CANADA-WIDE STANDARD FOR MERCURY EMISSIONS FROM COAL-FIRED ELECTRIC POWER GENERATION PLANTS

PROGRESS REPORT 2008

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Introduction

This report presents an update on progress toward meeting the targets of the Canada-wide Standard for Mercury Emissions from Coal-fired Electric Power Generation Plants. Only those jurisdictions that have coal-fired electric power generation plants are required to report progress to meet this standard. More information on the Canada-wide Standards for Mercury may be found on the CCME website at www.ccme.ca.

Summary

In 2006 the Canadian Council of Ministers of the Environment (CCME) endorsed Canada-wide Standards (CWS) for Mercury Emissions from Coal-fired Electric Power Generation Plants. The CWS set targeted caps for each signatory jurisdiction for the year 2010. Since the baseline year of 2003 the six signatories to the Canada Wide Standard for mercury emissions from coal-fired electricity generation have achieved a reduction of 1163 kilograms or 43 per cent. In 2008 there were 1,532 kilograms of mercury emitted in total from coal-fired power generation plants in signatory jurisdictions. In 2003, the coal-fired electric power generation sector emitted an estimated 2,695 kilograms of mercury from an estimated 3,725 kilograms of mercury in coal burned.

Province	**2008 Mercury Emissions**	**2010 cap**
Alberta	481 kg	590 kg
Saskatchewan	648 kg	430 kg (early actions to be used to meet cap)
Manitoba	9.6 kg	20 kg
Ontario	191 kg	Under discussion*
New Brunswick	41 kg	25 kg
Nova Scotia	161 kg	65 kg
Total	1532 kg	1130*

*Ontario cap to be added to total

Jurisdiction Reports

The following information was submitted by signatory jurisdictions in accordance with Section 2.1 of the *CCME Monitoring Protocol in Support of the Canada-Wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants.*

ALBERTA

The seven coal-fired power plant facilities in Alberta are the Battle River Generating Station, the Genesee Thermal Generating Station – Units 1 and 2, the Genesee Thermal Generating Station – Unit 3, the Keephills Generating Plant, the H.R. Milner Generating Station, the Sheerness Generating Station, the Sundance Generating Plant and the Wabamun Generating Station. All facilities were in operation in 2008.

BATTLE RIVER GENERATING STATION

a) Annual Mercury Emissions

The annual mercury emissions calculated in 2008 was 66.91 kg.

b) Mercury Capture Rates

The rate of capture, based on captured mercury to total inlet mercury was 27.1%

c) Monitoring Methods Use for All Parameters

For the annual mass balance:

Three of the daily coal samples were collected and then combined in equal mass into a weekly composite sample. Three raw fly ash samples were collected each week from the raw flyash silo into a weekly composite sample and three classified flyash samples were collected each week from the classified flyash silo into a weekly composite sample (when classifying occurred.). A sample of bottom ash is collected from the bottom ash belts (Units 4 and 5) and sluicing system (Unit 3) three times per week. All bottom ash was made into one weekly sample.

Samples were analyzed at an independent lab.

The preparation and analysis methods used for each test are shown in the table below:

Coal Monitoring Methods	
Component	**Analysis Method**
Compositing	BRGS COAL 609
Sample Preparation	ASTM D2013
Ash Content	ASTM D3174
Sulphur Content	ASTM D4239
Chlorine Content	ASTM D2361
Moisture	ASTM D3173 / ASTM D3302
Mercury	ASTM D6722
Heating Value	ASTM D5865
Residue (flyash, bottom ash) Monitoring Methods	
Compositing	BRGS ASH 702/BRGS ASH 707
Sulphur Content	ASTM D4239
Chlorine Content	ASTM D2361
Moisture	ASTM D3173 / ASTM D3302
Mercury	ASTM D6722
Loss-on-Ignition	ASTM D3174
Flue Gas	
Mercury (total and speciation)	Ontario Hydro Stack Test

d) Justification for Alternative Methods

ATCO Power collected as delivered coal and some of their reasons include: sampling at the feeders creates safety hazards for staff working near equipment that can start automatically; and that mass of coal is determined by the run of mine scale which is calibrated annually.

ATCO Power provided the following reasons for collecting flyash at silos: better mixing of flyash collected in the different precipitator fields; reduced safety hazards from sampling hot flyash from hot pressurized precipitator transport bottles; fewer resources required for sampling; and reduced operational risk of malfunctioning of the precipitator bottles.

Due to the design of the Unit 3 bottom ash sluicing system and Units 4 and 5 submerged bottom ash conveyors, bottom ash cannot be sampled before quenching.

ATCO did not incorporate LOI into their mass balance calculations for 2008 but will incorporate LOI into their mass balance calculations for 2009.

e) Supporting Data

Accuracy (from Stack Balance):

The accuracy of the mass balance method as compared to the stack balance method during the stack survey was 75.39%.

f) Mercury Speciation (Averages)

Ontario Hydro Method was used, with the following results:

Stack B
Total Mercury: 3.96 g/h
Particulate Mercury: 0.13%
Oxidized Mercury: 26.4%
Elemental Mercury: 73.5%

Stack C
Total Mercury: 3.32 g/h
Particulate Mercury: 0.28%
Oxidized Mercury: 20.1%
Elemental Mercury: 79.7%

For each stack test, only two sampling runs were conducted.

g) Mercury Content of Coal

As determined by the facility the annual average mercury content was 39.35 ppb.

h) Combustion Residues Mercury Content, Mass & Management Method

As determined by the facility the annual average mercury content of the classified fly ash was 108.45 ppb. The annual average mercury content of raw fly ash was 100.98 ppb. The annual average mercury content of the bottom ash was 6.2 ppb.

Mass of Residues:

The raw fly ash, classified fly ash and bottom ash generated in 2008 were 193,813 tonnes, 38,867 tonnes and 187,698 tonnes respectively. The 2008 annual mass of ash disposed to mine by the facility was 334,530 tonnes. The 2008 annual mass of ash sales to ASHCOR Technologies was 85,848 tonnes.

Management Method:

Fly ash is sold to ASHCOR technologies for reuse (in the cement industry). Unsold fly ash and all bottom ash are disposed of at designated ash disposal sites, which are capped with at least 1.2 m of suitable material below the reconstructed soil surface, and at least 1.5 m above the seasonally high water table prior to disturbance. Ash is disposed of by Sherritt mines.

GENESEE THERMAL GENERATING STATION – UNITS 1 AND 2

a) Annual Mercury Emissions

The annual mercury emissions in 2008 as calculated by the mass balance method were 75.11 kg.

b) Mercury Capture Rate

The rate of capture, based on captured mercury to total inlet mercury was 40.6%

c) Monitoring Methods Used for All Parameters

Samples are collected three times a week from three different mills on each unit. The six samples are combined into a weekly composite before being shipped to the analysis lab. Three bottom ash samples are collected weekly for each unit and combined into a weekly composite. Three raw ash samples are taken from the precipitator weekly and combined into a weekly composite. The preparation and analysis methods used for each test are shown in the table below:

Coal Monitoring Methods	
Component	Analysis Method
Sample Preparation	ASTM D2013 and ASTM D3302
Ash Content	ASTM D3174/ASTM D5142
Sulphur Content	ASTM D4239C
Chlorine Content	ASTM D4208
Moisture	ASTM D3174
Mercury	ASTM D6722
Heating Value	ISO 1928
Residue (flyash, bottom ash) Monitoring Methods	
Ash Content	ASTM D3174/ASTM D5142
Sulphur Content	ASTM D4239C
Chlorine Content	ASTM D4208
Moisture	ASTM D3174
Mercury	ASTM D6722
Loss-on-Ignition	ASTM D7348
Flue Gas	
Mercury (total and speciation)	Ontario Hydro Stack Test
Bottom Ash Quench Water	
Mercury	Cold Vapour Atomic Absorbance (first sample)
	Cold Vapour Atomic Fluorescence (8 samples)

d) Justification for Alternative Methods

For the first 6 months of the year, the lab contracted by EPCOR did not supply the analysis of the flyash on a dry basis, contrary to the CCME *Monitoring Protocol in Support of the Canada-Wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants* and the *Canadian Uniform Data Collection Program for Mercury from Coal-fired Electric Power Generation*. The contracted lab was changed, and the rest of the year the flyash analysis was taken on a dry basis. The difference between the annual average with the dry basis measurements and the as-received measurement was calculated to be 0.1275% which was considered to be immaterial.

e) Supporting Data

Quench Water Analysis Results:

Sample Date	Unit	Results	Units of Measure	Analysis Lab
09/05/2008	G1	<0.0001	mg/L	Bodycote
09/05/2008	G2	<0.0001	mg/L	Flett Research Ltd.
02/06/2008	G1	1.98	ng/L	Flett Research Ltd.
02/06/2008	G1	1.79	ng/L	Flett Research Ltd.
02/06/2008	G2	11.9	ng/L	Flett Research Ltd.
02/06/2008	G2	12.2	ng/L	Flett Research Ltd.
02/06/2008	G2	11.8	ng/L	Flett Research Ltd.
02/06/2008	G2	9.62	ng/L	Flett Research Ltd.
02/06/2008	G2	3.41	ng/L	Flett Research Ltd.
02/06/2008	G2	3.63	ng/L	Flett Research Ltd.
04/06/2008	G1	3.48	ng/L	Flett Research Ltd.
04/06/2008	G1	3.51	ng/L	Flett Research Ltd.
04/06/2008	G2	5.38	ng/L	Flett Research Ltd.
09/06/2008	G2	7.18	ng/L	Flett Research Ltd.
09/06/2008	G1	2.58	ng/L	Flett Research Ltd.
11/06/2008	G1	9.39	ng/L	Flett Research Ltd.
12/07/2008	G1	2.8	ng/L	Flett Research Ltd.
12/07/2008	G2	4.36	ng/L	Flett Research Ltd.

Scheduled plant outages:

Unit 1: March 13 - April 11 (30 days)
Unit 2: April 14 - May 2 (19 days)

Accuracy (from Stack Balance):

The accuracy of the mass balance method as compared to the stack balance method was 98.2%.

The accuracy was calculated using an estimation from the stack balance method that 73.74 kg/yr of mercury would be emitted if the emissions rates during the stack testing were held constant for

all operational hours, as compared to the 75.11 kg/yr calculated to be emitted using the mass balance method.

f) Mercury Speciation (Averages)

Ontario Hydro Method was used, with the following results:

Total Mercury: 9.49 g/h
Particulate Mercury: 0.92%
Oxidized Mercury: 31.1%
Elemental Mercury: 67.9%

g) Mercury Content of Coal

As determined by the facility the annual average mercury content was 45.07 ppb.

h) Combustion Residues Mercury Content, Mass & Management Method

As determined by the facility the annual average mercury content of the fly ash was 119.3 ppb. As determined by the facility the annual average mercury content of the bottom ash was 9.4 ppb.

