft Strategic Options Report submitted by various representatives are summarized in Appendix C. Documentation on the Strategic Options Process is accessible through a public file maintained by the Mining, Minerals and Metals Division, Environment Canada.

TABLE 10-4 SUMMARY OF STRATEGIC OPTIONS REPORT RECOMMENDATIONS FOR THE STEEL MANUFACTURING SECTOR

Recommendation No., Subject	Summary of Recommendation
1. Federal-Provincial Harmonization	Implement toxic management initiatives under the auspices of the Canada-Ontario Agreement (COA) and the Canadian Council of Ministers of the Environment (CCME).
2. Benzene Emissions	Implement an enhanced voluntary program to reduce benzene 1993 emissions by approximately 55% by 2000, 80% by 2005, and 90% by 2015. Develop and adopt a COA Environmental Code of Practice by December, 1998.
3. Polycyclic Aromatic Hydrocarbon (PAH) Emissions	Implement an enhanced voluntary program to reduce PAH 1993 emissions by approximately 45% by 2000, 65% by 2005, and 70% by 2015. Develop and adopt a COA Environmental Code of Practice by December, 1998.
4. Metals - Air Emissions	Reduce overall sector emissions of *CEPA*-toxic metals. Develop and adopt a CCME Environmental Code of Practice by December, 1998. Develop emission reduction targets and schedules for the Algoma Wawa sintering plant and the Sidbec-Dosco non-integrated mill. (See also Recommendation 7)
5. Metals - Water Effluents	Reduce overall wastewater sector releases of *CEPA*-toxic metals. Develop and adopt a CCME Environmental Code of Practice by December, 1998.
6. Dioxin and Furan Emissions	Participate with all other sectors, now considered to be potential sources of dioxin and furan emissions, in a Research Program to characterize, quantify and prioritize emission sources.
7. Sintering Plant Emissions	Develop an enhanced voluntary program which includes emission reduction targets and schedules for the Algoma sintering plant, by December, 1997. Evaluate and report on toxics management options for the Stelco Hilton Works sintering plant by December, 1997.
8. Mercury Emissions	Conduct a Mercury Release Assessment Program for the integrated mills and sintering plants and report on results by June, 1997.
9. Contaminated Sites	Continue remediation of Hamilton Harbour, Ontario, and St. Mary's River, Ontario, and develop a remediation plan for the tar ponds and coke oven site in Sydney, Nova Scotia.
10. Pollution Prevention Plans	Prepare and implement Pollution Prevention Plans.
11. Environmental Audits	Conduct periodic voluntary audits.
12. Ministerial Review	Submit a report on the implementation and effectiveness of the Strategic Options Report Recommendations to Ministers by March, 1999.

11.0 SOCIO-ECONOMIC IMPLICATIONS OF RECOMMENDATIONS

11.1 Cost of Recommendations

The cost of the Recommendations advanced in Section 10 are difficult to estimate accurately due to current uncertainties in the details of program design. However, it is feasible to provide preliminary engineering-type estimates based on the analyses which were undertaken and described in Section 8.1. It should be noted that these impacts are at the sector level because there was insufficient information available to undertake an assessment of impacts on a plant-specific basis.

Recommendation	Estimated Incremental Cost to Industry, 1997 to 2005 ($million)	
	Capital Cost	Operating Cost (1)
1. Federal-provincial harmonization	nil	nil
2. Benzene	40	41.2
3. Polycyclic aromatic hydrocarbons	18-22	47-73
4. Air emissions of metals	10	8
5. Water releases of metals	nil	nil
6. Dioxins and furans	nil	1.5-2.5
7. Emissions from sintering plants	5-10	4.3-8.5
8. Mercury	nil	0.3-0.5
9. Contaminated sites	nil	NEA
10. Pollution prevention plans	nil	1-2
11. Environmental audits	nil	3-5
12. Ministerial review	nil	nil
Total Estimated Cost to Industry	73-82	106.1-140.6

NEA: No estimate available

(1) Operating cost does not include depreciation.

