FINAL REPORT

ENVIRONMENT CANADA

ORIGINAL

Development of Technical Recommendations on Monitoring Provisions Suitable for a Mercury Emission Control Regulation for the Canadian Electric Power Generation Sector

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SNC·LAVALIN

DEVELOPMENT OF TECHNICAL RECOMMENDATIONS ON MONITORING PROVISIONS SUITABLE FOR A MERCURY EMISSION CONTROL REGULATION FOR THE CANADIAN ELECTRIC POWER GENERATION SECTOR

Final report

ENVIRONMENT CANADA
Gatineau, Quebec

O/Ref.: 606590
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GLOSSARY OF TERMS AND ACRONYMS

ACI	Activated carbon injection
APC	Air pollution control
APEC	Asia-Pacific Economic Cooperation
ASTM	American Society for Testing and Materials
BAT	Best available technologies
CAIR	Clean Air Interstate Rule
CAMR	Clean Air Mercury Rule
CCME	Canadian Council of Ministers of the Environment
CEA	Canadian Electricity Association
CEMS	Continuous emission monitoring system
CFR	Code of Federal Regulation
CS-ESP	Cold-side electrostatic precipitator
CVAAS	Cold-vapour atomic absorption spectrometry
CVAFS	Cold-vapour atomic fluorescence spectrometry
CWS	Canada-Wide Standard
DST	Dry sorbent trap
EGU	Electric generation utility
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ESP	Electrostatic precipitator
FF	Fabric filter
FGD	Flue gas desulphurisation
Hg^0	Elemental mercury
Hg^{2+}	Mercuric species
HHV	High heating value
HS-ESP	Hot-side electrostatic precipitator
LAC	Levelized annual cost
LIFAC	Limestone injection in the furnace and activation of calcium oxide
LME	Low mass emitters
LNB	Low-NO_x burner
MACT	Maximum achievable control technology
NACAA	National Association of Clean Air Agencies

NIST	National Institute of Standards and Technology
NO_X	Nitrogen oxides
NPRI	National Pollutant Release Inventory
OFA	Overfire air
OHM	Ontario Hydro method
PM	Particulate matter
QA	Quality assurance
QC	Quality control
RATA	Relative accuracy test audit
SCR	Selective catalytic reduction
SNCR	Selective non catalytic reduction
SO_X	Sulphur oxides
UDCP	Uniform Data Collection Program
UNECE	United Nations Economic Commission for Europe

1. INTRODUCTION

1.1 Background

Most impacts of mercury on human health originate from anthropogenic processes. The hazard comes largely from the airborne emissions which are known to disperse widely across the land before depositing onto the ground. Some mercury hot spots in the United States Northeast and Canada were even identified. When in water, a small fraction of mercuric species (Hg^{+2}) transforms to methyl mercury known to bio-accumulate in fishes. Unfortunately, it becomes an important health hazard for humans living around the hot spots since methyl mercury is a known mutagen and carcinogen.

Based on current data, coal-fired electric power producers are expected to remain the largest industrial emitters of mercury in Canada, even when accounting for the anticipated reductions of the Canada-Wide Standards (CWS) for the sector. In 2003, Canadian facilities have released about 2,700 kilograms of airborne mercury which is equivalent to over 70% of mercury contained in burned coal. Further reduction of this figure would certainly benefit those at risk from mercury exposure. Accordingly, the Canadian Council of Ministers of the Environment (CCME) has committed itself in 2006 to reduce mercury emissions by as much as 60% based on levels measured in 2003. Starting in 2010, the mercury emissions from Canadian electric power facilities are restricted at 1,130 kilograms nationwide (70% capture of mercury in coal). Then, after reviewing progress reports, a second phase of the CWS may explore the capture of 80% of mercury from coal for 2018 and beyond. Assessment of these reductions requires consistent monitoring and reporting by jurisdictions as required by the Monitoring Protocol supporting the corresponding CWS. This report re-examines this issue exploring more in detail the level of performance and economics of existing mercury monitoring procedures.

1.2 Project scope and objectives

This project is intended to give Environment Canada a better understanding of available methods for quantifying mercury emissions and the technical and economic implications they would have on the Canadian electricity sector. This study will also develop quantitative and qualitative technical recommendations concerning a mercury air-emissions monitoring regime suitable for the enforcement of a regulation which delivers credible emissions reductions.

To achieve these objectives, the following tasks will be performed:

1. Review currently available mercury monitoring techniques for air and soil/water emissions considered by other jurisdictions.
2. Recommend the best monitoring option for the Canadian electricity sector based on the following criteria: measurement frequency, accuracy and uncertainties, detection limit, reliability, practicality and extent of application, costs, advantages and limitations.
3. Recommend alternative monitoring options that would be appropriate for Canadian low-mass mercury emitters (LME) and peaking units.
4. Identify and describe the reporting requirements of mercury emissions obtained from recommended monitoring regimes.
5. Identify and assess quality assurance and quality control (QA/QC) requirements for recommended monitoring regimes.

6. Estimate capital, annual and levelized costs for operating the recommended monitoring regimes applicable to existing and hypothetical future Canadian electric power generation facilities.

An overview of existing Canadian facilities will be presented in Section 2 considering, among other things, coal utilization and mercury content, installed air pollution control technologies and mercury emissions previously reported by facilities according to inventory programs. The latter will help delineate the low-mass mercury emitters. An overview of four hypothetical future facilities, as defined by Environment Canada, will be presented as well. This section will help in the realization of Objective 6.

Section 3 will review the mercury monitoring regimes (Objective 1) and recommend the best options (Objectives 2 and 3). Section 4 will provide specific quality assurance, quality control and reporting guidelines for the Canadian facilities to follow in prospect of operating one of the recommended mercury monitoring regime (Objectives 4 and 5). Finally, Section 5 will address the cost implications to install and operate the recommended mercury monitoring regimes as a per unit basis (Objective 6) and globally for the existing and hypothetical future Canadian electric power generation utilities (EGUs).