Mass of Residues:

The annual mass of fly ash estimated to be generated by the facility was 436,034 tonnes. The annual mass of bottom ash estimated to be generated by the facility was 285,237 tonnes. EPCOR is reevaluating their methodology around these estimations.

Ash is sold on a dry basis while ash returned to the mine is on a wet basis.

Management Method:

184,242 tonnes of fly ash and 14,442 tonnes of bottom ash were sold. The remaining ash was returned to the mine.

GENESEE THERMAL GENERATING STATION – UNIT 3

a) Annual Mercury Emissions

The annual mercury emissions in 2008 as calculated by the mass balance method were 29.72 kg

b) Mercury Capture Rate

The rate of capture, based on captured mercury to total inlet mercury was 52.7%

c) Monitoring Methods Used for All Parameters

Three milled coal samples are taken weekly and are combined in a composite from rotating mill sample points. Three bottom ash samples are taken weekly and combined into a weekly composite. Three fly ash samples are taken weekly from the fly ash silo and are combined into a weekly composite. The preparation analysis methods used for each test are shown in the table below:

Coal Monitoring Methods	
Component	Analysis Method
Sample Preparation	ASTM D2013 and ASTM D3302
Ash Content	ASTM D3174/ASTM D5142
Sulphur Content	ASTM D4239C
Chlorine Content	ASTM D4208
Moisture	ASTM D3174
Mercury	ASTM D6722
Heating Value	ISO 1928
Residue (flyash, bottom ash) Monitoring Methods	
Ash Content	ASTM D3174/ASTM D5142
Sulphur Content	ASTM D4239C
Chlorine Content	ASTM D4208
Moisture	ASTM D3174
Mercury	ASTM D6722
Loss-on-Ignition	ASTM D7348
Flue Gas	
Mercury (total and speciation)	Ontario Hydro Stack Test
Bottom Ash Quench Water	
Mercury	Cold Vapour Atomic Absorbance (first sample)
	Cold Vapour Atomic Fluorescence (8 samples)

d) Justification for Alternative Methods

For the first 6 months of the year, the lab contracted by EPCOR did not supply the analysis of the flyash on a dry basis, contrary to the CCME *Monitoring Protocol in Support of the Canada-Wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants* and the *Canadian Uniform Data Collection Program for Mercury from Coal-fired Electric Power Generation*. The contracted lab was changed, and the rest of the year the flyash analysis was taken on a dry basis. The difference between the annual average with the dry basis measurements and the as-received measurement was calculated to be 0.2% which was considered to be immaterial by EPCOR.

e) Supporting Data

Quench Water Analysis Results:

Sample Date	Results	Units of Measure	Analysis Lab
09/05/2008	0.0003	mg/L	Bodycote
09/06/2008	17.2	ng/L	Flett Research Ltd.
09/06/2008	16.9	ng/L	Flett Research Ltd.
19/06/2008	7.74	ng/L	Flett Research Ltd.
19/06/2008	5.69	ng/L	Flett Research Ltd.
07/07/2008	3.60	ng/L	Flett Research Ltd.
09/07/2008	3.57	ng/L	Flett Research Ltd.
12/08/2008	11.1	ng/L	Flett Research Ltd.

EPCOR determined that the first sample reading was likely due to contamination.

Plant Outages:

Scheduled plant outage: May 16 - June 11 (27 days)
Forced plant outage: October 5 – November 18 (39 days)

Activated Carbon Testing:

Full Scale Activated Carbon Injection Demonstration was run July 26 to September 2

Accuracy (from Stack Balance):

The accuracy of the mass balance method as compared to the stack balance method was 95.26%.

The accuracy was calculated using an estimation from the stack balance method that 31.20 kg/yr of mercury would be emitted if the emissions rates during the stack testing were held constant for all operational hours, as compared to the 29.72 kg/yr calculated to be emitted using the mass balance method.

f) Mercury Speciation (Averages)

Ontario Hydro Method was used, with the following results:

Total Mercury: 4.69 g/h

Particulate Mercury: 0.20%
Oxidized Mercury: 0.47%
Elemental Mercury: 99.3%

g) Mercury Content of Coal

As determined by the facility the annual average mercury content was 42.0 ppb.

h) Combustion Residues Mercury Content, Mass & Management Method

As determined by the facility the annual average mercury content of the fly ash was 137.9 ppb. As determined by the facility the annual average mercury content of the bottom ash was 6.0 ppb.

Mass of Residues:

The annual mass of fly ash estimated to be generated by the facility was 565,335.5 tonnes. The annual mass of bottom ash estimated to be generated by the facility was 201,701.5 tonnes. These values are on a wet basis.

Management Method:

Fly ash and bottom ash are returned to the mine.

According to the EPEA approval for the Genesee mine, the ash is to be buried no less than 1.2 metres below the surface of the reconstructed land and must be deposited at least 1.5 metres above the level of re-established water table of the reconstructed land.

KEEPHILLS GENERATING PLANT

a) Annual Mercury Emissions

The annual mercury emissions in 2008 as calculated by the mass balance method were 22.2 kg

b) Mercury Capture Rate

The rate of capture, based on captured mercury to total inlet mercury was 79.0%

Enhanced activated carbon injection for mercury removal was installed at Keephills Unit 2 from August 2007 to October 2008.

c) Monitoring Methods Use for All Parameters

For as received coal, weekly composite samples are comprised of grab samples taken once each operating day of the week from the plant conveyor belt. Fly ash weekly composite samples are comprised of daily grab samples taken on at least three separate days of the week from one hopper in each of the first two fields of the electrostatic precipitator. One grab sample of bottom ash is taken per week (after quenching) from the bottom ash hoppers.

Monitoring Methods	
Component	**Analysis Method**
Sample Preparation	ASTM D2013
Ash Content	ASTM D3174
Sulphur Content	ASTM D5016
Chlorine Content	ASTM D4208
Moisture	ASTM D3173 / ASTM D1412
Mercury	ASTM D6722
Heating Value	NOT PROVIDED

d) Justification for Alternative Methods

TransAlta has assessed that they do not have the capability to collect bottom ash samples before quenching and that it would present a significant safety concern. TransAlta has also assessed that they do not have the capability to accurately sample milled coal.

TransAlta has determined that ash volumes cannot be accurately measured at Keephills. The fly ash to bottom ash ratio is determined using the measured fly ash totals from the TransAlta Sundance ash farm.

e) Supporting Data

Quench Water Analysis Results:

Sample ID	Date Sampled (2008)	Hg (ppm)
Water (Unit 1/2)	Oct 4 - 10	<0.001
Water (Unit 1/2)	Oct 11 – 17	<0.001
Water (Unit 1/2)	Oct 18 – 25	<0.001
Water (Unit 1/2)	Nov 2 – 8	0.016

Accuracy (from Stack Balance):

Enhanced activated carbon injection for mercury removal was installed at Keephills Unit 2 from August 2007 to October 2008. The stack test was performed when sorbent injection was not operating. TransAlta did not expect the results to be comparable.

The annual percent difference between the mass balance and stack test is 230%

f) Mercury Speciation (Averages)

A stack test schedule with alternating methods was approved by Alberta Environment for the Keephills facility in consideration of results from past monitoring conducted at the site. Annual testing alternates between Ontario Hydro Method in odd years and Method 29 in even years.

According to the schedule, a speciated stack test was not conducted in 2008 for Keephills. Speciation is provided below from a previous Ontario Hydro Method performed in 2005.

Particulate Mercury: 0.12%
Oxidized Mercury: 23.8%
Elemental Mercury: 76.0%

A Method 29 stack test was conducted in 2008, with the following results:

Total Mercury: 8.5 g/h

g) Mercury Content of Coal

As determined by the facility the annual average mercury content was 39 ppb.

h) Combustion Residues Mercury Content, Mass & Management Method

As determined by the facility the annual average mercury content of the fly ash was 227 ppb. As determined by the facility the annual average mercury content of the bottom ash was 15 ppb.

Mass of Residues:

Based on the total ash content in the coal burned at Keephills in 2008, TransAlta determined that there would have been approximately 480,000 tonnes of bottom ash and fly ash produced, which was all disposed of in the Keephills Ash lagoon.

Management Method:

Bottom ash and fly ash are slurried to the ash lagoon.

H.R. MILNER GENERATING STATION

	Total Mass Mercury		
Facility	Emissions (kg)	In coal burned (kg)	Retained in ash and residue (kg)
H.R. Milner 2008	4.1	12.77	13.9

a) Annual Mercury Emissions

The annual mercury emissions in 2008 were 4.1 kg.

b) Mercury Capture Rate

Applies to new units only

c) Monitoring Methods Use for All Parameters

- Stack Testing and Flow Monitoring (CEMS) Ontario Hydro Method/Stack Testing data used for emissions to air
- Mass Balance
- Other equivalent method used average of CanMet test analysis for coal, fly ash and bottom ash.

d) Justification for Alternative Methods

Samples were collected and tested once/month as per the Canadian Uniform Data Program (UDCP) for Mercury. The data for coal, fly ash and bottom ash were averaged over the year. The averages were multiplied by the coal consumed, fly ash and bottom ash produced to calculate total mercury in the coal burned, fly ash and bottom ash retained.

e) Supporting Data

The fly ash and bottom ash data are as reported in the NPRI

f) Mercury speciation

Parameter	Test 1	Test 2	Test 3	Average
Test Date Test Time	Sept. 25/08 09:28 - 10:35	Sept. 25/08 10:56 - 12:02	Sept. 25/08 12:20 - 13:27	
Particle Bound Mercury mg/m3 (dry basis)	0.000049	0.000056	0.000055	0.000053
Oxidized Mercury mg/m^3 (dry basis)	0.00060	0.00069	0.00052	0.00061
Elemental Mercury mg/m^3 (dry basis)	0.00058	0.00049	0.00042	0.00050
Total Mercury mg/m^3 (dry basis) kg/year	0.00012 8.38	0.00012 8.45	0.00010 6.84	0.00012 7.89
Particulate Concentration mg/m3 (dry basis) mg/m3 (wet basis)	49.6 45.9	43.9 40.2	48.3 45.5	46.9 43.9
Particulate Emission Rates Tonnes/hr (dry basis) g/Kg (dry basis) g/Kg (dry basis) @ 50% EA	0.038 0.040 0.44	0.033 0.035 0.038	0.038 0.039 0.043	0.036 0.038 0.042
Flow Rate m^3/sec Actual m^3/sec	215 384	216 381	218 382	216 382

Temperature °C	162	162	163	162
Moisture Vol %	7.5	6.2	5.8	6.5
Oxygen Vol %	8.4	8.4	8.3	8.4
Carbon Dioxide Vol %	12.0	12.0	12.0	12.0
Excess Air %	66.1	66.6	65.1	65.9
Load Gross MW	145	145	146	145

g) Mercury Content of Coal

2008 Mercury content = 12.77 kg

h) Combustion Residues Mercury Content, Mass & Management Method

Both ash waste streams were managed at the Flood Creek Ash Disposal Facility

2008 Mercury content of FA/BA = 13.9 kg

SHEERNESS GENERATING STATION

As per the CCME Monitoring Protocol in Support of the Canada-Wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants, the following information has been reported by the Sheerness Generating Station for 2008:

a) Annual Mercury Emissions

The annual mercury emissions in 2008 as calculated by the mass balance method was 89.7 kg

b) Mercury Capture Rate

The rate of capture, based on captured mercury to total inlet mercury was 29.4%

c) Monitoring Methods Used for All Parameters

Weekly composite samples are taken for coal, fly ash and bottom ash.

