

Canadian Council of Ministers of the Environment

CANADA-WIDE STANDARD

for

DIOXINS AND FURANS:

Steel Manufacturing Electric Arc Furnaces

Canada-wide Standard for Dioxins and Furans Steel Manufacturing Electric Arc Furnaces

PREAMBLE

Dioxins and Furans

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), commonly known as dioxins and furans, are toxic, persistent, bioaccumulative, and result predominantly from human activity. Due to their extraordinary environmental persistence and capacity to accumulate in biological tissues, dioxins and furans are slated for virtual elimination under the *Canadian Environmental Protection Act (CEPA)*, the federal *Toxic Substances Management Policy (TSMP)* and the Canadian Council of Ministers of the Environment's (CCME) *Policy for the Management of Toxic Substances (PMTS)*.

The presence of dioxins and furans in the Canadian environment can be attributed to three principal sources: point source discharges (to water, air and soil), contamination from *in situ* dioxins and furans, and loadings from long-range transboundary air pollution (LRTAP).

Canada has signed and ratified (December, 1998) the United Nations Economic Commission for Europe's (UNECE) Protocol on Persistent Organic Pollutants under the Convention on Long-Range Transboundary Air Pollution. This international Protocol has as its objective, "to control, reduce or eliminate discharges, emissions and losses of persistent organic pollutants (POPs)." As well as obligations for other specified POPs, it specifically obliges Parties "to reduce their emissions of dioxins, furans, polycyclic aromatic hydrocarbons (PAHs) and hexachlorobenzene (HCB) below their levels in 1990 (or an alternative year between 1985 and 1995)." The Iron and Steel sectors are included in this Protocol as "Major Stationary Sources" of these contaminants.

Dioxin and furan contamination found in soil, water, sediments, and tissues (*in situ* contamination), is the subject of national guidelines for dioxins and furans. These guidelines outline ambient or "alert levels" which may be used by jurisdictions as benchmarks for the management and monitoring of dioxins and furans already present in the environment.

Point source discharges to water have been the target of aggressive federal and provincial regulation, as well as industry innovation and change. Discharges of dioxins & furans to the aquatic environment reached non-measurable levels in 1995.

Development of the Canada-wide Standard

The Canada-wide Standards process has focussed on anthropogenic sources that are releasing dioxins and furans to the atmosphere and soil in a continuous process.

In January 1999, the Federal/Provincial Task Force on Dioxins and Furans released the first *Dioxins and Furans and Hexachlorobenzene Inventory of Releases*, followed by a draft Update issued by Environment Canada in October 2000 and a revised Update published in February 2001. The latest Update documented the current understanding of anthropogenic sources in Canada releasing dioxins and furans. The *Inventory of Releases* and the Updates list emissions from over 20 sectors by province and territory, and provides national summaries for each sector.

Initial efforts have focused on atmospheric releases, the most complete component of the Inventory. Six priority sectors, varying from regional to national in scope, accounting for about 80% of national emissions in the 1999 inventory have been identified as priorities for early action. These are waste incineration (municipal solid waste, hazardous waste, sewage sludge and medical waste); burning salt laden wood in coastal pulp and paper boilers in British Columbia; residential wood combustion; iron sintering; electric arc furnace steel manufacturing; and conical municipal waste combustion in Newfoundland.

CCME has taken a CWS approach for priority sectors such as coastal pulp and paper boilers, waste incineration (municipal solid waste, biomedical waste, hazardous waste, sewage sludge incineration, conical waste combustion), iron sintering and steel-making electric arc furnaces. Reductions from additional source sectors, many of which contribute very small amounts of dioxins and furans emissions, will continue to be pursued, through a variety of mechanisms including co-benefits resulting from other processes, action by individual jurisdictions, and public education.

Development of CWSs for dioxins and furans has taken into consideration environmental benefits, available technologies, socio-economic impacts, opportunities for pollution prevention and collateral benefits from reductions in other pollutants.

In recognition of the ultimate goal of virtual elimination, pollution prevention is being encouraged as the preferred method for avoiding the creation of dioxins or reducing releases to the environment.

Wherever possible, work on the dioxins and furans CWSs has been coordinated with other ongoing processes (e.g. Mercury CWS and the Strategic Options Process). A multi-pollutant approach will be carried forward to the remaining sectors while ensuring that dioxins and furans issues are addressed and that the ultimate goal of virtual elimination is kept clearly in mind. Opportunities for a multi-pollutant approach will also be pursued as part of the implementation of the Dioxins and Furans Canada-wide Standard.

