This addendum modifies and supplements the following report, which was approved by the CASA Board on March 12, 2015:

Report on the Second Five-Year Review of the Emissions Management Framework for the Alberta Electricity Sector (2013)

June 9, 2015

1. This Addendum modifies and supplements the attached report, *Report on the Second Five-Year Review of the Emissions Management Framework for the Alberta Electricity Sector (2013)*, March 4, 2015.

2. Wherever there is any conflict between this Addendum and the report, the provisions of this Addendum will control and the report will be interpreted accordingly.

3. Notwithstanding any terms in the report, it is modified as follows:

    a. Section 4.2: Gas-Fired Generation – for full details, refer to the report entitled *Control Technologies and Reduction Strategies: Recommendations to the Electricity Framework Review Project Team for their consideration. Prepared by the Control Technologies and Reduction Strategies Task Group of the CASA Electricity Framework Review Project Team,* June 9, 2015. Available on the CASA website.

    b. Section 4.3: Biomass-Fired Generation

        Replace

        Recommendation 4: Emissions Standards for Biomass-Fired Generation

        The 2013 Electricity Framework Review Project Team recommends that:

        > The 2018 Five-Year Review Project Team review the need to develop emission s standards for biomass-fired generation. If there is a need, the 2018 Team should determine BATEA-based emissions standards for biomass-fired generation.

        With

        Recommendation 4: Emissions Standards for Biomass-Fired Generation

        The 2013 Electricity Framework Review Project Team recommends that:

        > The 2018 Five Year Review team review the need to include biomass sources of electricity generation in the Alberta Electricity Framework.

    c. Section 7: Particulate Matter Management System – for full details, refer to the report entitled *PM Management System: Recommendations to the Electricity Framework Review Project Team for their consideration. Prepared by the PM Management System Task Group of the CASA Electricity Framework Review Project Team*, April 16, 2015. Available on the CASA website.

Report on the Second Five-Year Review of the Emissions Management Framework for the Alberta Electricity Sector (2013)

March 4, 2015

Contents

List of Tables

-

List of Figures

Acronyms and Abbreviations

AEMERA	Alberta Environmental Monitoring, Evaluation and Reporting Agency
AESO	Alberta Electric System Operator
BATEA	Best Available Technology Economically Achievable
bhp-hr	brake horsepower-hour
BLIERs	Base Level Industrial Emissions Requirements
CASA	Clean Air Strategic Alliance
CO_2	Carbon dioxide
EFR	Electricity Framework Review
ESRD	(Alberta) Environment and Sustainable Resource Development
ETS	Emissions Trading System
g	Gram
GHG	Greenhouse gas
GoA	Government of Alberta
GWh	Gigawatt-hour
HEAT	Health and Ecological Assessment Task (Group)
Hg	Mercury
HP	horsepower
J	Joule
kg	kilogram
kWh	Kilowatt-hour
LTO	Long-term outlook (referring to AESO report)
MW	Megawatt
MWh	Megawatt-hour
ng	nanogram
NMHC	Non-methane hydrocarbon
NOx	Nitrogen oxides (also oxides of nitrogen)
PM	Particulate matter
SCR	Selective Catalytic Reduction
SO_2	Sulphur dioxide

1 Executive Summary and Recommendations

In November 2003, CASA published its report, *An Emissions Management Framework for the Alberta Electricity Sector*. This report and its 71 recommendations for managing air emissions from the electricity were developed using a collaborative multi-stakeholder approach and were accepted by the Government of Alberta.

To ensure continuous improvement and to keep the Framework timely and relevant, a key recommendation (#29) was that a multi-stakeholder review be done every five years. The intent of the five-year review is to assess new emission control technologies, update emission limits for new generation units, determine if emission limits for new substances need to be developed, review implementation progress, and determine if the Framework is achieving its emission management objectives. The first five-year review began in 2008, with the final report published in May 2010 (*Report on the First Five-Year Review of the Emissions Management Framework for the Alberta Electricity Sector*). This report contained 10 consensus recommendations.

In March 2013, the CASA Board approved a Project Charter and established a multi-stakeholder project team to conduct the second five-year review of the Framework. To maintain consistency and continuity, the project team used the same definitions as in the 2003 Framework.

To ensure a thorough review, the team established several task groups to consider specific aspects of its project charter in more detail. These were:

- The Implementation Assessment Task Group
- The Base Case Working Group
- The Control Technologies and Reduction Strategies Task Group
- The Health and Environmental Assessment Task Group
- The Communications Task Group
- The Particulate Matter Management Task Group

Another important element of the review was the preparation by the electricity generation industry of a continuous improvement report. With both federal and provincial activities underway to address climate change, greenhouse gases were considered to be outside the scope of this five-year review.

The CASA Board approved 13 consensus recommendations from the Electricity Framework Review Project Team in March 2015. This report presents the results of the second five-year review, including recommendations consistent with the intent and purpose of the five-year review recommendations in the 2003 Framework.

It should be noted that the EFR team did not reach a consensus on the need to review and/or adjust the Alberta Framework given fundamentally divergent views regarding what is required to allow changes to be made to the Framework. An Interim Report summarizing the views was approved by the CASA Board in June 2014. The report requested that the Government of Alberta consider if adjustments to the Framework are warranted and the nature of those adjustments, and provide a description of the path forward as appropriate. A final decision from the Government of Alberta on a full review of the Framework is still pending and that decision may require a review of any foregoing provisional agreements.

Summary of Recommendations

Recommendation 1: Emissions Standards for Conventional Coal-Fired Generation

The 2013 Electricity Framework Review Project Team recommends that:

The standards and credit limits in the *Report on the First Five-Year Review of the Emissions Management Framework for the Alberta Electricity Sector*, May 13, 2010 be carried over for conventional coal.

Recommendation 2: Emissions Standards for Unconventional Coal-Fired Generation

The 2013 Electricity Framework Review Project Team recommends that:

The standards and credit limits for unconventional coal should be approved on a case-by-case review by the regulator.