11.2 Impact on Employment

As is described in Section 8.3, there is a minor impact on employment, that being a requirement for an estimated 50-75 additional employees to operate and maintain the improved environmental control systems. This is considered insignificant in the context of an industry with a total employment of 33,600 in 1995 (reference Section 4). No impact is anticipated on current operating employment.

11.3 Impact on Competitiveness

The Canadian steel producers are competitive in the world market and are continually upgrading or replacing facilities to maintain their competitiveness. Canada's largest steel trading partner is the United States with whom Canada has a positive trade balance in steel products. The cost impacts of the recommendations will increase production costs by a small amount which will have only a small impact on competitiveness. This will be offset in the United States market by the continual increase in environment-related costs for U. S. steel producers and the minimization of U.S. attempts to restrict trade on the grounds of there not being a level environmental playing field between the U. S. and Canada. Thus, it is concluded that there is no negative overall impact on competitiveness by the Recommendations of the SOR.

11.4 Benefits

The major benefits of the Recommendations will be:

- reduction of releases of toxic substances from the steel sector and associated reduction of exposures and risks of these and associated pollutants by the public and by ecosystems;
- improved environmental quality in the vicinity of steel mills;
- reduction of steel worker occupational exposure to toxics by improved containment, collection and control;
- demonstration of effectiveness of balanced voluntary and regulatory approaches to environmental management;
- harmonization of federal-provincial efforts to effectively manage releases of toxic substances from the steel manufacturing sector;
- clarity and documentation of environmental performance of the sector;
- consistency with international trade requirements;

- consistency and contributions to international environmental initiatives and commitments;

- improved science and technology, and innovation in the sector; and

- development of environmental industry sector jobs in consulting services, equipment supply, and construction.

11.5 Conclusions

The SOR recommendations recognize the effectiveness of the initial voluntary ARET program, and the voluntary commitments made by most of the sector companies. However, the SOR recommendations will strengthen current voluntary programs by ensuring verification and full appropriate participation by all sector companies, and by having complementary regulatory requirements where appropriate. Generally the Environmental Codes of Practice and the targets and schedules are intended to provide a level playing field of environmental standards and foster the concept of continuous improvement in environmental performance by all companies in the steel manufacturing sector in Canada.

It is expected that Canadian mills will eventually surpass current and planned U.S. and European Union standards, by new process technologies replacing existing coke-making facilities, and state-of-the-art pollution control technologies in all mills. It is suggested that the gradualistic and primarily non-regulatory approach recommended in the SOR recommendations may be more cost effective than conventional regulatory approaches for this sector.

Implementation of the SOR recommendations will not of themselves cause socio-economic disruptions in the Canadian Steel Manufacturing Sector or to governments, while continuously improving environmental quality and health protection.

SUBMISSION OF REPORT

These recommendations for the management of toxics from the steel manufacturing sector are respectively presented to Ministers by the Steel Manufacturing Sector Strategic Options Process Issue Table.

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APPENDIX A

Issue Table Participants
Strategic Options Process
Steel Manufacturing Sector

Active Members	Organization
Patrick Finlay (Chair)	Environment Canada
Kin Mah (Coordinator)	Environment Canada
Anita Wong	Environment Canada (Canada-Ontario Agreement)
Arthur Sheffield	Environment Canada
Jennifer Rae	Health Canada
Yousry Hamdy	Ontario Ministry of Environment and Energy
Mark Dunn	Ontario Ministry of Environment and Energy
Jean Lavergne	Ministère de l'Environnement et de la Faune du Québec
John D. Jonasson	Manitoba Environment
Louise Knox	Hamilton Harbour Remedial Action Plan
Tom McGuire	Dofasco Inc.
Brent Steele	Dofasco Inc.
Donald Marr	Atlas Specialty Steels
Marcel Martinelli	Atlas Stainless Steels
Stéphane Gingras	Canadian Environmental Network (Great Lakes United)
David Fife	Industry Canada
G. Raymond Horton	Industry Canada
Jim Skeaff	Natural Resources Canada
Shaheer Mikhail	Natural Resources Canada
Observers	
Robert Schutzman	IPSCO Inc.
Bruce McKee	IPSCO Inc.
William Brown	Slater Steels
Bob Downie	Gerdau Courtice Steel Inc.
Tom Tonner	Gerdau MRM Steel Inc.
Tom Wesolowski	Co-Steel Lasco