Coal Monitoring Methods	
Component	**Analysis Method**
Sample Preparation	ASTM D2013
Ash Content	ASTM D3174
Sulphur Content	ASTM D4239
Chlorine Content	ASTM D2361
Moisture	ASTM D3173/D3302
Mercury	ASTM D6722
Heating Value	ASTM D5865

Residue (flyash, bottom ash) Monitoring Methods	
Sulphur Content	ASTM D5016
Chlorine Content	ASTM D2361
Moisture	ASTM D3173/ASTM D3302
Mercury	ASTM D6722
Loss-on-Ignition	ASTM D3174
Flue Gas	
Mercury (total and speciation)	Ontario Hydro Stack Test

d) Justification for Alternative Methods

ATCO did not incorporate LOI into their mass balance calculations for 2008 and also used Equation 1.1a from Appendix A: Sample Calculations of the CCME Monitoring Protocol in Support of the Canada-Wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants. ATCO will incorporate LOI and Equation 1.1b into their mass balance calculations for 2009.

e) Supporting Data

Quench Water Analysis Results:

The water in bottom ash troughs for the steam generators were tested on a weekly basis for total mercury. Average amounts of 0.0000043mg/L resulted, and discontinuation of bottom ash trough water sampling for mercury analysis has been requested.

Accuracy (from Stack Balance):

The accuracy of the mass balance method as compared to the stack balance method was 99%. The accuracy was calculated using the measured 0.05622 kg of mercury that was emitted during the stack test, as compared to the 0.0557 kg calculated to be emitted using the mass balance method.

f) Mercury Speciation (Averages)

Ontario Hydro Method was used, with the following results:

Total Mercury: 9.36 g/h

Particulate Mercury: 0.3%
Oxidized Mercury: 30.0%
Elemental Mercury: 69.7%

g) Mercury Content of Coal

As determined by the facility the annual average mercury content was 45.6 ppb.

h) Combustion Residues Mercury Content, Mass & Management Method

As determined by the facility the annual average mercury content of the raw fly ash was 83.9 ppb. The annual average mercury content of sales fly ash was 158.9 ppb. The annual average mercury content of the bottom ash was 6.5 ppb.

Mass of Residues:

The annual mass of fly ash generated by the facility was 360,394 tonnes. The annual mass of bottom ash disposed of by the facility was 160,993 tonnes.

Management Method:

80,192 tonnes of fly ash was sold for use in concrete manufacturing. The remaining ash was sent to the ash management site.

SUNDANCE GENERATING PLANT

a) Annual Mercury Emissions

The annual mercury emissions in 2008 as calculated by the mass balance method were 153.9 kg.

b) Mercury Capture Rate

The rate of capture, based on captured mercury to total inlet mercury was 43.2%.

The table below shows mercury released and percent capture calculated from each stack.

	Mercury released from the Stack (g/year)	**% Capture**
Sundance (total)	153,948.7	43.2
Unit 1/2	26,210.7	35.6
Unit 3/4	56,934.9	52.6
Unit 5/6	61,508.0	44.2

c) Monitoring Methods Used for All Parameters

For as received coal, weekly composite samples are comprised of grab samples taken once each operating day of the week from the plant conveyor belt. Fly ash weekly composite samples are comprised of daily grab samples taken on at least three separate days of the week from one hopper in each of the first two fields of the electrostatic precipitator. One grab sample of bottom ash is taken per week (after quenching) from the bottom ash hoppers.

Monitoring Methods	
Component	**Analysis Method**
Sample Preparation	ASTM D2013
Ash Content	ASTM D3174
Sulphur Content	ASTM D5016
Chlorine Content	ASTM D4208
Moisture	ASTM D3173 / ASTM D1412
Mercury	ASTM D6722
Heating Value	NOT PROVIDED

d) Justification for Alternative Methods

TransAlta has assessed that they do not have the capability to collect bottom ash samples before quenching and that it would present a significant safety concern. They were also unable to sample from the bottom ash hoppers for Sundance Units 1 and 2 so samples representing a mixture of Units 1 and 2 are collected from the hydro bin at the ash farm

TransAlta has also assessed that they do not have the capability to accurately sample milled coal.

e) Supporting Data

Bottom Ash Quench Water Analysis Results:

Sample ID	**Date Sampled (2008)**	**Hg (ppm)**
Water (Unit 3/4)	Oct 6	<0.001
Water (Unit 5/6)	Oct 4 – 10	<0.001
Water (Unit 3/4)	Oct 11 – 17	<0.001
Water (Unit 5/6)	Oct 11 – 17	<0.001
Water (Unit 3/4)	Oct 18 – 25	<0.001
Water (Unit 5/6)	Oct 18 – 25	<0.001
Water (Unit 3/4)	Nov 2 – 8	0.003
Water (Unit 5/6)	Nov 2 – 8	0.005

Accuracy (from Stack Balance):

The annual percent difference between the mass balance and stack tests for the entire facility was 15.2%.

The calculated percent difference between the mass balance and stack test for each stack is provided in the table below:

Stack	Stack test Type	Hg (g/hour)	Unit Pair Availability	Operational hours	Total g/year based on stack tests	Total g/year based on mass balance	% Difference
1	Method 29	5.50	94.75	8322	45,762.5	26,210.7	74.6
2	Ontario Hydro	5.96	91.35	8024	47,824.1	56,934.9	16.0
3	Method 29	9.23	90.05	7910	73,009.2	61,508.0	18.7

TransAlta believes the mercury emissions on the day of the stack test may have been unusually high and so the correlation between mass balance and stack test is not close. However, TransAlta believes the 15.2 % difference for the entire plant indicates good overall agreement.

f) Mercury Speciation (Averages)

A stack test schedule with alternating methods (Ontario Hydro Method and Method 29) for the three stacks at the Sundance facility was approved by Alberta Environment in consideration of results from past monitoring conducted at the site. The Ontario Hydro Method was used only on Stack 2 in 2008, with the following results:

Total Mercury:

Stack 2: 5.96 g/h

Particulate Mercury: 3.00%
Oxidized Mercury: 14.0%
Elemental Mercury: 83.0%

Method 29 was used, with the following results:

Total Mercury:

Stack 1: 5.50 g/h
Stack 3: 9.23 g/h

Ontario Hydro Method Stack Tests are shown in the Table below:

Stack	Date	Elemental Mercury	Oxidized Mercury	Particulate Mercury
Sundance 2 (Units 3&4)	June 2000	86.0%	11.5%	2.48%
Sundance 3 (Units 5&6)	April 2004	94.9%	5.1%	0%
Sundance 1 (Units 1&2)	May 2006	77.2%	22.6%	0.26%
Sundance 2 (Units 3&4)	April 2008	83.0%	14.0%	3.00%

g) Mercury Content of Coal

As determined by the facility the annual average mercury content was 39 ppb.

The table below provides annual average mercury content for coal by unit pair:

Units	Annual Average Mercury Content (ppb)
Unit 1/2	23
Unit 3/4	47
Unit 5/6	47

h) Combustion Residues Mercury Content, Mass & Management Method

As determined by the facility the annual average mercury content of the fly ash was 115 ppb. As determined by the facility the annual average mercury content of the bottom ash was 10 ppb.

The table below provides annual average mercury content for fly ash and bottom ash by unit pair:

Units	Annual Average Mercury Content for Fly Ash(ppb)	Annual Average Mercury Content for Bottom Ash(ppb)
Unit 1/2	57	8
Unit 3/4	154	11
Unit 5/6	135	11

Mass of Residues:

The annual mass of fly ash generated by the facility was 988,589 tonnes (numbers were obtained from the Sundance ash plant.) The annual mass of bottom ash calculated by the facility was 352,267 tonnes.

Management Method:

328,871 tonnes of fly ash was sold. The remaining ash was returned to the mine.

WABAMUN POWER PLANT

The Wabamun Power Plant is planning to decommission their facility and to cease operations by March 2010. Currently, only Unit 4 is in operation at the plant. Since the plant is scheduled to be shut down early next year, the facility was not required to implement a mercury control program. Mercury emissions reported for 2008 to NPRI by the Wabamun Power Plant was 44 kg. It should be noted that data submitted to NPRI for 2008 has not yet been reviewed by Environment Canada. Values reported previously to NPRI from 2005 to 2007 ranged from 43 to 53 kg.

SASKATCHEWAN

Saskatchewan has three coal-fired electric power generation plants including Boundary Dam Power Station, Poplar River Power Station, and Shand Power Station. All three plants are operated by SaskPower.

Saskatchewan Ministry of Environment and SaskPower have entered into a draft Memorandum of Understanding (MOU) on monitoring mercury emissions from coal-fired power plants in support of the Canada-wide Standards (CWS). As part of the MOU, the ministry has also received and accepted a proposed mercury monitoring plan the utility prepared with the assistance of the *Monitoring Protocol*. In accordance with the MOU requirement, mercury monitoring at the SaskPower's coal-fired power plants started on January 1, 2007.

The mass balance approach is the method being followed in Saskatchewan. In 2008, the total amount of mercury emitted from all the coal-fired power plants in Saskatchewan is 648 kg. Saskatchewan's early actions will be used to meets its provincial cap of 430 kg/yr for the years 2010 to 2013. Examples of early actions include a mercury switch collection program and early mercury controls at the Poplar River Power Station.

Saskatchewan's overall approach to managing emissions from coal-fired power plants is to incorporate the CWS into the conditions of permit to operate issued pursuant to Saskatchewan's *Clean Air Act* and Clean Air Regulations. If the construction of a new coal-fired power plant is considered a "development", management of mercury emissions will be introduced through *The Environmental Assessment Act* process.