During development of the inventory, it was realized that the data on dioxins and furans is limited. The information in the dioxins and furans inventory will be refined and updated on a regular basis through a variety of sources including the National Pollutants Release Inventory (NPRI) as a means of tracking progress and as a means of identifying any future sources of releases that must be addressed.

Part I:

Steel Manufacturing Electric Arc Furnaces

Rationale for Standard

Electric arc furnace (EAF) steel manufacturing is an important recycling activity which contributes to the recovery of steel resources and waste minimization. However, the nature of the process is such that it also results in the formation of dioxins and furans and their subsequent release to the environment.

EAF steel manufacturing results in an estimated annual release of approximately 11 g ITEQ/year of dioxins and furans to the atmosphere. This currently represents approximately seven percent of the national total documented in the updated inventory of releases.¹

EAF steel manufacturing is a batch process which can result in fluctuating emissions during heating of the charge and from heat to heat. Gas handling systems for steel manufacturing EAFs vary from facility to facility, both in configuration and design. These factors contribute to a varying concentration in process off-gases from steel manufacturing EAFs. Based on currently available emission test data, process off-gas concentrations of dioxins and furans from Canadian steel manufacturing EAFs range from approximately 44 to 254 pg ITEQ/Nm³.²

Recognizing that action was required to reduce these emissions to help achieve the goal of virtual elimination, the Canadian Council of Ministers of Environment (CCME) directed that Canada-wide Standards (CWS) be developed for Dioxins and Furans from Steel Manufacturing Electric Arc Furnaces. The development of these standards took into account: the application of best available techniques for preventing, capturing or controlling emissions of dioxins and furans; existing stringent requirements in some jurisdictions and sectors; the views of stakeholders; and, preliminary socio-economic considerations undertaken to date.

A comprehensive report was developed on dioxin/furan formation mechanisms, emissions, emission control technology and associated costs, and emission standards pertinent to steel production processes.³ This report concludes, among other things, that best available control technology is capable of limiting atmospheric releases of dioxins and furans from steel manufacturing EAFs to less than 100 pg ITEQ/Nm³. However, it was recognized that time will be required to evaluate and implement the most cost-effective prevention and control techniques for Canadian steel manufacturing EAF facilities.

Numerical limits, with timelines for implementation, are presented in this CWS. This will allow a standard to be established for the interim period prior to a planned review of the standard in 2003. This review, which is to be complete by December 31, 2003, will incorporate advancements in scientific, technical and economic information and analysis.

¹ Environment Canada, *Inventory of Releases: Updated Edition*, Prepared by Environment Canada. February 2001.

² Ibid.

³ Charles E. Napier Co. Ltd. for Environment Canada, *Background Technical Discussion Paper on the Release and Control of Dioxins/Furans from the Steel Sector*, Draft September 27, 2000.

The requirement to develop a Pollution Prevention Strategy for the EAF steel sector is included and this considers the management of other pollutants. A process to review the standard is also included.

These actions represent significant steps towards the goal of virtual elimination, as expressed by attaining concentrations less than the Level of Quantification (LOQ) of 32 pg ITEQ/Nm³.

Definitions

Steel manufacturing EAF means an EAF that is used to produce molten steel for further processing into rolled steel products.

Modified EAF means the complete replacement of an existing EAF or EAF gas conditioning system, or an increase in the hourly steel production rate of 25 percent or more through physical modifications of the EAF facility.

New EAF means an EAF that is constructed after the date of Ministerial endorsement of this standard.

Nature and Application

Emission limits are expressed as a concentration in the total exhaust gas exiting the EAF air-pollution control system(s).

New or modified steel manufacturing EAFs will be expected to comply immediately with the standard.

The emission limits, and testing and reporting requirements for existing steel manufacturing EAFs are to be met by the end of the calendar year specified.

All facilities will be subject to annual emissions testing, as detailed in the *Dioxins and Furans Emission Testing and Reporting* section, to verify compliance with the limits and to increase the knowledge of these emissions in the sector.

Numerical Limits and Timelines for Achieving the Limits

The following numerical limits and timelines for achievement represent significant steps toward achieving virtual elimination of dioxins and furans.

New and Modified Furnaces:

Dioxin and furans emissions shall be less than 100 pg ITEQ/Rm³ ⁽⁴⁾ from any new or modified steel manufacturing EAF.

Existing Furnaces:

Phase 1: Dioxin and furans emissions shall be less than 150 pg ITEQ/Rm³ at all existing steel manufacturing EAFs by 2006.