Support Consultants

Eric Cowan	Apogee Research International Ltd.
Ken Watson	Apogee Research International Ltd.
Gary Amendola	Amendola Engineering
Bill Lemmon	Charles E. Napier Company Ltd.
Christopher Doiron	C.C. Doiron and Associates

Corresponding Members

Claude Fortin	Environment Canada
Marc Villeneuve	Environment Canada
Joe Kozak	Environment Canada
Raouf Morcos	Environment Canada
Barry Munson	Environment Canada
John Prinsen	Environment Canada
Lorraine Seed	Health Canada
Steven MacDonald	Health Canada
Barbara Sutherland	Natural Resources Canada
Suzanne Fortin	Agriculture Canada
Don Edgecombe	Department of National Defence
F de Leon	Canadian Environmental Law Association
John Oudyk	Canadian Public Health Association
Kathleen Carrière	Min. de l'Env. et de la Faune
Darryl Grover	Government of Newfoundland and Labrador
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Jerry Lahaye	Ontario Ministry of Environment and Energy
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Jean Van Loon	Canadian Steel Producers Association
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Andrew Broadhead	QIT - Fer et Titane Inc.
Luc Chabot	Stelco McMaster Ltée
Fraser L. Craig	Algoma Steel Inc.
Gerry Freiman	Algoma Steel Inc.
Joel Hartley	Ivaco Rolling Mills Limited Partnership
Joel MacLean	Sydney Steel Corporation
Geoff Saldanha	Stelco Inc., Lake Erie works
Robert Santerre	Sidbec-Dosco (Ispat) Inc.

Supporting Members

Michel Lalonde	Alcan Smelters and Chemicals Ltd
John Ayres	Environment Canada
David Campbell	Environment Canada
Marc Deslauriers	Environment Canada
John Clarke	Environment Canada
Anthony Kosteltz	Environment Canada

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APPENDIX B GLOSSARY OF TERMS

Acid Neutralization: Chemical treatment of water to eliminate acidity and remove iron compounds from solution.

Baghouse: An air pollution control device used to trap particulates by filtering gas streams through large fabric bags, usually made of glass fibres.

Blowdown: Refers to the controlled discharge of spent waters to limit the build-up of dissolved solids and other pollutants.

Carbon steel: A kind of steel with various percentages of carbon and little or no other alloying elements; also known as straight carbon steel, or plain carbon steel.

Clarifier Thickener: A settling tank which is used to remove settleable solids by plain gravity or colloidal solids by coagulation following chemical flocculation; will also remove floating oil and scum through skimming.

Clinker-type Aggregate: A mixture of iron-bearing materials, limestone and coke breeze ignited and fused into a porous strong material product (sinter) suitable for charging to the blast furnace.

CO: Carbon monoxide is a normal product of incomplete fossil fuel combustion. CO is itself a fuel, as it can be oxidized to form CO_2.

CO_2: Carbon dioxide is a product of fossil fuel combustion. Globally, it is the dominant greenhouse gas.

Coal Charging: The process by which coal is added to the coke ovens by a mobile machine called a larry car, which travel on rails along the top of the coke battery and changes the ovens through ports in the top.

Coke Breeze: Fines from coke screenings.

Coke Batteries: Coke ovens which are rectangular chambers arranged in batteries containing up to 100 ovens in each battery.

Coking: Coking is the heating of coal in a coke oven in the absence of air to high temperatures between 1000^0 C to 1100^0 C for a period of 16 to 20 hours. The volatiles are driven off during this coking cycle.

Cooling Tower: A device which reduce temperature of water by contacting it with air.