Over the years, SaskPower has carried out significant research and development (R&D) on mercury to ensure the other information provision of the CWS is met. Some of the SaskPower's mercury control activities include:

- SaskPower's Emission Control Research Facility, which has established a mercury capture rate of 75% at Poplar River Power Station, received a national stewardship award in 2008.
- A commercial system including full-scale injection of enhanced activated carbon into the electrostatic precipitator was installed for both Poplar River units and handed over to the plant on June 5, 2009 making it the first permanent utility mercury control system in Canada.
- 43 kg of mercury was recovered from mercury switches and thermostats in 2008 with 29.5 kg eligible as an offset toward the CWS for mercury emissions requirement. Additional credits have been achieved as a result of mercury captured from Poplar River Power Station.
- Collaboration with lignite burning facilities in North Dakota to get various tests done on coal.
- Investigation of several coal treatment approaches in order to remove significant amount of mercury and other pollutants from lignite coal.

Achievement of the CWS

Saskatchewan's existing plants are well positioned to meet the provincial mercury cap of 430 kg starting in 2010 as a result of SaskPower's above noted control activities. For existing units, the annual mercury emissions from each unit will be totaled and compared to the Saskatchewan annual mercury limit of 430 kg. Any credits for early actions will be applied to reduce total annual emissions to 430 kg.

No new units have come on line during this reporting period. Any new units that may be installed in the future will clearly be designed to meet these limits. For any new units, the mercury emissions will be compared to the amount of mercury content of coal to determine whether 75% reduction required for lignite coal is achievable. The mercury emissions will also be compared to the amount of electricity generated by the unit to determine whether the emission rate limit of 15 kg/TWh for lignite is achieved.

CREDITS FOR EARLY ACTION

The Canada Wide Standards contains provisions for SaskPower to use credits for early actions to meet its caps for the years 2010 to 2013. Examples of early actions include a mercury switch collection program and early mercury controls at the Poplar River Power Station.

Mercury collection

Starting in 2003, SaskPower implemented a collection program with several scrap metal companies to recover old mercury switches in automobiles before they were fed to a steel mill furnace. On April 10, 2006 SaskPower announced a free service to its customers to recycle old home thermostats which contain mercury. In addition, SaskPower has been collecting spent fluorescent light bulbs and all of SaskPower's streetlight lamps for mercury recovery. The mercury collected to date is summarized below:

Year	Mercury Collected from Mercury Switches, kg	Mercury Collected from Other Sources, kg	Total Mercury Collected, kg
2003	16.476	-	16.476
2004	32.092	-	32.092
2005	52.192	0.378	52.570
2006	40.670	4.648	45.318
2007	55.768	3.670	59.438
2008	29.500	13.504	43.004
Total	**226.698**	**22.200**	**248.898**

Mercury Reduction at Poplar River Power Station

SaskPower has taken on an extensive R&D program to enhance the development of technologies that may be used to control the mercury emitted from SaskPower's units, which is primarily elemental in nature. This work also has applications to other Canadian utilities that emit mainly elemental mercury, in contrast to U.S. coal plants where flue gas mercury tends to have significant fractions of oxidized mercury. A key milestone of this work was the commissioning of SaskPower's Emissions Control Research Facility (ECRF) where selected technologies can be assessed for their capability to remove mercury from a slipstream of Poplar River's flue gas. Since the ECRF started operations, mercury removal from Poplar River has become more significant as:

- the ECRF has operated more consistently;
- a full-scale mercury removal demonstration occurred on Poplar River Unit 2;
- various modifications were made to the plant to prepare for the installation of long-term mercury controls and;
- Canada's first permanent mercury control system was installed for both units of Poplar River in 2009.

The changes in mercury emissions at Poplar River since this work began are summarized below:

Year	Baseline Mercury Emissions, kg	Mercury Emissions, kg	Reduction in Mercury Emissions, kg
2003	297.82	297.82	0
2004	297.82	294.80	3.02
2005	297.82	281.11	16.71
2006	297.82	222.12	75.70
2007	297.82	311.73	-13.91
2008	297.82	239.13	58.69
Total	**1,786.92**	**1646.71**	**140.21**

The following information on Saskatchewan coal-fired electric power generating plants was provided by SaskPower.

BOUNDARY DAM, POPLAR RIVER AND SHAND POWER STATIONS

a) Annual Mercury Emissions (kg)

Boundary Dam Power Station Unit 1	25
Boundary Dam Power Station Unit 2	23
Boundary Dam Power Station Unit 3	50
Boundary Dam Power Station Unit 4	48
Boundary Dam Power Station Unit 5	54
Boundary Dam Power Station Unit 6	93
Total for Boundary Dam Power Station	292
Poplar River Power Station Unit 1	117
Poplar River Power Station Unit 2	123
Total for Poplar River Power Station	240
Shand Power Station Unit 1	115
Total for Shand Power Station	115
Total for SaskPower	648

b) Mercury Capture Rates

Boundary Dam Power Station Unit 1	7.48%
Boundary Dam Power Station Unit 2	12.47%
Boundary Dam Power Station Unit 3	2.82%
Boundary Dam Power Station Unit 4	2.51%
Boundary Dam Power Station Unit 5	5.55%
Boundary Dam Power Station Unit 6	6.81%
Average for Boundary Dam Power Station	5.77%
Poplar River Power Station Unit 1	2.24%
Poplar River Power Station Unit 2	35.18%
Average for Poplar River Power Station	22.33%
Shand Power Station Unit 1	3.80%
Average for Shand Power Station	3.80%
Average for SaskPower	12.37%

c) Monitoring Methods Used for All Parameters

Mass Balance Approach

SaskPower uses the mass balance approach where over a given period of time the masses of mercury entering the unit in the coal stream and leaving the unit in solid by-product residue streams are determined. The difference between these masses represents the amount of mercury emitted from the unit. The methods for mass balance determinations are based on the successful

program in which SaskPower and Saskatchewan MoE (at the time Saskatchewan Environment) worked together to determine the mercury inventories from SaskPower's coal-fired units during the development of the Canada Wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants. Any modifications from the previously used methods are based on the requirements of MOU between MoE and SaskPower plus recommendations from the report, "Review of and Comments on SaskPower's Past and Future Sampling Protocols for Mercury in Coal and Coal Combustion By-Products," prepared by Champagne Coal Consulting Inc. (CCCI).

Mercury in Coal Monitoring

The coal sampling procedure is in line with existing plant practices where coal is collected by automated sampling equipment on a daily basis according to ASTM D2234. Mercury analysis is performed at SaskPower's Operations Support chemistry laboratory using the LECO AMA 254 that was shown to effectively determine mercury in coal, fly ash and bottom ash during the mercury inventory program conducted in the development of the mercury standard. In order to assure equipment availability during this program SaskPower acquired a Leeman Labs Hydra C mercury analyzer which has similar capabilities to the LECO instrument. In the event SaskPower's mercury analytical equipment is not available, even with this redundancy, samples are still collected as described below and analyzed once the equipment becomes operational again. If the mercury analytical equipment is not available for a lengthy period of time, SaskPower may use the services of an external lab with a demonstrated ability to analyze mercury, such as CANMET or the University of North Dakota Energy and Environmental Research Center (EERC).

Under normal plant coal sampling equipment availability three daily samples are collected over a two week period and analyzed for mercury according to ASTM D-6722. One sample per week is analyzed if the equipment availability is reduced. If the sampling equipment is not available, feeder samples are collected and analyzed considering the recommendations of the CCCI report. The mercury mass entering the unit is determined from the mercury concentration of the coal analyzed and the amount of coal fed to the unit over the period of time represented by the analyzed coal. Further discussion is found in Appendix D.

Mercury in Fly Ash Monitoring

Fly ash samples representing each unit are collected once every two weeks and analyzed according to ASTM D-6722.

At Shand fly ash is collected from the silo used for holding fly ash before it is sent to storage or from the trucks transporting the fly ash for utilization.

At Poplar River fly ash is initially collected from the hoppers of each depth of an electrostatic precipitator (ESP) row. In the previous work determining SaskPower's mercury inventory during the development of the Canada Wide Standards for mercury, the amount of mercury present furthest downstream was insignificant and mercury determinations were subsequently based on the mercury found in upstream hoppers. If this proves to be the case after the first quarter of fly ash analysis, then sampling again would be restricted to the upstream hoppers.

Fly ash sampling from Boundary Dam is similar to that of Poplar River. However, fly ash from a number of units is collected in a silo for utilization. Once SaskPower has determined whether the fly ash in the silo represents the fly ash of those units, then fly ash sampling for those units would be done from the silo, similarly to what is done at Shand. If this not the case, fly ash sampling would continue in a similar fashion to that of Poplar River.

The mercury mass leaving the unit in the fly ash is determined from the mercury concentration of the fly ash analyzed and the amount of fly ash leaving the unit over the period of time represented by the analyzed fly ash. Further monitoring information is available in Appendix D.

Mercury in Bottom Ash Monitoring

The mercury content of bottom ash tends to be insignificant due to the almost complete volatilization of mercury during combustion and the subsequent transport of mercury with the flue gas away from where bottom ash is formed. Therefore bottom ash is sampled on a quarterly basis and analyzed according to ASTM D-6722 to verify that the amount of mercury retained by the bottom ash remains negligible. The mercury mass leaving the unit in the bottom ash is determined from the mercury concentration of the bottom ash analyzed and the amount of bottom ash leaving the unit over the period of time represented by the analyzed bottom ash.

d) Justification for Alternative Methods

Mercury Analysis

Mercury analysis was performed exclusively by ASTM D-6722 as set out in the MOU. Also, as agreed to in the MOU, SaskPower acquired a second mercury analyzer in order to back up the existing LECO AMA254. The instrument selected was a Leeman Hydra C which provides a more efficient means of performing the ASTM D-6722 analyses. However, the methods developed for the LECO AMA254 were not directly transferrable to the new instrument and several months were required to develop suitably reliable methods for the Leeman Hydra C. Also, the LECO AMA254 experienced a variety of maintenance issues, the most significant of which was the occurrence of excessive back pressure across the instrument. The Leeman purchased by SaskPower was one of their first commercial instruments and maintenance issues also occurred with it, including a new replacement furnace not being immediately compatible with the early instrument. These delays in performing the analyses resulted in a significant backlog of samples. In order to deal with this, EERC analyzed a significant number of fly ash samples collected from Poplar River Unit 2. Refer to Appendix D for a summarized operating procedure of the Leeman Hyrda C and Leco AMA254 mercury analyzers.

Mercury in Coal Monitoring

Boundary Dam Power Station
In 2008, 67 of 78 the (85.9%) scheduled coal samples were collected by ASTM D-2234 and subsequently analyzed for mercury by ASTM D-6722. The only collected sample in January was on the 30th. One sample was missed in September and three missed in October.