Phase 2: Dioxins and furans emissions shall be less than 100 pg ITEQ/Rm³ at all existing steel manufacturing EAFs by 2010.

Anticipated Environmental Benefits

Presently available information indicates that a reduction of over 60 percent in dioxins and furans releases from existing steel manufacturing EAFs will be achieved by 2010 with the implementation of the numerical targets and timelines listed above. This will equate to a reduction in total annual releases from the current estimated 11 grams ITEQ to 4 grams ITEQ from steel manufacturing EAFs.

Dioxins and Furans Emissions Testing and Reporting

All steel manufacturing facilities using electric arc furnaces for the production of steel shall test EAF process off-gases for dioxins and furans and report the results no later than 2002.

Every steel manufacturing EAF will be tested annually commencing in 2002 to enable tracking and reporting of progress in reducing emissions. Reporting will include both:

- the concentration of dioxins and furans from atmospheric releases; and
- the total annual loading of dioxins and furans releases to air, expressed in grams ITEQ .

All testing and reporting will be conducted in accordance with the following reference methods and quality assurance requirements unless equivalent methodologies are approved by responsible jurisdictions.

- *Standard Reference Methods for Source Testing: Measurement of Releases of Selected Semi-volatile Organic Compounds from Stationary Sources*, Department of the Environment Report EPS 1/RM/2 1989; and
- *Internal Quality Assurance Requirements for the Analysis of Dioxins in Environmental Samples*, Department of the Environment Report EPS 1/RM/23 1992.

⁴ The reference conditions for Rm³ are defined as volumes at 25⁰C (298.15⁰K), 101.3 kPa, dry gas basis and operating O₂ levels.

Pollution Prevention Strategy

In keeping with the Precautionary Principle as set out as guidance in the Canada-wide Standards sub-agreement, and in consideration of the CWS principles of sound science, technical feasibility and socio-economic impacts, efforts are to continue by steel manufacturing EAF operators to prevent, destroy or capture emissions of dioxins and furans. Emphasis should be placed on identifying and implementing opportunities to prevent the creation of dioxins and furans, and emissions of other pollutants generally. As an initial action with shared responsibility by all jurisdictions, strategies identifying opportunities to minimize emissions of air pollutants from the steel manufacturing EAF sector will be developed through a multi-stakeholder process by October 31, 2003.

The objective should be to provide a framework for continual progress toward the goal of virtual elimination of dioxins and furans and to take into account the Multi-pollutant Emissions Reduction Strategy specified by CCME Ministers.

Recognizing that opportunities and benefits for minimizing air pollutant emissions, and specifically avoiding the creation of dioxins and furans, fall beyond the exclusive influence of the operators of steel manufacturing EAFs, the preparation of this Strategy should and will engage a wide range of stakeholders and experts, recognizing and complimenting ongoing consultative processes on various issues.

Factors to be considered in developing the Strategy should include:

- Opportunities for improved control and release reductions of particulate matter;
- Combustion chemistry of the EAF process;
- The feasibility of applying existing and emerging pollution prevention and control techniques (e.g., catalytic oxidation, containment of fugitive emissions, best management practices for operations and maintenance, etc.);
- Reduction of mercury sources and emissions through the Mercury CWS development process;
- Cross-media transfers and management of pollutants;
- Emissions of greenhouse gases;
- Resource utilization; and
- Energy efficiency.

Review of the Standard

The standard for existing steel manufacturing EAFs is set pending the acquisition of further test data for EAF operations using various pollution prevention and control techniques. Recognizing the ultimate objective of virtual elimination as set out in the *Canadian Environmental Protection Act* and the CCME's Policy for the Management of Toxic Substances, steel manufacturing EAF operators are encouraged to voluntarily pursue further reductions in emissions. In doing so, the operators should conduct additional studies to identify the reasons for higher dioxin and furan emissions at some locations, and implement measures to achieve virtual elimination at all locations when practicable. Measures to be explored include feed and process modifications to prevent or reduce dioxin and furan formation, as well as emission control upgrades.