Dolomite: A mineral ($CaMg(CO_3)_2$) consisting of a calcium magnesium carbonate found in crystals and in extensive beds as a compact limestone.

Dry Dust Catcher: A device to remove solid particles from a gas stream.

Electrostatic Precipitator: An air pollution control device that removes particulate matter by imparting an electrical charge to particles in a gas stream for mechanical collection on an electrode.

Effluent: A release of pollutants into waters.

Emission: A release of pollutants into the air.

Emission factor: The average amount of a pollutant emitted from each type of polluting source in relation to a specific amount of material processed.

Fabric filters: A device for removing dust and particulate matter from industrial emissions much like a home vacuum cleaner bag. The most common use of fabric filters is the baghouse.

Flocculation: In wastewater treatment, the process of separating suspended solids by chemical creation of clumps or flocs.

Fluorspar: Fluorspar is the commercial term for fluorite, a calcium fluoride mineral (CaF_2) which is used as a flux material in the blast furnace, electric arc and basic oxygen furnace operations, to achieve the desired slag fluidity.

Fugitive Emissions: These emissions are usually resulting from process leakages and spills of short duration, which are associated with storage, material handling, charging and other secondary process operations. Fugitive emissions are usually uncontrolled.

Galvanizing: The process of applying a coating of zinc to the finished cold rolled steel; the coating is applied by dipping in molten zinc (hot dip) or by the electrolytic method.

Hexavalent Chromium(Cr^{+6}): Chromium, in its hexavalent state, is a known human carcinogen.

ISO 14000: The International Organization for Standardization (ISO) is an international federation of over 100 national standards bodies which, since 1993, has been developing a series of integrated environmental management systems (EMS) standards, known as the ISO 14000 Series.

Life-Cycle Management: An integrated approach to minimizing the environmental impacts associated with a product or service through all stages of the life-cycle.

Multiple-Cyclone Separator: A multiple-cyclone separator is an air pollution control device which separates the particulate matter from the gas by spinning the particulates in a vortex fashion. It consists of a number of small-diameter cyclones operating in parallel, having a common gas inlet and outlet. The gas enters the collecting tube and has a swirling action imparted to it by a stationary vane.

NO_x: Nitrogen oxides, formed during high temperature reactions with air, consist of nitrous oxide (NO) and nitrogen dioxide (NO_2) and reported as nitrogen oxides (NO_x).

Open Combustion: A type of basic oxygen process furnace, in which sufficient air is drawn in to the furnace to fully convert carbon to carbon dioxide. The open combustion system off-gases are cleaned either by wet scrubbing (wet-open combustion) or by dry electrostatic precipitation (dry-open combustion).

Particulates: Particulates are any finely divided solid or liquid particles in the air or in an emission. Particulates include dust, smoke, fumes and mist, etc.

Pig Iron: The term pig iron is generally applied to the metallic product of the blast furnace when it contains over 90% iron.

Scale: An iron oxide that forms on the surface of the hot steel.

Scale Pit: A settling basin for removing solid materials from water used on rolling mills. These solids are mostly mill scale, the flakes and particles of iron oxide that form on steel during heating. The solids sink to the bottom of the basin, from which they can be dredged for recycling. Oil rising to the surface of the basin can be skimmed off and reprocessed.

Scrubber: An air pollution control device that uses a liquid spray to remove pollutants from a gas stream by absorption or chemical reaction. Scrubbers also reduce the temperature of the gas stream.

Sedimentation: In wastewater treatment, the settling out of solids by gravity.

Shaft Furnace: A refractory lined vertical cylinder where iron pellets are fed into the top of the shaft furnace through a large numbers of distributor pipes which reduce the possibility of size separation and gas channelling.

SO_2: Sulphur dioxide is formed primarily by the combustion of sulphur-containing fuels.

Solid Waste: Materials that remain as a result of industrial processes or other human activities. Much of the solid waste generated in the steel industry is being recycled.