Poplar River Power Station
In 2008, 57 of the 78 (73.1%) scheduled coal samples were collected by ASTM D-2234. The ASTM mechanical sampler was unavailable Sept.1 – Nov. 10 and feeder samples were collected over this period. For the sampling periods of April 18 – May 1 and July 23 – Aug. 5 only one of the three biweekly samples was collected due to sampler unavailability. One of the three bi-weekly samples was not collected in one other period.

Shand
The drop sampler in place at Shand has not been operational during this reporting period due incompatibility with the incoming coal feed size. This sampler has been replaced by a Ramsey sweep arm sampler that is being commissioned. Feeder samplers were collected throughout this reporting period in order to obtain the required coal data. Coal samples were not collected during the plant overhauls. During the analysis of these samples it was noted that the coal received did not meet the -60 mesh fineness of ASTM D6722 for mercury analysis. If the coal is not sufficiently fine then individual particles are not completely burned out during the sample preparation for analysis by the instrument. Consequently, not all the mercury is transported to the amalgamator of the mercury analyzer and false low values are determined. Therefore, the Shand coal samples were ground manually prior to analysis. A tear in the screen of the coal grinder at Shand was subsequently noted and the screen has been replaced.

During 2008, feeder samples were taken on a daily basis in which the analyzed mercury concentration for each specific day was used to calculate daily mercury in coal values. This was done to attempt to achieve more accurate representation of the daily mercury in coal since the mechanical sampler is yet to be fully commissioned. 210 total work-day feeder samples were collected and analyzed during 2008 with weekend data backfilled by averaging the two days before and two days after the missing weekend data.

Mercury in Fly Ash Monitoring

Boundary Dam Power Station
Fly ash samples have been collected and analyzed for all units as well as the silos.

Poplar River Power Station
Unit 2 - Samples were collected from all fields enough times so that estimates could be made of mercury emissions based on samples collected from fewer fields. Data is missing from some of the second quarter, during which the unit underwent its spring maintenance outage and some samples were sent to EERC for analysis.

Unit 1 - Samples were collected from all fields enough times so that estimates could be made of mercury emissions based on samples collected from fewer fields. The unit underwent a major overhaul in 2008, during which time preparations were made to accommodate the permanent carbon injection system to be installed in 2009. No samples were collected during this period. Samples were also not collected during the sampling periods of Aug. 22 – Sept. 4, Sept. 5 -18, Sept. 19 – Oct. 2 and Oct. 17 – 30. The unit was off-line for maintenance during the Sept. 5 -18 period, while fly ash values for the other three periods were based on the average over the quarter of that period, as was done during the mercury inventory process.

Unit 2 - Samples were collected from all fields enough times so that estimates could be made of mercury emissions based on samples collected from fewer fields. Full-scale carbon injection was occurring over this period. In order to better characterize mercury retention in fly ash samples were collected from all the accessible cells several times and analyzed by EERC. EERC also analyzed several samples collected from the regular sampling episodes in order to deal with the sample backlog discussed in the mercury analysis. Samples were not collected during the sampling period Sept. 19 – Oct. 2 when the unit was not operating.

Shand
In 2008, 26 out of the 27 scheduled samples were collected. The average of the mercury values for the sampling quarter was used to estimate mercury emissions for the one period when a sample was not collected.

<u>Mercury in Bottom Ash Monitoring</u>

Boundary Dam
Bottom ash was not been collected during 2008; therefore, a value of zero is reported for this year.

Poplar River
Bottom ash was not collected during 2008 for Poplar River; therefore, a value of zero is reported during these years.

Shand
In 2008 only two of the four quarterly samples were collected. The average values for 2008 were applied to the 2008 periods when ash was not collected since mercury in bottom ash values at Shand have been consistent for all the years mercury has been analyzed there.

e) Supporting Data

Additional data can be found in the *Mercury Monitoring Report for 2007 & 2008*, prepared by and available from SaskPower.

f) Mercury Speciation

Stack	Test Dates	Contractor	Particulate Mercury	Oxidized Mercury	Elemental Mercury
Boundary Dam 1&2	2004 – Aug - 20	EERC	<0.1%	16.3%	83.6%
Boundary Dam 5	2004 – Aug - 20	EERC	<0.1%	16.7%	83.3%
Boundary Dam 6	2003–Dec-03-05	SRC	1.8%	18.1%	80.1%
Poplar River 1	2005–Nov–11-16	SRC/EERC	0	26.6%	73.4%
Poplar River 1	2005–Oct-17,18	SRC/EERC	0	27.3%	72.7%
Poplar River 2	2007–Jun-13,14	EERC	0	6.2%	93.8%
Poplar River 2	2008–Mar–11,12	EERC	0.4%	39.2%	60.4%
Shand	2004–May-13,14	MAXXUM	0.06%	6.9%	93.0%

As SaskPower's plants are all mine-to-mouth operations, the fuel remains constant and no process changes have occurred at Boundary Dam or Shand, mercury speciation in this reporting period should be represented by the above data.

g) Mercury Content of Coal (kg)

Boundary Dam Power Station Unit 1	27
Boundary Dam Power Station Unit 2	26
Boundary Dam Power Station Unit 3	51
Boundary Dam Power Station Unit 4	49
Boundary Dam Power Station Unit 5	57
Boundary Dam Power Station Unit 6	99
Total for Boundary Dam Power Station	310
Poplar River Power Station Unit 1	120
Poplar River Power Station Unit 2	188
Total for Poplar River Power Station	309
Shand Power Station Unit 1	119
Total for Shand Power Station	119
Total for SaskPower	738

Amount of Mercury Retained in Fly Ash (kg)

Boundary Dam Power Station Unit 1	2.0
Boundary Dam Power Station Unit 2	3.2
Boundary Dam Power Station Unit 3	1.4
Boundary Dam Power Station Unit 4	1.2
Boundary Dam Power Station Unit 5	3.1
Boundary Dam Power Station Unit 6	6.8
Total for Boundary Dam Power Station	17.9
Poplar River Power Station Unit 1	2.7
Poplar River Power Station Unit 2	66.1
Total for Poplar River Power Station	68.8
Shand Power Station Unit 1	4.5
Total for Shand Power Station	4.5
Total for SaskPower	91.2

Amount of Mercury Retained in Bottom Ash (kg)

Boundary Dam Power Station Unit 1	n.d.
Boundary Dam Power Station Unit 2	n.d.
Boundary Dam Power Station Unit 3	n.d.
Boundary Dam Power Station Unit 4	n.d.
Boundary Dam Power Station Unit 5	n.d.
Boundary Dam Power Station Unit 6	n.d.
Total for Boundary Dam Power Station	n.d.
Poplar River Power Station Unit 1	n.d.
Poplar River Power Station Unit 2	n.d.
Total for Poplar River Power Station	n.d.
Shand Power Station Unit 1	.05
Total for Shand Power Station	.05
Total for SaskPower	.05

h) Combustion Residues Mercury Content, Mass & Management Method (Mg)

Boundary Dam Power Station Unit 1	54,566
Boundary Dam Power Station Unit 2	51,840
Boundary Dam Power Station Unit 3	102,751
Boundary Dam Power Station Unit 4	98,609
Boundary Dam Power Station Unit 5	113,806
Boundary Dam Power Station Unit 6	199,780
Total for Boundary Dam Power Station	621,352
Poplar River Power Station Unit 1	173,686
Poplar River Power Station Unit 2	266,191
Total for Poplar River Power Station	439,877
Shand Power Station Unit 1	204,364
Total for Shand Power Station	204,364
Total for SaskPower	1,267,142

Fly ash and bottom ash are hydraulically transported to ash lagoons at both Boundary Dam and Poplar River and the transport water is circulated back to the plant to collect more ash. Lagoons at both plants are lined and monitored to ensure ash constituents do not migrate into the environment. Extensive testing of by-products resulting from the test work at the ECRF have demonstrated that any mercury captured by activated carbon is effectively fixed and that less mercury is released than when activated carbon is not present. Consequently, ashes containing carbon at Poplar River are also placed in the lagoons. None of the ash produced at Poplar River is currently utilized, although interest in this is increasing. About 15% of the ash produced at Boundary Dam is utilized, but greater demand is being experienced and SaskPower is considering upgrading the infrastructure at Boundary Dam to accommodate the anticipated added activity.

At Shand fly ash and bottom ash are dry hauled to a dedicated placement site that is designed to minimize any contact with water. The site is also lined and monitored to prevent ash constituents from entering the environment. Recent fly ash utilization at Shand has been about 30% and this is expected to increase significantly. Applications for most, if not all, of the fly ash produced at Shand are expected to occur in the next few years.

MANITOBA

Manitoba has only one small coal-fired electricity generation plant located in Brandon. Under Manitoba Statute (*The Climate Change and Emissions Reduction Act*, C.C.S.M. c. C135), after December 31, 2009, Manitoba Hydro is not to use coal to generate power, except to support emergency operations.

BRANDON GENERATING STATION

a) Annual Mercury Emissions

The annual emissions of total mercury in calendar year 2008 were 9.575 kilograms via the air and 0.750 kilograms in the ash.

b) Mercury Capture Rates

This is not a requirement of the Manitoba facility since is not a new generating unit. However, during 2008 the percent mercury capture rate was 9.68%.

c) Monitoring methods used for all parameters

Manitoba Hydro utilizes the Mass Balance method of determining their total annual mercury emissions. Mass balance calculations are made following the UDCP guide for mercury from coal-fired electric power generation. An annual stack testing program for mercury emissions, conducted in August 2008, provides mercury speciation data to support the mass balance calculations. The results of the 2008 stack testing program are within ±20% of the mass balance results, thereby corroborating the mass balance results reported.

The mercury speciation in flue gas sampling program was designed to comply with the requirements of "*The Canadian Uniform Data Collection Program (UDCP) for Mercury from Coal-Fired Electric Power Generation*", developed by the Canadian Council of Ministers of the Environment Mercury Canada-Wide Standards Development Committee in January 2003. This test program employed wet chemistry stack testing in accordance with the Ontario Hydro Method. The table below outlines the test matrix that was followed in completing this objective.

Test Matrix

Sampling Locations	No. of Runs	Sample/Type Pollutant	Sampling Method	Sample Run Time (min)	Analytical Method	Analytical Labora-tory
Precipitator Inlet	3	Speciated Mercury	Ontario Hydro Method	144	CVAAS(1) or CVAFS(2)	ALS(3)
Precipitator Outlet	3	Speciated Mercury	Ontario Hydro Method	150	CVAAS(1) or CVAFS(2)	ALS(3)

(1) CVAAS – Cold vapour atomic absorption spectrometry
(2) CVAFS – Cold vapour atomic fluorescence spectromety
(3) ALS – ALS Laboratory Group, Burlington, Ontario

The speciated mercury samples were collected isokinetically which allowed the simultaneous determination of stack gas temperatures and velocities, stack gas composition and moisture content.