Recommendation 3: Emissions Standards for Gas-Fired Generation (Non-Consensus)

Although the CTRS Task Group had extensive discussions on developing an emissions standard for gas-fired generation, they were unable to reach agreement on a standard. The group's final report will include information on its six consensus recommendation, as well as details on the diversity of perspectives with regards to the non-consensus on emissions standards for gas-fired generation. The intent of the group's final report will be to provide input to any future policy development the Government of Alberta might undertake on this issue.

Recommendation 4: Emissions Standards for Biomass-Fired Generation

The 2013 Electricity Framework Review Project Team recommends that:

The 2018 Five-Year Review Project Team review the need to develop emission s standards for biomass-fired generation. If there is a need, the 2018 Team should determine BATEA-based emissions standards for biomass-fired generation.

Recommendation 5: Emissions Standards for New Diesel-Fired Reciprocating Engines (regular use units)

The 2013 Electricity Framework Review Project Team recommends that:

The following standards apply to new diesel-fired reciprocating engines in regular use units that are approved on January 1, 2016 or later:

> 1200 HP (0.89 MW) (<30 L displacement per cylinder): 0.50 g/bhp-hr (approximately 0.67 g/kWh)

> 699 kW (805 HP) (≥30 L displacement per cylinder): 1.8 g/kWh (approximately 1.34 g/bhp-hr)

These standards are expressed in a similar format to the US EPA Tier 4 Compression Ignition New Source Performance Standards, which include diesel-powered generator sets, and is based on selective catalytic reduction (SCR).

Recommendation 6: Emissions Standards for New Diesel-Fired Reciprocating Engines (stand-by units)

The 2013 Electricity Framework Review Project Team recommends that:

The following standard apply to new diesel-fired reciprocating engines in stand-by units that are approved on January 1, 2016 or later:

> 750 HP (0.560 MW) 4.8 g (NMHC+NOx)/bhp-hr (approximately 6.4 g (NOx+NMHC)/kWh)

This standard is expressed in a similar format to the US EPA Tier 2 Compression Ignition New Source Performance Standards for generator sets, and is based on combustion controls (that is, no SCR).

Recommendation 7: Emissions Standards for New Natural Gas-Fired Reciprocating Engines

The 2013 Electricity Framework Review Project Team recommends that:

The following standard apply to new natural gas-fired reciprocating engines that approved on January 1, 2016 or later:

> 75 kW (500 hp is US size range): 2.7 g/kWh (based on 2.01 g/bhp-hr)

This standard is based on the BLIERs for NOx for natural gas-fired reciprocating spark ignition engines, which are based on the US EPA requirements for these types of engines.

Recommendation 8: Evaluation of Category 2 Substances

The 2013 Electricity Framework Review Project Team recommends that:

The multi-stakeholder group undertaking the 2018 Electricity Framework Review ensure that each substance listed in Category 2 (i.e. Management actions need to be considered) is evaluated as described in Table 1 of this report.

Recommendation 9: Substances for Ongoing Surveillance

The 2013 Electricity Framework Review Project Team recommends that:

The multi-stakeholder group undertaking the health and ecological assessment for the next five-year review explicitly include substances listed in Category 3 in the search terms for the health and ecological literature reviews.

Recommendation 10: Future Substance Reviews

The 2013 Electricity Framework Review Project Team recommends that:

A multi-stakeholder Health and Environmental Assessment Task (HEAT) Group be convened as soon as possible after the 2018 Electricity Framework Review Project Team is established, and that it be provided with the terms of reference from the 2013 HEAT Group, to adjust as the new Group deems necessary.

Recommendation 11: Implementation of the Emissions Trading System

The 2013 Electricity Framework Review Project Team recommends that:

Implementation of the Emissions Trading System be assessed as part of the 2018 five-year review of the Alberta Electricity Emissions Management Framework.

Recommendation 12: GoA Decision on Previous Recommendations

The 2013 Electricity Framework Review Project Team recommends that:

The CASA Board request an update on the status of the GoA decision process related to recommendations 6, 7 and 9, as found in the 2010 report from the first five-year review.

Recommendation 13: Public Consultation

The 2013 Electricity Framework Review Project Team recommends that:

The 2018 Five-Year Review Project Team consider the role of public consultation and develop a plan at the beginning of its process.

2 The Electricity Sector in Alberta

Albertans expect to have a reliable supply of electricity to support their businesses, industries, and everyday activities. The electricity sector in this province has undergone many significant changes in the last 15 years or so, including deregulation, a rapidly growing demand due to industrial and population growth, and increasing public discussion about the potential for renewable energy sources. In addition to overall supply, transmission has also been a topic of interest when it comes to ensuring reliable electricity supplies across the province.

Figure 1 shows the installed capacity in the province, by source, as of September 2014. "Installed capacity" is the total amount of electricity that theoretically could be produced if all the facilities in Alberta were generating power. Total installed capacity as reflected in the chart is 14,598 megawatts (MW).