Recognizing that uncertainties and gaps exist, new data and information about the formation, prevention and destruction of dioxins and furans in the EAF sector will be assessed. This standard will be thoroughly reviewed in 2003 through a multi-stakeholder process. This review will include:

- an evaluation of the results of additional testing from all EAF facilities in Canada, including the consideration of variance and consistency of test results;
- an assessment of further research into the understanding of the formation and destruction of dioxins and furans in electric arc furnaces;
- consideration of advances in testing methodology, including the advisability of reporting test results in accordance with the World Health Organization's toxic equivalence methodology as well as using the NATO/CCMS I-TEQ method;
- consideration of advances in pollution abatement and prevention techniques, including details of emerging technologies applicable to the sector;
- consideration of cost implications and socio-economic impacts of retrofitting advanced emission prevention and control techniques, including the application, efficacy and reliability under Canadian conditions;
- consideration of any new, emerging or revised regulatory standards and compliance practices in other jurisdictions;
- examination of the benefits of pursuing reductions of dioxins and furans in conjunction with other pollutants, in particular particulate matter; and
- examination of possibilities for further reductions of dioxins and furans to the level of the LoQ.

Summary of the Canada-wide Standard for Dioxins and Furans for Steel Manufacturing Electric Arc Furnaces

The following table summarizes the numerical limits, other provisions and the timelines for their achievement.

Dioxins and Furans Limits	Implementation Schedule
<i>For New and Modified EAFs</i>	
100 pg/Rm3 ITEQ	Effective upon CCME ministerial endorsement
<i>For Existing EAFs</i>	
Testing and reporting	2002
150 pg/Rm3 ITEQ	2006
100 pg/Rm3 ITEQ	2010
Pollution Prevention Strategy Development	2003
Review of the Standard	2003

Notes: Years specified mean by December 31 of that calendar year.
 Rm³ - Volumes at 25⁰C, 101.3 kPa, dry gas basis and operating O₂ levels.
 ITEQ - International Toxic Equivalency Quotient.

PART 2:

Reporting on Progress:

Ministers will receive reports on progress in achieving the CWS by jurisdictions in Spring 2004 and Spring 2008. Ministers will ensure that a single public report is prepared and posted on the CCME web site for public access. The report in 2004 will reflect interim progress on achieving the CWSs. The 2008 report will evaluate whether targets have been met and the effectiveness of the determined efforts with respect to smaller facilities. More details on reporting on progress are included in Annex 1.

Each jurisdiction will detail the means of ensuring achievement of the CWS in a manner consistent with the typical or desired programs for the affected facility/sector, so as not to impose an unnecessary level of reporting duplication.

With a view to continuous improvement towards the goal of virtual elimination, an evaluation of the Dioxin and Furan Canada-wide Standards will be presented to Ministers in Spring 2006. The evaluation will consider new scientific, technical and economic information and provide an assessment of the need to develop the next set of CWS targets and timelines to continue progress toward virtual elimination.

ADMINISTRATION:

Jurisdictions will review and renew Part 2 and Annex 1 five years from coming into effect.

Any party may withdraw from this Canada-Wide Standard upon three month's notice.

This Canada-Wide Standard comes into effect for each jurisdiction on the date of signature by the jurisdiction.

Annex 1

Dioxins and Furans CWS Reporting Framework

Introduction

Under the Harmonization Accord and its Canada-wide Environmental Standards Sub-Agreement, all jurisdictions are to report to the public and to Ministers on their progress towards achieving the CWSs for dioxins and furans.

This reporting framework is intended to provide a transparent and consistent mechanism for reporting by jurisdictions in a fashion which minimizes resource requirements for government and industry alike, while maximizing the availability of information on achievement of these standards.

The framework addresses:

- 1) frequency, timing and scope of reporting
- 2) guidance as to the means of determining compliance/achievement of the CWS
- 3) common measurement parameters for reporting purposes
- 4) data management and public reporting

Frequency, timing and scope of reporting

The reporting schedule will be tied into assessing the performance of the governments in meeting the benchmarks and timelines relevant to the standards. A report in 2004 will provide a means for tracking interim progress and reporting on additional studies (e.g. pollution prevention strategy, 2003 review). The 2008 report will indicate compliance with the CWS.

Jurisdictions will submit sectoral data for inclusion in the progress reports in a timely manner. To report on achievement of the CWS, a data report along with an assessment of progress will be compiled into a single report for Ministers and a public version will be posted on the CCME web site for public access.

Reports will be limited to information on those facilities which are subject to achievement and/or compliance with the Canada-wide Standard as endorsed by the Ministers of the Environment and as implemented variously by the responsible jurisdictions or industries. This information is intended to show compliance rates and performance characteristics in a manner which documents sectoral performance as well as jurisdictional performance. It is not intended to provide a facility-by-facility record of performance.