Mercury content of coal and coal combustion residues (fly ash, bottom ash) are determined routinely by Manitoba Hydro throughout the year. The sampling protocol is outlined in the document submitted to Manitoba Conservation entitled "Manitoba Hydro Brandon Generating Station Site Specific Test Plan for Mercury in Coal, Ash & Residue Sampling and Analysis Program". The program is designed to collect and analyze coal and residue composite samples every week during the year when Brandon Unit #5 is generating. Weekly composite samples are comprised of three daily samples taken during the week. Bottom ash samples were only taken during the first three weeks of the testing program to verify that mercury content in the ash was very low (below the detection limit). The weekly coal and residue sampling program employs the following test methods:

Applicable Reference Methods

COAL

TOPIC	STANDARD	TITLE
Sampling	ASTM D6609	Standard Guide for Part-Stream Sampling of Coal
Sample Preparation	ASTM D2013	Standard Practice of Preparing Coal Samples for Analysis
% Moisture	ASTM D3302	Standard Test Method for Total Moisture in Coal
% Moisture	ASTM D3173	Standard Test Method for Moisture in the Analysis Sample of Coal and Coke
Mercury	ASTM D6722	Standard Test Method for Total Mercury in Coal and Coal Combustion Residues by Direct Combustion Analysis
Mercury	EPA Method 7473	Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry
% Ash	ASTM D3174	Standard Test Method for Ash in the Analysis Sample of Coal and Coke from Coal
% Sulphur	ASTM D4239C	Standard Test Methods for Sulfur in the Analysis Sample of Coal and Coke Using High Temperature Tube Furnace Combustion Methods
Higher Heating Value	ASTM D5865	Standard Test Method for Gross Calorific Value of Coal and Coke
Higher Heating Value	ISO 1928	Solid mineral fuels -- Determination of gross calorific value by the bomb calorimetric method, and calculation of net calorific value

FLY ASH

TOPIC	STANDARD	TITLE
Sampling	No Standard	Not Applicable
Sample Preparation	No Standard	Recommended size reduction is 150-um (No. 100) U.S.A. standard sieve
% Moisture	ASTM D3302	Standard Test Method for Total Moisture in Coal
% Moisture	ASTM D3173	Standard Test Method for Moisture in the Analysis Sample of Coal and Coke
Mercury	ASTM D6722	Standard Test Method for Total Mercury in Coal and Coal Combustion Residues by Direct Combustion Analysis
Mercury	EPA Method 7473	Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry
% Sulphur	ASTM D5016	Standard Test Method for Sulfur in Ash from Coal, Coke, and Residues from Coal Combustion Using High-Temperature Tube Furnace Combustion Method with Infrared Absorption

BOTTOM ASH

TOPIC	STANDARD	TITLE
Sampling	No Standard	Not Applicable
Sample Preparation	No Standard	Recommended size reduction is 150-um (No. 100) U.S.A. standard sieve
Mercury	ASTM D6722	Standard Test Method for Total Mercury in Coal and Coal Combustion Residues by Direct Combustion Analysis
Mercury	EPA Method 7473	Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry

Additionally, coal and ash composite samples were collected in conjunction with the speciated mercury emission testing to allow mercury mass balance calculations per the UDCP for mercury guide. Coal composite samples from both the pulverizer pipes and the coal feeder were collected, prepared and analyzed for ultimate and proximate analysis, calorific value, %chlorine, and mercury. Composite combustion residue (fly ash and bottom ash) samples were collected for analysis of total mercury, %chlorine, %carbon, % sulphur and %moisture.

d) Justification of Alternative Methods

No alternative methodologies are employed by Manitoba Hydro for the determination of total annual mercury emissions.

Minor modifications to the speciated mercury emissions testing methodologies were employed for the August 2008 source testing program. These modifications were discussed with and presented to Manitoba Conservation in a Pre-test Plan. Approval to proceed with the sampling program and minor test method modifications was received from Manitoba Conservation prior to testing. The test method deviations are discussed in Section 3.2 of the Dillon mercury source testing report.

e) Supporting Data

No supporting data was requested by Manitoba Conservation.

f) Mercury Speciation

Mercury speciation of the total annual mercury air emissions is available from the results of the 2008 mercury source testing program. The Ontario Hydro Method allows for the determination of elemental mercury and oxidized mercury (both particle-bound and non-particle-bound). Table 3.2 summarizes the results of the electrostatic precipitator inlet / outlet triplicate source testing program and the results of mercury analyses performed on coal, fly ash and bottom ash samples collected concurrently with the air emissions testing. Based on the flue testing results, the majority of mercury loading to the electrostatic precipitator and emissions from the electrostatic precipitator is in the elemental form. The relative proportions of oxidized mercury and particle-bound mercury is similar in the upstream flue while the amount of particle-bound mercury is approximately fifty times lower than the oxidized mercury in the downstream flue.

On a percentage basis, elemental mercury represents 89% of the total mercury emissions and oxidized mercury represents 11% of the total mercury emissions.

Summary of Results				
Sample Location	Elemental Mercury (g/hr)	Oxidized Mercury (g/hr)	Particle-Bound Mercury (g/hr)	Total Mercury (g/hr)
Coal				
Run 1	Not applicable	Not applicable	Not applicable	3.09
Run 2				2.34
Run 3				2.33
Average				2.59
Bottom Ash				
Run 1	Not applicable	Not applicable	Not applicable	0.02
Run 2				0.02
Run 3				0.02
Average				0.02
Fly Ash				
Run 1	Not applicable	Not applicable	Not applicable	0.07
Run 2				0.09
Run 3				0.06
Average				0.07
Downstream Flue				
Run 1	2.06	0.23	0.006	2.29
Run 2	1.90	0.24	0.004	2.15
Run 3	1.90	0.22	0.005	2.13
Average	1.95	0.23	0.005	2.19
Upstream Flue				
Run 1	2.41	0.13	0.093	2.64
Run 2	2.24	0.06	0.118	2.41
Run 3	2.22	0.09	0.203	2.51
Average	2.29	0.09	0.138	2.52

g) Mercury Content of Coal

The mercury content of the coal during the 2008 calendar year (weekly sampling periods) ranged between 0.037 and 0.098 parts per million with an average of 0.063 (the weighted average mercury content was 0.061 ppm). The mercury content of the coal during the annual stack test (comprised of three test runs) was 0.063, 0.066 and 0.083 parts per million.

h) Combustion Residues Mercury Content, Mass & Management Method

The coal combustion residue mercury content and mass amounts are provided in the following table:

Coal Combustion Residue Type	Number of Samples	Mercury Content (ppm)	Average (ppm)	Mass Amounts (tonnes)	Total Mercury Released in the Ash (kg)
Fly ash	37	0.049 to 0.375	0.100	7,498	0.7496
Bottom ash	8	< 0.001 to 0.001	< 0.001	2,499	0.0003

Combining the amount of mercury in bottom ash and fly ash released results in a total release of mercury in the combustion residue of 0.750 kilograms.

The coal combustion residues are sent to an ash lagoon for storage. The Brandon Generating Station has approval to utilize the coal combustion residues for various purposes, including, but not limited to; unstabilized sub-base or base course in roads, as a component of cement-stabilized road bases and as an embankment material for roads, area fills and dikes. However, no coal ash was utilized at Brandon in 2008.

ONTARIO

Ontario currently has four operating coal-fired electric generating stations. Ontario is legally required by regulation to phase out coal use at all four coal-fired generating stations by the end of 2014 and has initiated a series of measures including announcing the phasing out of four coal-fired units in 2010. For 2008, Ontario's total mercury emissions from coal-fired electric generating stations were 191 kilograms.

Generation Station	**Kilograms emitted in 2008**
Lambton	58 kg
Nanticoke	84 kg
Thunder Bay	31 kg
Atikokan	18 kg
Total	191 kg

Since the 2003 baseline year Ontario has reduced its mercury emissions from coal-fired electric power generation plants by 60%. Closing the Lakeview coal-fired electricity generating station in April 2005 was an important first step in reducing Ontario's mercury emissions. Since the coal-phase-out was announced, Ontario has not and will not be initiating any new coal-fired electric power generation.

LAMBTON GENERATING STATION

a) Annual Mercury Emissions

Year	Mass Mercury Emissions – to Air (kg)
2000	174
2001	164
2002	130
2003	122
2004	46
2005	67
2006	53
2007	107
2008	58

b) Monitoring Methods Used for All Parameters

The sampling and analytical procedures used to compile the mercury emission figure are described in the accepted Mercury Monitoring Reporting Program (MMRP) dated September 2008.

c) Justification for Alternative Methods

Mass balance calculations were used to calculate mercury emissions from Units 3, 4 (scrubbed units). We have a high confidence in the results because of the sampling frequency for gypsum and sludge committed to in the MMRP.

MASS BALANCE CALCULATIONS

The mass balance method used for Units 3, 4 is similar to the method used for Units 1, 2, but gypsum and sludge are incorporated in the calculation.

The following is a description of the general steps taken in performing the mass balance method:

Mercury Concentration in Coal and its Residues

- The monthly mercury concentration (mg/kg) in coal is determined from the monthly composite coal samples from each month during the year.
- The monthly mercury concentration (mg/kg) in fly ash is determined from the monthly composite ash samples from each month during the year.
- The annual mercury concentration (mg/kg) is bottom ash is determined from the single grab sample taken during the year
- The monthly mercury concentration (mg/kg) in gypsum is determined from the monthly composite gypsum samples from each month during the year.

- The monthly mercury concentration (mg/kg) in Flue Gas Desulphurization sludge is determined from the single grab sample taken each month during the year.

Mass of Coal and its Residues

- Total coal burned of each coal type in a month is determined (Mg) from the mass of coal consumed in the period using station Operating Results and Ledger (ORaL) records.
- Total ash land filled from each coal type in a month (Mg) is calculated. The monthly quantity of ash produced for each coal type is calculated as a function of monthly station coal consumption and the ash content of the coal. The station monthly ash production figure is then separated into fly ash and bottom ash components using a percentage split for each coal type. The mass of fly ash produced for each fuel type is them multiplied by the precipitator efficiency to determine the mass of fly ash land filled each month.
- Total bottom ash produced in the year (Mg) is calculated. The monthly quantity of ash produced for each coal type is calculated as a function of monthly station coal consumption and the ash content of the coal. The station monthly ash production figure is then separated into fly ash and bottom ash components using a percentage split for each coal type. The derived monthly bottom ash mass is them summed into a total annual mass.
- Total gypsum generated in a month (Mg) is calculated. The monthly quantity of gypsum produced each month is calculated as a function of monthly station coal consumption values for each FGD equipped unit, the sulphur content of the fuel, the SO_2 removal efficiency of the FGD and the molar ratio of sulphur to gypsum.
- The monthly mass of sludge land filled is the sum of the mass of each load of sludge deposited at the sludge landfill during the month.