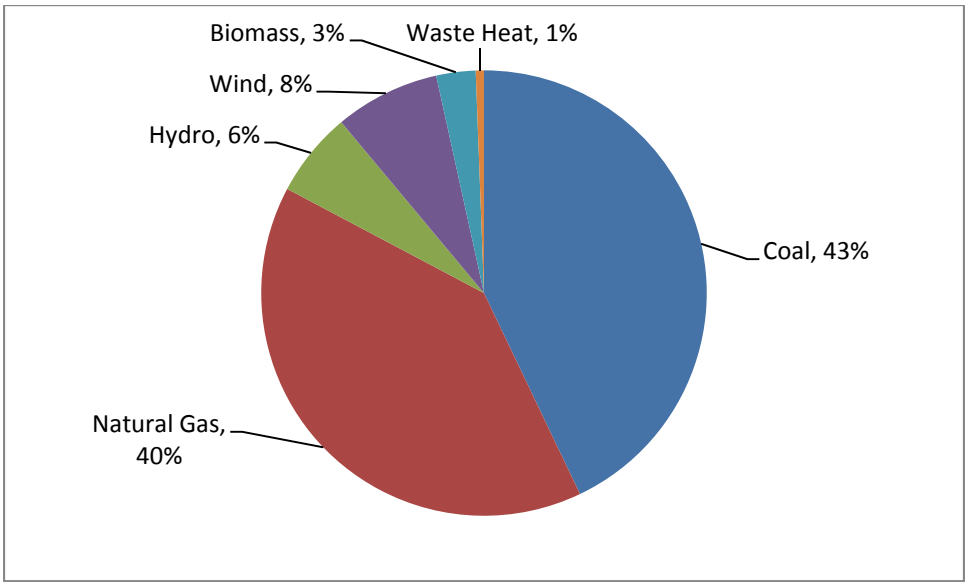

Figure 1: Alberta's Electric Energy Capacity by Source, 2014

Source: Alberta Utilities Commission and Alberta Electric System Operator (taken from Alberta Energy website, October 9, 2014, at http://www.energy.alberta.ca/Electricity/682.asp)

In 2013, Alberta produced 76,004 gigawatt-hours (GWh) of electricity; sources of this generation are shown in Figure 2.

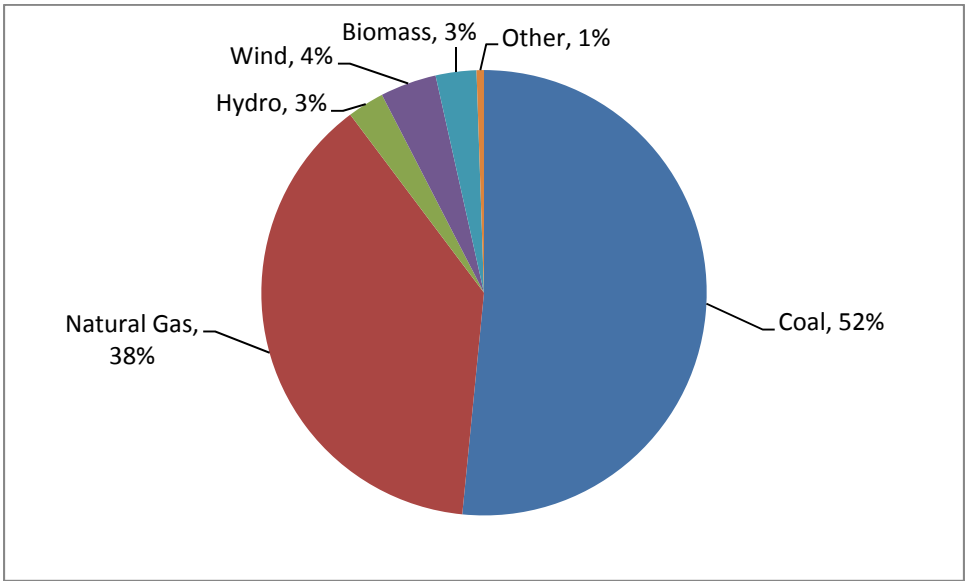

Figure 2: Alberta's Electric Energy Generation by Source, 2013

Source: Alberta Utilities Commission (taken from Alberta Energy website, October 9, 2014, at http://www.energy.alberta.ca/Electricity/682.asp). "Other" sources include fuel oil and waste heat.

The 2014 Long-term Outlook (LTO) for the electricity sector, prepared by the Alberta Electric System Operator (AESO), includes a 20-year peak demand and electricity consumption forecast and a generation capacity projection for Alberta. The LTO forecasts the Alberta economy to continue to grow strongly throughout the forecast period, driven by growth in oilsands development, and projects electricity consumption to grow in tandem with the economic outlook. Over the next 20 years, Alberta Internal Load is expected to grow at an average annual rate of 2.5%. Oilsands expansion will increase load growth directly, especially in the northeast, and economic growth associated with oilsands development will increase load growth across the province. With oilsands growth, cogeneration development will also occur. In the face of growing demand, the need to compensate for retirement of coal-fired generation, and anticipated low natural gas prices, gas-fired generation is expected to be the predominant source of new generation over the next 20 years.[1]

Electric power generation is a significant emitter of several major air pollutants: sulphur dioxide (SO_2), nitrogen oxides (NOx), and mercury (Hg). Coal-fired units also produce primary particulate matter (PM) and electricity generated by the burning of fossil fuels creates greenhouse gas emissions (GHGs). In 2012, this sector produced 32% of Alberta's total SO_2 and nearly 10% of its total NOx emissions. Mercury emissions from coal-fired units are the largest industrial source of those emissions with controls being implemented in 2011.

[1] Source: Alberta Electric System Operator. 2014. *AESO 2014 Long-term Outlook.* 76 pages. Available online at http://www.aeso.ca/downloads/AESO_2014_Long-term_Outlook.pdf.

2.1 Alberta's Emissions Management Framework for the Electricity Sector

In January 2002, Hon. Lorne Taylor, Alberta's then-Minister of Environment, asked the Clean Air Strategic Alliance (CASA) to develop a new way to manage air emissions from the electricity sector. The Electricity Project Team developed *An Emissions Management Framework for the Alberta Electricity Sector* (the Framework). The Framework was developed through a collaborative, multi-stakeholder process that included government, non-government organizations, locally-affected interest groups, and the Alberta electricity sector. The Framework is a set of 71 consensus recommendations, negotiated by the team and agreed to as a package. These recommendations were adopted by consensus of the CASA Board of Directors in 2003 and subsequently implemented as regulations in 2004–2005 by the Government of Alberta. The Framework reflects a creative mix of management strategies that increase long-term regulatory certainty for all parties, provide flexibility in reducing emissions, and encourage continuous improvement of the overall management system.

To ensure continuous improvement in both management and performance, the Framework recommends a defined multi-stakeholder evaluation process at five-year intervals (Recommendation 29). The intent of the five-year review is to assess new emission control technologies, update emission limits for new generation units, determine if emission limits for new substances need to be developed, review implementation progress and determine if the Framework is achieving its emission management objectives.