Suppressed Combustion: A type of basic oxygen process furnace, in which oxygen supply to the furnace is limited to convert carbon to carbon monoxide. The suppressed combustion system off-gases are normally cleaned by wet scrubbing.

Sustainable Development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Tempering: A special rolling procedure that adds hardness to the steel: usually applied after annealing.

Vacuum Degassing: Vacuum degassing is used as a refining operation to reduce the hydrogen content in the molten steel for rolling operations in order to prevent the formation of flakes or internal cracks.

Venturi Scrubber: An air pollution control device in which the liquid injected at the throat of a venturi is used to scrub particulate matter from the gas flowing through the venturi.

US EPA: Environmental Protection Agency in the United States which is the U.S. equivalent to Environment Canada.

VOC: Volatile Organic Compounds are also known as Reactive Organic Gases (ROG) or Non-Methane Volatile Organic Compounds (N-MVOC). Volatile Organic Compounds refer only to photochemically reactive hydrocarbons and therefore exclude compounds such as methane, ethane and several chlorinated organics.

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APPENDIX C

PUBLIC COMMENTS ON ISSUE TABLE DRAFT STRATEGIC OPTIONS REPORT

Summary of Comments on Steel Manufacturing Sector Strategic Options Report, Draft December 30, 1996:

1. Don Marr (Atlas Specialty Steels, January 30, 1997)

- Table 6-1 of the Steel Manufacturing Sector Strategic Options Report (SOR) should be updated, as the numbers for Cr, Ni and Pb are overstated.

2. Robert Santerre (Sidbec-Dosco, February 18, 1997)

- Information regarding Sidbec-Dosco emission testing in 1995 (Section 8.1.4.1) should be reflected in Table 10-3 (Section 10.4).
- The non-integrated mills column and the Sidbec-Dosco column in Tables 8-3.3 to 8-3.5 should be combined.

3. Fraser Craig (Algoma Steel Inc., March 21, 1997)

- Algoma agrees with the thrust of the SOR's recommendations and recognizes the ongoing need to reduce contaminants wherever possible.
- Algoma is already taking steps to eliminate many of the 16 *CEPA*-toxic substances from their releases.
- Algoma has maintained an aggressive and effective program to reduce coke oven battery door leaks to reduce emissions of polyaromatic hydrocarbons (PAHs).
- Algoma has reduced 1993 benzene releases by 47% through pollution prevention techniques.
- Algoma has made substantial voluntary commitments to the ARET Program for both benzene and PAH reduction.
- Engineering is currently underway to control metals fugitive emissions from the Company's #2 Steel-making Shop and a Task Force has been set up to refine pollution prevention methods at #7 Blast Furnace.
- Algoma intends to carry out a mercury material balance during 1997.
- Algoma has carried out regular environmental audits using an independent outside auditor. The next audit is planned for 1997 or early 1998.

- Algoma's sintering operation at Wawa is in compliance with current Ontario Environmental Protection Act point of impingement objectives. Algoma agreed with the Ontario Ministry of Environment and Energy to carry out ambient sampling, primarily for mercury and arsenic, to determine ambient levels adjacent to the plant.
- Algoma's ability to fund capital environmental projects at this operation is constrained by the nature of the iron ore business. Wawa is a small scale underground mining operation.

4. *David Gates (Nova Scotia Department of Environment, February 5, 1997)*

- Nova Scotia would like to have an opportunity to comment on the CCME Codes of Practice for air and water releases of metals (Recommendations 4 and 5) before they are finalized.
- Recommendation 5 for water releases of metals should make allowances for marine and tidally flushed receiving waters.

5. *Stefania Trombetti (Environment Canada, February 25, 1997)*

- First paragraph of Section 10.1 should be replaced with the text provided by her.

6. *David Campbell (Environment Canada, March 11, 1997)*

- Annual stack testing is now the norm in the incineration field and incinerators which are considerably smaller than steel mills are tested for many compounds.
- It is important getting large sources such as steel mills to do testings for particulates, PCBs, Dioxin, Furans, HCB, PAHs and at least Hg, Cd and Pb.