Monthly Mass of Mercury

- The monthly mass of mercury (kg) in coal is the product of the concentration of mercury in coal and the total coal burned for each fuel type in a given month.
- The monthly mass of mercury (kg) trapped in the land filled fly ash is the product of the concentration of mercury in ash and the mass of ash land filled for each fuel type in a given month.
- The monthly mass of mercury (kg) trapped in gypsum is the product of the concentration of mercury in the gypsum and the mass of gypsum produced in a given month.
- The monthly mass of mercury (kg) trapped in the land filled sludge is the product of the concentration of mercury in the sludge and the mass of sludge land filled in a given month.

Annual Mass of Mercury

- The annual mass of mercury (kg) in coal, land filled fly ash, gypsum and sludge is the sum of the calculated monthly masses for the year.
- The annual mass of mercury (kg) trapped in the bottom ash is the product of the concentration of mercury in bottom ash and the mass of bottom ash for each fuel type in the year.
- The annual mass of mercury (kg) emitted to air is the annual mass of mercury contained in the various residues subtracted from the annual mass of mercury in coal.

Fly Ash Sampling Study

Over the course of 12 months, the 2008 calendar year, a fly ash sampling study was conducted at Lambton GS on both Units 1&2 and 3&4. The purpose of the study was to determine whether monthly composite sampling provides results consistent with weekly composite sampling.

Fly ash grab samples were taken three times a week from each unit pair's fly ash silo (i.e. Unit 1&2 and Unit 3&4) consistent with the sampling program outlined in the MMRP for Lambton GS. A single grab sample from each unit pair's fly ash silo was taken concurrently once per week. The thrice weekly samples were combined into a single weekly composite sample from each unit pair. The once weekly samples were combined into a single monthly composite sample for each unit pair. These composite samples were sent for mercury analysis and the results underwent statistical analysis.

A student's t-test for two data sets with equal variances was conducted between the two sets of mercury data. The test determines whether the population mean of each data set are statistically the same.

The analysis showed that at even a 99% confidence interval there is a very good correlation between the mean values of the weekly and monthly composite samples. These results lead to the conclusion that the population means are statistically identical therefore showing that monthly composite sampling provides results that are consistent with weekly sampling.

A second analysis was performed in which fly ash generation numbers were combined with the mercury content from each dataset to give total mercury mass for the period, and then a relative difference was calculated.

This analysis again showed a very good correlation between the calculated mass based on the weekly and monthly composite samples.

Based on these analyses Lambton GS applied for reduced fly ash sampling which was approved. Based on this approval, Lambton GS used the results from the monthly composite fly ash samples in its 2008 mercury emission calculations. Going forward Lambton GS will be following the approved sampling strategy of sampling fly ash weekly and sending for analysis monthly composite samples for each unit pair.

d) Supporting Data

The following tables show the coal consumption, ash production, and average mercury concentrations for each unit pair used to calculate the 2008 mercury emissions. Note: Due to rounding, re-computation of the values in this table may not yield the exact results.

Unit 1&2 Mass and Mercury Concentration

Unit 1&2	Coal		Fly Ash		Bottom Ash	
	Mass (Mg)	Hg (mg/kg)	Mass (Mg)	Hg (mg/kg)	Mass (Mg)	Hg (mg/kg)
January	64458	0.074	6170	0.229		
February	87682	0.084	8002	0.230		
March	80026	0.104	7628	0.324		
April	47643	0.094	4785	0.311		
May	36191	0.077	3471	0.294		
June	69781	0.080	6469	0.266	9184	0.039
July	87651	0.077	9645	0.270		
August	48702	0.078	4368	0.320		
September	22422	0.090	2297	0.320		
October	15945	0.096	1581	0.320		
November	42162	0.084	4242	0.280		
December	49074	0.099	4852	0.430		

Unit 3&4 Mass and Mercury Concentration

	Coal		Gypsum		EWPT Sludge		Fly Ash		Bottom Ash	
	Mass (Mg)	Hg (mg/kg)	Mass (Mg)	Hg (mg/kg)	Mass (Mg)	Hg (mg/kg)	Mass (Mg)	Hg (mg/kg)	Mass (Mg)	Hg (mg/kg)
January	190732	0.103	24774	0.290	596	8.400	13594	0.204		
February	166734	0.101	21481	0.263	849	6.169	14830	0.186		
March	182070	0.094	24517	0.249	853	4.938	15093	0.222		
April	93848	0.096	12672	0.198	776	8.273	6475	0.246		
May	78463	0.105	9917	0.170	480	17.135	5478	0.214		
June	135244	0.098	16750	0.122	1065	4.147	9873	0.242	19579	0.059
July	153835	0.106	19966	0.294	226	6.227	12169	0.230		
August	169760	0.114	21761	0.354	633	8.079	13077	0.250		
September	183753	0.105	23006	0.403	866	11.842	13714	0.240		
October	136585	0.112	17820	0.269	777	6.501	10231	0.270		
November	114820	0.093	14602	0.322	685	8.838	8097	0.220		
December	87071	0.114	12018	0.182	250	8.591	6082	0.260		

The following tables show the calculated mass of mercury in coal and its various residues for each unit pair used to calculate the 2008 mercury emissions. Note: Due to rounding, re-computation of the values in this table may not yield the exact results. Also note that the effluent from the FGD sludge dewatering process was not included in the mass balance as analysis shows that no mercury is captured in this effluent.

Unit 1&2 Mercury Mass (kg)

Month	Coal	Fly Ash	Bottom Ash
January	4.8	1.4	
February	7.4	1.8	
March	8.3	2.5	
April	4.5	1.5	
May	2.8	1.0	
June	5.6	1.7	
July	6.7	2.6	
August	3.8	1.4	
September	2.0	0.7	
October	1.5	0.5	
November	3.5	1.2	
December	4.9	2.1	
Total	55.8	18.5	0.4
Total Released	37.0		

Unit 3&4 Mercury Mass (kg)

Month	Coal	Fly Ash	Bottom Ash	Gypsum	Sludge
January	19.6	2.8		7.2	5.0
February	16.8	2.8		5.7	5.2
March	17.1	3.3		6.1	4.2
April	9.0	1.6		2.5	6.4
May	8.2	1.2		1.7	8.2
June	13.3	2.4		2.0	4.4
July	16.3	2.8		5.9	1.4
August	19.4	3.3		7.7	5.1
September	19.3	3.3		9.3	10.3
October	15.3	2.8		4.8	5.1
November	10.7	1.8		4.7	6.1
December	9.9	1.6		2.2	2.1
Total	175.0	29.5	1.2	59.7	63.5
Total Released	21.0				

The FGD sludge mercury concentration is measured on a dry basis while the mass of land filled sludge is measured on a wet basis. The following assumptions and justifications are made to show that this does not significantly affect the final reported mass of released mercury.

The mercury mass balance study conducted in 2005 at Lambton GS (attached in Appendix 2 of the MMRP) shows that roughly 40% of the sludge in the FGD effluent is deposited in the FGD effluent lagoon (Emergency Lagoon). If we assume that the mass of sludge land filled has 40% moisture content then the values cancel out and the above calculations stand.

To show that these assumptions are reasonable a verification was performed between the measured total mass of mercury released for units 3&4 versus a calculated total mass of mercury. This calculated total mass of mercury is based on the mercury emission rate measured during the mercury emission source test on Unit 3. The following formula was used to calculate this value.

$$\text{Calculated Annual Hg Release (kg)} = \frac{\text{Annual Generation for unit pair(Gw - hr)} \times \text{Source Test Measured Hg Emission Rate}\left(\frac{\text{mg}}{\text{s}}\right)}{\text{Avg. Load During Source Test for unit pair(Gw)}} \times \frac{3600\left(\frac{\text{s}}{\text{hr}}\right)}{1{,}000{,}000\left(\frac{\text{mg}}{\text{kg}}\right)}$$

The following table shows the inputs as well as the resultant calculated annual release of mercury.

Hg Source Test Verification	Unit 3&4	Unit 1&2
Annual Generation (Gw-hr)	10485.8	1815.4
Average Load during Source Test (Gw)	0.496	0.457
Measured Mercury Emission Rate (mg/s)	0.5	3
Calculated Annual Hg Release (kg)	19	43
Measured Annual Hg Release (kg)	21	37
% Difference	10%	-16%

The calculated annual release of mercury was compared to the actual measured total annual release of mercury from Unit 3&4 and as shown there was only a 3 kg (10%) difference between the two values with the reported value being the higher of the two.

This source test verification was performed on Unit 1&2 as well as an independent evaluation of the accuracy of the Calculated Annual Hg Release equation. As shown in the table, this approach again provided a calculated annual mercury release value reasonably close to the measured annual mercury release value.

e) Mercury Speciation

The following table summarizes the results of mercury tests conducted to date.

Emission Source	Unit	Sample Date	Particulate Mercury (mg/s)	Oxidized Mercury (mg/s)	Elemental Mercury (mg/s)	Total Mercury (mg/s)	Emission Concentration (ug/Rm3 dry)
Group 4							
Lambton	2	July, 2000	0.04	2.88	0.91	3.83	7.1
			1%	75%	24%		
Lambton	1	October, 2008	0.27	2.13	0.06	3	6
			9%	71%	20%		

Emission Source	Unit	Sample Date	Particulate Mercury (mg/s)	Oxidized Mercury (mg/s)	Elemental Mercury (mg/s)	Total Mercury (mg/s)	Emission Concentration (ug/Rm3 dry)
Group 5							
Lambton	3	May, 2001	<0.01	0.06	0.64	0.7	1.3
			<1%	9%	91%		
Lambton	4	September, 2003	<0.01	0.07	0.14	0.21	0.4
			<1%	32%	67%		
Lambton	4	November, 2004	<0.01	0.02	0.13	0.16	0.3
			1%	15%	84%		
Lambton	3	September, 2005	0.01	0.09	0.18	0.27	0.5
			4%	33%	67%		
Lambton	3	September, 2008	0.01	0.18	0.33	1.37	2.7
			3%	34%	64%		

f) Mercury Content of Coal; and,
g) Combustion Residues Mercury Content, Mass & Management Method

Please see the section d) above which details the amount of the different types of coal consumed and the amount of by-products generated as well as the associated mercury content.