Each five-year review should be a publicly credible, transparent, participatory process that involves stakeholders from all sectors, including the public. If core assumptions are proven wrong, the Framework will be revised. A full review of the structure of the Framework itself would be triggered by the environmental and health factors noted in recommendation 34 and the economic factors noted in recommendation 35.

The first five-year review started in 2008 and the Electricity Framework Review (EFR) Team submitted its report and recommendations to the CASA Board in June 2009. The report contained ten consensus recommendations and one non-consensus item. The consensus items included revisions to the PM, NOx, and SO_2 emission standards for new coal-fired units based on improvements in emission control technologies, effective January 1, 2011. The non-consensus item pertained to NOx emission standards for new gas-fired generation for both peaking and non-peaking units. The Minister of Environment at the time, Hon. Rob Renner, asked the team to continue seeking consensus on this matter and substantial effort was made during 2009–2010 in response to this request. Despite those best efforts, consensus could not be achieved. A final report, including the interests and rationale with respect to the non-consensus recommendation, was forwarded to the Government of Alberta in May 2010 for decision. (Note: The final report from the first five-year review, which began in 2008, is referred to in this document and in the Project Charter for the current review as the "2010 report.")

2.2 The Alberta Framework and the National Context

In 2011 and 2012, the CASA Board discussed the potential misalignments between the Alberta Framework, Environment Canada's proposal for Base Level Industrial Emissions Requirements (BLIERs) for existing coal-fired electricity generation units under the National Air Quality Management System, and the proposed federal *Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations* (GHG Regulations). The Board emphasized the need for CASA to respond to these issues in a strategic manner and struck a Working Group to develop a

report on the potential misalignments. In December 2011, the working group presented its final report to the Board and, upon the Board's approval, the Government of Alberta committed to presenting the report at the Canadian Council of Ministers of the Environment Champion's table. On September 12, 2012, the federal GHG Regulations were published in the Canada Gazette, Part II: Official Regulations; the working group updated its report in October 2012 and resubmitted it to the CASA Board and the Government of Alberta.[2]

The CASA report argued that Alberta's Electricity Framework, developed through a collaborative multi-stakeholder process, was already in place and showing results, thus precluding the need for any other emissions management approach for the electricity sector in this province. In fact, there were concerns that the BLIERs could negate and undermine the Alberta approach.

The Framework considers Alberta's deregulated electricity market, is results-based and adaptable, and considers four priority pollutants (mercury, particulate matter, NOx and SO_2) whereas the Environment Canada approach dealt with only two (NOx and SO_2). These two substances were significantly reduced over five years in Alberta as a result of Framework implementation.[3] No firm direction on the BLIERs has come forward from Environment Canada in the intervening time, so BLIERs were not considered in the current five-year review.

2.3 The Second Five-Year Review of the Framework

In March 2013, the CASA Board approved a Project Charter and established the multi-stakeholder EFR project team to conduct the second five-year review of the Framework.[4] The goal of the project was:

> *To ensure the Emissions Management Framework for Alberta's Electricity Sector (the Framework) reflects current circumstances, the project team will conduct a Five-Year Review, as outlined in Recommendation 29 of the Framework. The team will also consider whether a review of the structure of the Framework itself is warranted and develop recommendations as appropriate.*

The Project Charter described an initial assessment to assist the team in determining if a review of the structure of the Framework itself was warranted. The initial assessment included three tasks:

1. GHG Regulations: Identify potential implications and emissions management issues for the Framework created by the implementation of federal GHG Regulations.
2. Emissions Growth Review Trigger (Recommendation 34): Update the emissions forecast and determine if the emissions are 15% higher for a five-year period than projected in the previous five-year review.
3. Economic Review Trigger (Recommendation 35): Determine if the economic assumptions underlying the Framework are significantly different, so as to adversely affect the viability of the electricity sector.

The team undertook the tasks outlined in its charter based on the following assumptions:

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[2] Electricity Working Group Report, prepared by the CASA Electricity Working Group for the CASA Board of Directors, October 5, 2012.

[3] NOx and SO_2 emissions from electricity generation in Alberta fell by 45,027 tonnes and 25,058 tonnes respectively between January 1, 2006 and December 31, 2011.

[4] The Project Charter appears in Appendix A and team and sub-group members are listed in Appendix B.

- The GHG Regulations will be implemented, as published in Canada Gazette, Part II: Official Regulations and any inconsistencies with the Alberta Framework will need to be identified, considered, and addressed; and
- Environment Canada's proposed BLIERs for existing coal-fired units will not be implemented in Alberta and need not be considered at this time.

To accomplish the second five-year review in a timely manner, the team began by identifying specific areas where progress could be made, assuming that the CASA Framework would remain intact. Multi-stakeholder task groups were formed and charged with examining in detail each of the following areas and making recommendations to the team:

- Extent to which previous recommendations in the 2003 Framework and the first five-year review have been implemented.
- Emissions forecasts.
- Current and emerging control technologies and reduction strategies.
- Air emission substances from the electricity sector that are subject to formal control.
- Assessment of the Emissions Trading System (Recommendation 8 regarding the management approach for SO_2 and NOx emissions).
- Development of a PM management system for existing generation units.
- Public participation and consultation on Framework implementation.