7. *Jean Van Loon (Canadian Steel Producers Association, March 6, 1997)*

- The steel sector supports the need for responsible action in the management of releases of toxic substances.
- Many CSPA members did not participate in the SOP because of fundamental disagreement with the federal government's approach to the management of toxic substances.

- CSPA and its members are already addressing a number of the issues identified in the SOP.
- CSPA and its members have established a working group to develop a comprehensive implementation plan which will demonstrate their commitment to protecting the environment through responsible voluntary action.

Summary of Comments on Steel Manufacturing Sector Strategic Options Process from a Public Meeting held in Burlington, Ontario on January 30, 1997:

1. Louise Knox (Hamilton Harbour Remedial Action Plan (RAP), January 31 and March 18, 1997)

General comments:

- The community does not consider itself to be adequately protected from harmful emissions from the iron and steel sector.
- A Stelco representative acknowledged the need for "continuous improvement". He stated that Stelco is already on a track that leads to continuous improvement and feels that regulations would be redundant.
- The recommendations in the Strategic Options Report may not be effective.
- Skepticism was expressed about federal government's ability to measure progress, especially with the lack of emission data.
- It was strongly recommended that the federal government should use measurement of ambient concentrations of contaminants as the benchmark for progress.
- Environment Canada should consider control of particulates for integrated mills.
- As there will be more information on mercury, dioxins and furans, on solid waste and so on, a mechanism for reporting to the community on follow-up on these issues was suggested.

Summary of Public comments:

- The releases to water on page xiii of the SOR are shown in values "greater than x**"** should be explained. (Note: a greater than value indicates that not all steel mills reported releases).
- Concern was expressed that the voluntary approach will not work. The Hamilton Beach Residents' Association wants stringent regulations especially for companies that are in their back yards.

- Some were very disappointed that particulates are not addressed. Health Canada has a study that shows the health effects of respirable and inhalable particulates.
- The need for a formal assessment of particulates makes the *CEPA* an impediment to action rather than a help.
- Substances of local concern should be assessed to determine which ones post the highest risk, and then controlled in order of priority.
- It would be impossible to evaluate effectiveness of the SOR recommendations by 1999 because compliance with voluntary reduction targets seem to be ineffective. The lack of accurate release data also make it impossible to evaluate the effectiveness of compliance.

2. D. Lobo (City of Hamilton, March 20, 1997)

- Most of the comments were similar to those submitted by Louise Knox.

3. Debi Lambert (Hamilton resident, March 7, 1997)

- The SOR is another form of “self regulation” benefiting industry.
- She expressed skepticism about the voluntary process as Stelco did not participate in the SOP.
- What is needed is a strict enforcement by an outside party in view of Ontario’s plan to soften environmental regulations.
- Hamilton is an industrialized city facing serious environmental problems as well as escalating costs to human health. Strong leadership is needed to clean up the city. It is not acceptable to wait until 2015 to cleanup the city.
- She suggested that more support be given to local Ministry of Environment and Enenrgy to enable them to continue with air monitoring and hopefully stricter enforcement.

4. Brian McCarry (McMaster University, Hamilton, Febuary 21, 1997)

- The report of the Hamilton Air Quality Initiative will hopefully be released in June 1997.
- The Hamilton Air Quality Initiative study suggested that the steel industry has been a major contributor to the releases of air toxics into Hamilton air.

- If the recommendations for benzene and PAH emission reductions are implemented by the two major mills, the quality of Hamilton air will improve proportionally.
- It may be worthwhile to make a clear statement in the SOR about the overall expected impacts of the planned reductions on airsheds that are impacted by steel mills (Hamilton, Sault Ste. Marie), in terms of public health impacts to get the attention of the Ministers and other politicians.
- The SOR cost estimates for PAH and benzene reductions seem very low. However, the cost figures are well within the reach of the integrated mills, especially given the good years the local industries have had recently.
- The government should designate PM10 particulates as a *CEPA* toxic substance.

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