In 2008, bottom ash was sold as a gravel substitute and gypsum was sold into the wallboard industry. Fly ash was land filled on site.

Ash Type	Quantity Diverted from Disposal (Mg)	Quantity Land Filled on Site (Mg)	Total (Mg)
Bottom Ash	28,763	0	28,763
Fly Ash	23,395	168,828	192,223
Gypsum	219,284	0	219,284

NANTICOKE GENERATING STATION

a) Annual Mercury Emissions

Year	Mass Mercury Emissions – to Air (kg)
2008	84
2007	148
2006	145
2005	156
2004	134
2003	205
2002	250
2001	226
2000	229

The decrease in mass mercury emissions for 2008 was due to a decrease in mercury concentration in sub-bituminous coal.

b) Monitoring Methods Used for All Parameters

The sampling and analytical procedures used to compile the mercury emission figure are described in the accepted MMRP dated September 2008.

c) Justification for Alternative Methods

No alternate methods were used in 2008

d) Supporting Data

The following table shows the coal consumption, ash production, and average mercury concentrations used to calculate emissions.

Note: Due to rounding, re-computation of the values in this table may not yield the exact results.

Material	Mercury Concentration (mg/kg) H_c/H_a	Moisture (%)	Amount Consumed or Produced (Mg) T_c/T_a	Total Mercury (kg) C_m/A_m
Sub-bituminous Coal	0.060	28.0	6,385,386	277
Bituminous Coal	0.070	7.1	1,427,466	92
Bottom Ash	0.01		72,793	<1
Fly Ash	0.70		406,739	285
			Emitted to Air	84

(e) Mercury Speciation

The following table summarizes the results of mercury tests conducted to date.

Emission Source	Unit	Sample Date	Particulate Mercury (mg/s)	Oxidized Mercury (mg/s)	Elemental Mercury (mg/s)	Total Mercury (mg/s)	Emission Concentration (ug/Rm3 dry)
Group 1							
Nanticoke	2	April. 2007	0.018	0.84	1.0	1.86	3.4
			1.0%	45.6%	54.3%		
Nanticoke	2	April, 2005	0.021	0.86	1.24	2.12	4.2
			1.0%	40.5%	58.5%		
Nanticoke	3	June, 2007	0.00	0.89	1.31	2.20	4.2
			0.2%	40.3%	59.5%		
Nanticoke	3	April, 2005	0.16	0.65	0.47	1.28	2.4
			12.5%	50.8%	36.7%		
Nanticoke	6	Aug, 2004	0.02	0.59	0.63	1.24	2.5
			1.9%	47.4%	50.7%		
Nanticoke	6	June, 1999	0.04	0.44	0.54	1.03	2.1
			4.1%	43.0%	52.9%		

Emission Source	Unit	Sample Date	Particulate Mercury (mg/s)	Oxidized Mercury (mg/s)	Elemental Mercury (mg/s)	Total Mercury (mg/s)	Emission Concentration (ug/Rm3 dry)
Group 2							
Nanticoke	5	March, 2007	0.23	0.53	0.43	1.18	2.3
			19.2%	44.5%	36.3%		
Nanticoke	5	Sept, 2004	0..02	1.02	0.28	1.32	2.5
			1.7%	76.9%	21.4%		
Nanticoke	5	April, 2002	0.54	0.73	0.23	1.50	2.8
			35.9%	49.0%	15.1%		
Group 3							
Nanticoke	7	June, 2008	0.01	2.04	0.63	2.68	5.1
			0.4%	76.0%	23.6%		
Nanticoke	7	April, 2005 Test 1	0.09	1.10	0.11	1.31	2.4
			6.9%	84.4%	8.7%		
Nanticoke	7	April, 2005 Test 2	0.20	0.89	0.09	1.18	2.3
			16.5%	75.7%	7.8%		
Nanticoke	7	Aug, 2004	0.03	1.46	0.36	1.85	3.7
			1.9%	78.8%	19.3%		
Nanticoke	7	July, 2004	0.01	2.17	0.13	2.31	4.6
			0.6%	93.9%	5.5%		
Nanticoke	7	May, 2004	0.01	1.16	0.20	1.37	2.7
			0.6%	84.7%	14.7%		
Nanticoke	7	April, 2004	0.17	1.05	0.08	1.30	2.5
			12.8%	81.2%	6.0%		

f) Mercury Content of coal; and,
g) Combustion Residues Mercury Content, Mass & Management Method

Please see section (d) on Supporting Data. It details the amount of the different types of coal consumed and the amount of ash generated as well as the associated mercury content.

In 2008, fly ash and bottom ash was sold to the cement making and concrete industries. The remainder was land filled on site.

Ash Type	Quantity Diverted from Disposal (Mg)	Quantity Land Filled on Site (Mg)	Total (Mg)
Bottom Ash	55,330	17,463	72,793
Fly Ash	253,168	153,571	406,739

THUNDER BAY GENERATING STATION

a) Annual Mercury Emissions

Year	**Mass Mercury Emissions – to Air (kg)**
2000	56
2001	78
2002	72
2003	57
2004	37
2005	37
2006	39
2007	24
2008	31

b) Monitoring Methods Used for All Parameters

The sampling and analytical procedures used to compile the mercury emission figure are described in the accepted MMRP dated September 2008.

c) Justification for Alternative Methods

No alternate methods were used in 2008

d) Supporting Data

The following table shows the coal consumption, ash production, and average mercury concentrations used to calculate emissions. Due to rounding, re-computation of the values in this table may not yield the exact results.

Material	Mercury Concentration (mg/kg dry)	Coal Consumed (Mg wet)	Coal Consumed or Ash Produced (Mg dry)	Total Mercury (kg)
Sub-bituminous Coal	0.085	243,075	181,212	15
Lignite Coal	0.112	212,913	142,183	16
Bottom Ash	0.034		7,463	0
Fly Ash	<0.005		22,385	0
Mercury Emitted to Air				31

e) Mercury Speciation

The following table summarizes the results of mercury tests conducted to date.

Emission Source	Unit	Sample Date	Particulate Mercury (mg/s)	Oxidized Mercury (mg/s)	Elemental Mercury (mg/s)	Total Mercury (mg/s)	Emission Concentration (ug/Rm3 dry)
Group 6							
Thunder Bay	2	June, 1998	<0.01	0.07	1.76	1.83	10.7
			1%	4%	96%		
Thunder Bay	2	Dec, 2006	<0.01	0.16	1.59	1.75	10.0
			0%	9%	91%		
Thunder Bay	3	Dec, 2008	<.01	0.05	1.09	1.14	6.3
			0%	4%	96%		

f) Mercury Content of coal; and,
g) Combustion Residues Mercury Content, Mass & Management Method

Please see section d) above which details the amount of the different types of coal consumed and the amount of ash generated as well as the associated mercury content.

In 2008, fly ash was sold to the cement making and concrete industries. The remainder was land filled on site.

Ash Type	Quantity Diverted from Disposal (Mg)	Quantity Land Filled on Site (Mg)	Total (Mg)
Bottom Ash	0	7,463	7,463
Fly Ash	24,099	*	22,385

* indicates that sales exceeded production; the remainder was recovered from storage

ATIKOKAN GENERATING STATION

a) Annual Mercury Emissions

Year	Mass Mercury Emissions – to Air (kg)
2000	35
2001	37
2002	38
2003	39
2004	42
2005	40
2006	26
2007	25
2008	18

b) Monitoring Methods Used for All Parameters

The sampling and analytical procedures used to compile the mercury emission figure are described in the accepted MMRP dated September 2008.

c) Justification for Alternative Methods

No alternate methods were used in 2008.

d) Supporting Data

The following table shows the coal consumption, ash production, and average mercury concentrations used to calculate emissions. Due to rounding, re-computation of the values in this table may not yield the exact results.

Material	Mercury Concentration (mg/kg dry)	Coal Consumed (Mg wet)	Coal Consumed or Ash Produced (Mg dry)	Total Mercury (kg)
Lignite Coal	0.112	242,459	160,241	18
Bottom Ash	<0.005		5,115	0
Fly Ash	0.027		20,395	1
			Emitted to Air	18

e) Mercury Speciation

The following table summarizes the results of mercury tests conducted to date.

Emission Source	Unit	Sample Date	Particulate Mercury (mg/s)	Oxidized Mercury (mg/s)	Elemental Mercury (mg/s)	Total Mercury (mg/s)	Emission Concentration (ug/Rm3 dry)
Group 7							
Atikokan	1	Sep, 1998	<0.01	0.18	2.46	2.64	10.1
			0%	7%	93%		

f) Mercury Content of coal; and,
g) Combustion Residues Mercury Content, Mass & Management Method

Please see section d) above which details the amount of the different types of coal consumed and the amount of ash generated as well as the associated mercury content.

In 2008, fly ash was sold to the cement making and concrete industries. The remainder was land filled on site.

Ash Type	Quantity Diverted from Disposal (Mg)	Quantity Land Filled on Site (Mg)	Total (Mg)
Bottom Ash	0	5,115	5,115
Fly Ash	11,829	8,566	20,395

NEW BRUNSWICK

Through the CWS, New Brunswick has committed to reducing mercury emissions from existing coal-fired power plants within the province to 25 kilograms per year by 2010.

GRAND LAKE AND BELLEDUNE GENERATING STATIONS

There are two existing coal-fired power plants in New Brunswick (Grand Lake and Belledune Generating Stations). Mercury emissions from these two power plants totalled approximately 44 kg/yr in 2008 due to reduced operation of the Grand Lake Generating Station. NB Power has committed to take the Grand Lake Generating Station out of service by June 2010, which will enable New Brunswick to meet the mercury emission cap of 25 kilograms per year.

NOVA SCOTIA

Nova Scotia has four coal-fired electric power generation plants which utilize a combination of coal and petroleum coke for fuel. Mercury emissions for these plants are regulated through a fleet-wide cap under the Air Quality Regulations. The Air Quality Regulations established a mercury cap of 168 kg for emissions from coal-fired plants in 2005. The Air Quality Regulations were amended to reduce this cap to 65 kg in 2010 to comply with the Canada-Wide Standards.

LINGAN, POINT TUPPER, TRENTON AND POINT ACONI POWER STATIONS

Annual Mercury Emissions (kilogram)*

Facility	**Year**						
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Lingan	104	83	87	55	86	82	95
Point Tupper	15	24	24	13	23	31	24
Trenton	43	49	56	35	49	41	40
Point Aconi	1.0	2.5	2.1	2.1	2.5	2.6	2.9
Total Annual Emissions	**163**	**158.5**	**169.1**	**105.1**	**160.5**	**156.6**	**161.9**

*Source: Environment Canada NPRI