The team also undertook an initial assessment to determine if a review of the structure of the Framework itself was warranted. Although the team put significant effort into this assessment, they were unable to reach consensus on the need to review or adjust the Framework, given divergent views of members as to what is required to allow changes to be made. The key issues and differing perspectives were described in detail in the June 2014 Interim Report from the team to the CASA Board of Directors. As is the CASA protocol when consensus is not reached, the Board asked the Government of Alberta to consider if adjustments to the Framework are warranted and, if so, to indicate the nature of such adjustments, and to describe the path forward as appropriate. Then-Minister of Environment and Sustainable Resource Development, Hon. Robin Campbell, responded to CASA on August 13, 2014 that his department was working with the departments of Energy and Health to develop a cross-ministry plan to review the interim report and determine the next steps for the Framework. CASA would be notified of the process and results. The Minister further advised that "the Government of Alberta is committed to the current emissions management framework. Until a carefully weighed decision has been made on the interim report and the framework, the government will continue to make regulatory decisions in accordance with the existing framework." [5]

Despite the non-consensus on the initial assessment, the team agreed to proceed with the Five-Year Review process. The team recognizes that any recommendations may need to be reviewed subsequent ot a GoA decision. Following direction from the CASA Board, the team set aside the non-consensus items and proceeded with the five-year review in accordance with Recommendation 29. As the sub-groups undertook their work, members consulted regularly with their stakeholder organizations to test the approach and obtain feedback on draft recommendations before presenting them to the EFR team. The team provided guidance to the sub-groups as appropriate and reviewed recommendations as they came forward, accepting, amending or rejecting each one. Some sub-groups engaged consultants to carry out specific analysis and each sub-group prepared a final report

[5] The text of Minister Campbell's letter to CASA appears in Appendix C.

summarizing its approach and the results of its work. All of these documents are listed in Appendix D along with information about how to access them.

This report from the EFR team describes the work and analysis done to fulfill the team's charter.

3 Emissions Forecasts

An initial assessment helped the team determine if a review of the structure of the Framework itself was warranted. The steps taken in this assessment were:

a) Identify potential implications and emissions management issues for the CASA Framework created by the implementation of Canada's GHG regulations.
b) Update the emissions forecast for NOx, SO_2, PM and mercury and determine if the emissions are 15% higher for a five-year period than projected in the previous five-year review.
c) Determine if the economic assumptions underlying the Framework are significantly different, as to adversely affect the viability of the electricity sector.

For the first five-year review initiated in 2008, a multi-stakeholder Base Case Working Group was formed to, among other things, update the emissions forecast for NOx, SO_2, PM and mercury and determine if the emissions are 15% higher for a five-year period than projected in the previous five-year review.

For the current review, the Base Case Working Group carried out the tasks described in Recommendations 29 in the original Framework. Specifically, the group retained a consultant to undertake the work in two phases; the first to provide a detailed comparison of the key assumptions of previous forecasts and a second phase to provide a 2014 Emissions Forecast.

For the first phase of the work the consultant provided the key underlying assumptions for the 2003 NS-1 scenario, the 2008-2009 Base Case and the report entitled Alberta's Annual Electricity Study 2013: Power Struggle. Assumptions used in the various forecasts were appropriate for the time the models were developed. However, the assumptions are different for each of the three time periods and have resulted in substantial differences in the models. In addition to the differences in assumptions there were also errors discovered in past models that impact the outcome of those models. It is important that users of the forecasts are aware of these aspects of the reports and should refer to the Base Case Working Group subgroup report for additional details on the differences between the 2003, 2009 and 2014 forecasts.

In the 2003 Framework, Recommendation 34 directs each five-year review team to assess whether emissions from the previous five-year forecast have increased more than 15%. Figure 3 illustrates the percent change between the current (2014) and prior (2009) forecast.

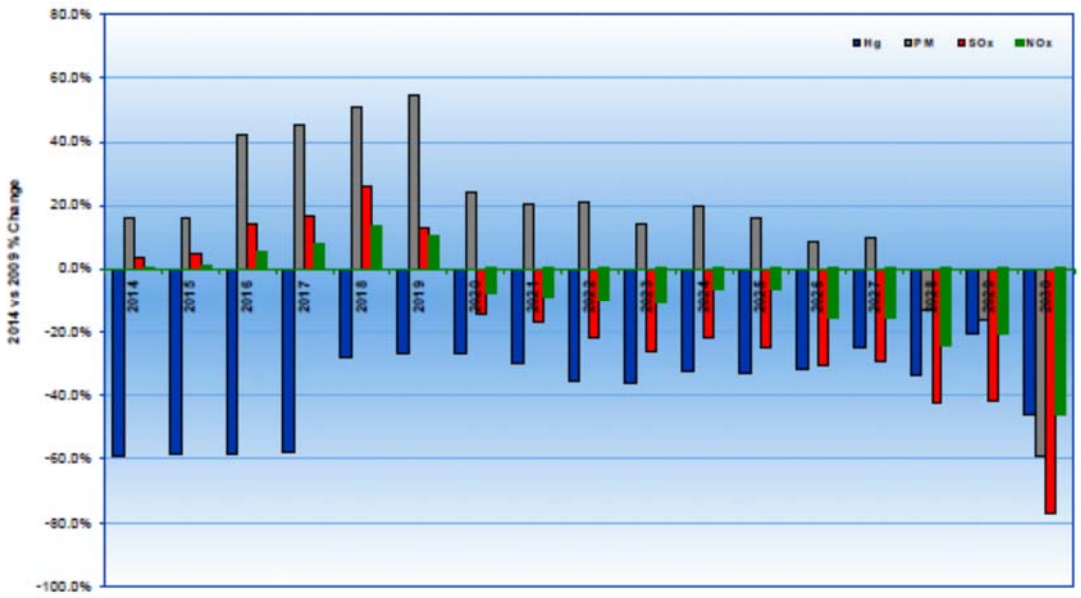

Figure 3: % Change Between the 2014 and 2009 Emissions Forecasts (EDC Associates, 2014)

Based on the above information, the Base Case Working Group agreed that the emissions growth for Mercury, SO2 and NOx are less than the 15% trigger value for a five year period. The PM emissions modelling indicates growth is above the 15% trigger and as such the management framework elements addressing PM should be reviewed. The Base Case Working Group proposed that this matter be referred to the PM Management subgroup.