Means of determining compliance/achievement of the CWS

The Canada-wide Standards for dioxins and furans lend themselves to achievement through voluntary action, or through compliance with regulated or legally enforceable limits. As such, it is necessary to provide some means to ensure that a level playing field exists so that the numeric value provided in the CWS is applied equally or similarly in each jurisdiction. One means to do this is to require identical compliance procedures, but this may require that some jurisdictions apply compliance procedures for dioxins and furans CWSs that are different than those used for locally determined or regulated parameters such as SO₂, PM, ammonia, etc. An example is where the dioxins and furans CWS is expressed as the average of 3 stack tests, whereas a jurisdiction may normally utilize the median value of 3 tests to determine compliance.

In an effort to streamline implementation, each jurisdiction will determine the exact means of ensuring compliance/achievement in a manner consistent with the typical or desired programs for the affected facility/sector. It is anticipated that minor variations in jurisdictional requirements will result in minimal variation across the country which is insignificant with respect to the overall reduction activities which range from 50-99% for various facilities.

Common measurement parameters for reporting purposes

Each facility report will include specific measures corrected so as to be compatible and consistent for the purposes of public reporting. Dioxin and furan emissions must be corrected for the O₂ content of gases, to ensure compliance with the standards, except where noted otherwise.

While little confusion is likely to exist over the implementation of dioxins and furans CWSs for “greenfield” facilities, it is possible that significantly expanded or modified facilities can/should be considered as new for the purposes of achievement/compliance with the dioxins and furans CWS. It will be the responsibility of the jurisdictions to determine at which point a facility no longer qualifies as an “existing” facility and must conform to the standard for “new or expanded” facilities as a result of significant modifications/alterations to the facility operations or physical plant.

Jurisdictions must report measurements that are below the detection limit in a consistent manner. These measurements should be reported as the limit of detection.

Facilities will generally be required to perform stack tests at an annual frequency in order to demonstrate compliance. However, jurisdictions may vary the stack testing requirements for these facilities in cases where performance has been consistently demonstrated to be below the Level of Quantification (LoQ) as defined by Environment Canada. Where five years’ data has been accumulated with all results reported below the LoQ, the stack testing frequency may be revised to a biennial schedule so long as all subsequent test results remain below the LoQ. For the purpose of reporting emissions, the most recent stack test results available should be used. Jurisdictions have the responsibility of deciding whether to implement this variance for all, some or none of the source types subject to these standards.

Data management and public reporting

Reports on achieving the CWS will include a data report and a report on achievement of the standard. Sectoral and jurisdictional specific data will be supplied in a spreadsheet format to facilitate reporting. A consolidated report will be made available to all jurisdictions and to the Ministers, along with the draft public report, prior to formal release of the public report. The public report will be released upon approval by the Council of Ministers.

Jurisdictions will provide a report in spreadsheet format so that the data report and report on achievement can be prepared along with the public report for review and approval. Reports will be prepared and distributed to all jurisdictions prior to review by Ministers. Along with the report on achievement, a draft public report will be provided for review and consideration prior to the Ministers' meeting at which public release is anticipated. That public report will be posted to the CCME web site upon approval by the Ministers. Jurisdictions are encouraged to provide reference to the CCME web site and/or pointers in their own web sites in order to ensure a single location for dioxins and furans CWSs reporting should errors/miscalculations have to be corrected at some time.

In addition to the consolidated public reporting on dioxins and furans CWSs, jurisdictions must provide a contact for facility-specific information in the advent that the public wishes to access compliance or achievement information. Such data will be supplied in a manner consistent with the normal data-reporting/compliance reporting procedures of the jurisdiction in question - the consolidated spreadsheet will not be made publicly available in that it may include proprietary (business) information.

**Canada-wide Standard for Dioxins and Furans:
Steel Manufacturing Electric Arc Furnaces**

Signed by:

British Columbia	Honourable Joyce Murray
Alberta	Honourable Lorne Taylor
Saskatchewan	Honourable Buckley Belanger
Manitoba	Honourable Steve Ashton
Ontario	Honourable Chris Stockwell
Environment Canada	Honourable David Anderson
New Brunswick	Honourable Brenda Fowlie
Nova Scotia	Honourable Ronald Russell
Prince Edward Island	Honourable Chester Gillan
Newfoundland and Labrador	Honourable Kevin Aylward Honourable Tom Lush
Yukon	Honourable Jim Kenyon
Northwest Territories	Honourable Jim Antoine
Nunavut	Honourable Olayuk Akesuk

Note: Québec has not endorsed the Canada-wide Accord on Environmental Harmonization or the Canada-wide Environmental Standards Sub-agreement.