4 Control Technologies and Reduction Strategies

Three specific tasks were undertaken for this part of the review:

a) Determine emission standards and corresponding deemed credit threshold for new thermal generation units, including gas-fired new peaking units, based on the Best Available Technology Economically Achievable (BATEA).
b) Determine emission standards for new reciprocating engines and diesel engines for electrical generation, based on BATEA, considering any related work of the reciprocating engine BLIERs group.
c) Review the electricity sector Continuous Improvement report relative to the previous continuous improvement goal statements, and propose, where appropriate, recommendations for modifications to the Framework that result in improved opportunities for supporting continuous improvement efforts.

The Control Technologies and Reduction Strategies (CTRS) Task Group engaged Eastern Research Group, Inc. (ERG) for this component of the review. ERG completed a review of emission control measures for electricity generation technologies for the previous five-year review in 2009. This report included an assessment of controls for coal-fired boilers and gas-fired turbines, as well as other information, such as future generation technologies, fuels, and control measures. In 2014, ERG:

- Updated simple and combined cycle turbine control technologies and evaluated additional issues unique to co-generation installations;
- Investigated both operational and economic issues associated with co-generation, including those involving the Heat Recovery Steam Generation (HRSG) portion of co-generation units; and
- Evaluated environmental variables that affect emission generation and control.

ERG's final report describes the methodology used to evaluate and assess the various control technologies. The report also discusses additional considerations associated with co-generation and combined cycle installations and advances in duct firing, provides an analysis of SO_2 from alternative gaseous fuels, describes additional parameters that affect emissions levels, discusses the actual permitted limits of turbine installations, assesses achievable emission limits, and provides information on units that may need to be addressed on a case-by-case basis.

Building on the information in the ERG report, the Task Group discussed potential new standards for coal-, gas-, and biomass-fired generation units and for reciprocating engines. Based on the work of the Task Group, the Team made seven recommendations, shown below.

4.1 Coal-Fired Generation

The standards that are recommended for new coal-fired thermal generation units are carried over from what was agreed to in 2010, as it was difficult to complete an analysis due to the uncertainty around a full review of the Framework. The EFR Project Team agreed that, in general, in terms of conventional coal-fired power plants, the 2010 recommended emission limits continued to reflect BATEA based limits. A final decision from the Government of Alberta on a full review of the Framework is still pending and that decision may require a review of any foregoing provisional agreements.

Recommendation 1: Emissions Standards for Conventional Coal-Fired Generation
The 2013 Electricity Framework Review Project Team recommends that:

> The standards and credit limits in the *Report on the First Five-Year Review of the Emissions Management Framework for the Alberta Electricity Sector*, May 13, 2010 be carried over for conventional coal.

Recommendation 2: Emissions Standards for Unconventional Coal-Fired Generation
The 2013 Electricity Framework Review Project Team recommends that:

> The standards and credit limits for unconventional coal should be approved on a case-by-case review by the regulator.

4.2 Gas-Fired Generation

Recommendation 3: Emissions Standards for Gas-Fired Generation (Non-Consensus)
Although the CTRS Task Group had extensive discussions on developing a standard for gas-fired generation, they were unable to reach agreement on a standard. The group's final report will include information on its six consensus recommendation, as well as details on the diversity of perspectives with regards to the non-consensus on standards for gas-fired generation. The intent of the group's

final report will be to provide input to any future policy development the Government of Alberta might undertake on this issue.

4.3 Biomass-Fired Generation

Biomass is becoming a more significant energy source in Alberta. Biomass-fired units contribute electricity to the grid now, and this is expected to increase. The team is of the view that biomass generation should be part of the next five-year review in 2018; possible considerations include:

- Definition of biomass
- Range of fuel sources
- Priority pollutants from biomass
- End of life design requirements.

Recommendation 4: Emissions Standards for Biomass-Fired Generation

The 2013 Electricity Framework Review Project Team recommends that:

> The 2018 Five-Year Review Project Team review the need to develop emission s standards for biomass-fired generation. If there is a need, the 2018 Team should determine BATEA-based emissions standards for biomass-fired generation.

4.4 Reciprocating Engines

The team looked at standards for new diesel-fired and gas-fired reciprocating engines. The Framework does not include end-of-design-life requirements for reciprocating engines as it does for coal- and gas-fired units. The issue of design life was discussed but the team concluded it did not have enough information on the normal design life for reciprocating engines to determine if a design life period should be proposed. Future five-year review teams can reconsider this issue; until a decision is made on design life for reciprocating engines, the recommendations would apply only to new units that generate electricity. An exemption would apply to remote communities, which are defined as communities that do not have year-round road access.

Recommendation 5: Emissions Standards for New Diesel-Fired Reciprocating Engines (regular use units)

The 2013 Electricity Framework Review Project Team recommends that:

> The following standards apply to new diesel-fired reciprocating engines in regular use units that are approved on January 1, 2016 or later:
>
> > 1200 HP (0.89 MW) (<30 L displacement per cylinder): 0.50 g/bhp-hr (approximately 0.67 g/kWh)
> >
> > 699 kW (805 HP) (≥30 L displacement per cylinder): 1.8 g/kWh (approximately 1.34 g/bhp-hr)
>
> These standards are expressed in a similar format to the US EPA Tier 4 Compression Ignition New Source Performance Standards, which include diesel-powered generator sets, and is based on selective catalytic reduction (SCR).

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The 2013 Electricity Framework Review Project Team recommends that:

The following standard apply to new diesel-fired reciprocating engines in stand-by units that are approved on January 1, 2016 or later:

> 750 HP (0.560 MW) 4.8 g (NMHC+NOx)/bhp-hr (approximately 6.4 g (NOx+NMHC)/kWh)

This standard is expressed in a similar format to the US EPA Tier 2 Compression Ignition New Source Performance Standards for generator sets, and is based on combustion controls (that is, no SCR).

Recommendation 7: Emissions Standards for New Natural Gas-Fired Reciprocating Engines

The 2013 Electricity Framework Review Project Team recommends that:

The following standard apply to new natural gas-fired reciprocating engines that approved on January 1, 2016 or later:

> 75 kW (500 hp is US size range): 2.7 g/kWh (based on 2.01 g/bhp-hr)

This standard is based on the BLIERs for NOx for natural gas-fired reciprocating spark ignition engines, which are based on the US EPA requirements for these types of engines.

An analysis of gas-fired boilers with steam turbines was not undertaken because this was seen as an unlikely emissions source.

4.5 Continuous Improvement

Recommendation 29 in the 2003 Framework specified that continuous improvement would be addressed in each five-year review. The expectation was that electricity generators would prepare a continuous improvement report as part of each five-year review. The report would summarize emission control initiatives taken during the previous five years and identify goals for further continuous improvement during the next five-year period. Progress against these goals would then be assessed at each subsequent review, starting in 2013. If appropriate, the multi-stakeholder review team could recommend modifications to the Framework that enhance opportunities for supporting continuous improvement efforts.

Electricity generation has increased by 10% since 2008, while sector emissions have fallen, as reported in the National Pollutant Release Inventory. Specifically, emissions of SO_2 and NOx are down by 14%, PM emissions have fallen by 20%, mercury emissions are down 43%, and greenhouse gases are 11% lower. These emission reductions have resulted from:

- Reduced operation of higher emitting units
- Retirement of older units
- Additions of new low-emitting generation (mainly natural gas and wind)
- Regulatory initiatives, such as mercury control
- Emissions reduction efforts taken by electricity sector participants
- Improvements in the provincial transmission system.

Looking ahead, the industry report notes that the AESO is forecasting a 23% increase in electricity demand by 2023. It is expected that:

- The generation mix will continue to shift away from coal.
- New low emitting generation will continue to replace older units.
- Growth in the development of renewable energy will continue.

- Regulatory initiatives will contribute to further reductions in sector emissions.

5 Substance Review

As part of this five-year review, the project team established a multi-stakeholder Health and Ecological Assessment Task (HEAT) Group to:

a) Review air emission substances emitted by the electricity sector that are subject to formal control, including existing List 2 substances and possible new substances, and identify if further action is required.
b) Oversee a review to identify any new and relevant studies or research findings regarding potential environmental or health effects from air emissions from electricity generation, including an independent peer review of the results. This task was based on Recommendation 5 from the first five-year review.

To complete this element of the 2013 five-year review, three main pieces of work were undertaken, the results of which are summarized in the HEAT Group's final report:

- Health and Ecological Assessment. Two literature reviews were done to determine if there are any new and relevant studies or research findings regarding potential ecological (biotic and abiotic) or human health effects from air emissions from electricity generation. This work was done by consultants.
- Chemical Screening. Because the literature reviews would only provide information on substances that had been studied (not all emitted substances), the group also conducted a chemical screening. This screening generated an inventory of chemicals and emission rates from electrical generation, and yielded information on toxicity potency, bioaccumulation, and persistence potential. This work was also done by a consultant.
- Air Emissions Substance Review. This was done to review each substance identified in the chemical screening, consider information produced by the literature reviews, and categorize each substance to indicate if further action would be required. Relevant reports from previous CASA work on this topic were referenced as necessary.

Access information for the consultant reports and the final report from the HEAT Group is provided in Appendix D.

The independent peer review proposed in the previous five-year review was deemed unnecessary because it was decided that a) the HEAT Group and the project team had sufficient expertise to draw conclusions from the literature reviews and communicate conclusions to non-expert readers, and b) adequate checks and balances were built into the process to ensure completeness, accuracy and transparency of the literature reviews.

5.1 Health and Ecological Assessment

After examining the rationale for the original Priority and List Two substances, it was decided that the literature reviews undertaken for this deliverable should go beyond those two categories to include others that reflected varying levels of concern. The process involved completion of health and ecological assessment literature reviews, focused on:

- New information on the five Priority substances;
- New information since 2008 on any emissions from electricity generation; and
- Information on mixtures since 2008.

It was then determined if and how any new information might affect the Framework, which informed recommendations in this area.

The original 2003 Framework identified five priority substances to be addressed and another group of substances referred to as "List Two." The priority substances were SO_2, NOx, mercury, particulate matter, and greenhouse gases (mainly CO_2). List Two was developed by screening a number of substances; the eventual List Two substances did not meet the extensive criteria and rationale set out for priority substances, yet warranted further assessment for co-benefits resulting from the management of priority substances. Complex mixtures were not part of the assessment by the initial team but could be examined in future review processes.

5.1.1 Health Effects Literature Review

The first literature review looked at atmospheric emissions and associated health effects associated with thermal electricity generation, reviewing a collection of recent "white" and "grey"[6] literature abstracts (2008-2013) related to the atmospheric emissions of thermal electricity generation and the associated health effects. For the health effects studies, articles considered relevant were original epidemiology, animal, or *in vitro* studies evaluating the health impacts of atmospheric emissions from power plants. For atmospheric emissions, articles were considered relevant if they measured emissions directly from power plant stacks, measured ambient pollutant concentrations near power plants, or presented past or future emission inventories of existing power plants.

5.1.2 Ecological Effects Literature Review

The second literature review focused on ecological effects of air emissions associated with electricity generation. The objective was to report on studies from white and grey literature regarding adverse ecological (includes biotic and abiotic) effects from substances known to be emitted to the air from electricity generation. Over 6,775 titles and abstracts were reviewed, of which only 345 (5%) were determined to be relevant. There were no obvious trends in the research overall, with many articles reporting a wide range of receptors and endpoints.

5.2 Chemical Screening

Chemical screening was done to identify all emissions from coal- and natural gas-fired electricity generation, and their associated emission rates, toxicity, bio-accumulation, and persistence. This assessment:

- Generated an inventory of chemicals and emission rates from electrical generation facilities in Alberta;
- Conducted a toxic potency screening for each facility selected for the assessment and presented the chemicals that contributed 99.9% of the relative potency from the emission profiles;
- Determined the bio-accumulation and persistence potential of chemicals emitted by electrical generation facilities; and

[6] "White" abstracts are associated with articles that have been peer-reviewed and published in the scientific literature. "Grey" abstracts are associated with articles that have not been peer-reviewed and appear in other sources, such as government and industry publications.

- Summarized the findings of human health risk assessments of historical environmental impact assessments and community based bio-monitoring that was conducted in close proximity to electrical generation facilities.

5.3 Air Emissions Substance Review

In this phase of work, each substance identified in the chemical screening was reviewed, information produced by the literature reviews was further considered, and each substance was categorized to indicate if further action would be required. Four categories were used to sort the substances (Table 2). No new substances were added to the Priority List (category 1) which continues to reflect the substances identified in the 2003 Framework. List Two substances were re-categorized, along with additional substances, into categories 2, 3 and 4. This approach represents a more scientifically robust way to categorize and prioritize substances emitted by electricity generation.

Table 1: Air Emissions Substance Review - Categories for Further Action

Category		Description
1	Priority List	Substances that are known to be an issue, and known ways of managing them exist and are being employed (i.e., existing priority substances, for which there is insufficient evidence to remove from the list).
2	Management action needs to be considered	Substances that need to be evaluated by the Project Team for further management action. Considerations should include but are not limited to: • What is the state of science on this substance? • Can the substance be reduced? • What are management options for reduction? • What is the cost of reduction? • Are there co-benefits to management? • Is monitoring required?
3	Ongoing surveillance recommended	Substances that the 2018 Review should explicitly include in the search terms of the health and ecological literature , with the express purpose of watching for potential emissions trends over time, and to identifying data gaps.
4	Insufficient information	Substances for which there is insufficient evidence to indicate that action is required.

It was agreed that, based on current science, certain substances appear to need further attention, but decisions about management actions would need to include considerations beyond the task group's scope of work and expertise. This led to the creation of category 2, which includes substances for which management action needs to be considered. Not enough scientific information exists now to warrant moving any of the substances in category 2 to the priority list. Category 2 substances need further evaluation to determine what can be done, taking into account things like the co-benefits and costs of management, whether monitoring is needed, speciation of the substance, and others. This category would provide useful guidance to the GoA with respect to potential areas on which to focus attention and resources. Substances in categories 1 and 2 are listed in Table 3. A full list of all

categorized substances along with more details on rationale and considerations appears in Appendix E.

Table 2: Substances in Category 1 and 2

Category	Substance
Category 1: Priority List	Total Particulate Matter (includes $PM_{2.5}$, PM_{10}, and TSP)
	Mercury
	SO_2
	NO_2
	GHGs
Category 2: Management action needs to be considered	Antimony
	Arsenic*
	Barium
	Cadmium*
	Cobalt*
	Lead*
	Manganese*
	Selenium*
	Chromium* (i.e., Chromium III and Chromium VI for the purposes of this review)
	Formaldehyde
	Benzene*
	Hydrogen fluoride*

** Indicates a substance that was also on List Two.*

It should be noted that the definition of category 2 is not the same as the previous List 2. It was previously thought that addressing priority substances would also provide co-benefits to many List 2 substances. The substances in category 2 were identified independently of any co-benefits.

The category 2 list of substances requiring further study and for which management action needs to be considered is evolving. List Two included 15 substances, while the current category 2 has 12. Nine substances from List 2, identified in Table 3, are also in category 2. They are still viewed as possibly requiring management action and for these, co-benefits may still exist. Three new substances were added to category 2 due to their potential as carcinogens or for other health or ecological reasons. The remaining six List Two substances[7] have been placed in the new category 3, where ongoing surveillance is recommended to identify emissions trends and data gaps. In general, these six substances are not being produced from coal-fired generation in sufficient amounts for management action to be considered at this time.

The HEAT Group recommended that the EFR Project team determine a mechanism to ensure that, prior to the commencement of the 2018 Five-Year Review, each substance listed in Category 2 be evaluated as described in Table 1. As such, the CTRS Task Group undertook a general, high-level

[7] These are beryllium, hexachlorobenzene, hydrogen chloride, polycyclic aromatic hydrocarbons (PAHs), thallium, and dioxins and furans (2,3,7,8 TCDD and 2,3,7,8 TCDF).

assessment of the Category 2 substances. The CTRS Task Group concluded that no immediate action was required and reported this to the EFR Project Team.

Recommendation 8: Evaluation of Category 2 Substances
The 2013 Electricity Framework Review Project Team recommends that:
The multi-stakeholder group undertaking the 2018 Electricity Framework Review ensure that each substance listed in Category 2 (i.e. Management actions need to be considered) is evaluated as described in Table 1 of this report.
It should be noted that, for the 2018 Five-Year Review, the work described in Recommendation 8 will require a strong linkage between the technology review to identify BATEA, the air emission substance review, and any new information illustrating potential health and ecological effects associated with emissions from the electricity sector.

Certain substances appear to have an impact on human and/or animal health, but not to a degree that requires immediate management. These substances should be tracked on an ongoing basis to watch for emission trends and identify data gaps. They were placed in category 3 – "Ongoing surveillance recommended" – for substances that should be explicitly included in the search terms for the ecological and health literature reviews of the 2018 five-year review.

Recommendation 9: Substances for Ongoing Surveillance
The 2013 Electricity Framework Review Project Team recommends that:

> The multi-stakeholder group undertaking the health and ecological assessment for the next five-year review explicitly include substances listed in Category 3 in the search terms for the health and ecological literature reviews.

5.4 Guidance for Future Reviews

This substance review posed some challenges in several areas due in part to a lack of understanding of the work that had been done in previous years. More details are available in the full report from the HEAT Group, but these challenges related to:

- Limitations in available information
- Process design, and
- Considerations for improving the literature reviews and chemical screening.

It is very important for review teams and their sub-groups to thoroughly and clearly document their work to help subsequent groups develop an effective process, stay on schedule, and ensure that institutional memory is not lost. The current HEAT Group established a good template for future substance reviews and, subject to securing appropriate funding, the formation of such a group should be a high priority in the next five-year review. Membership of the new group will be determined at the time of formation.

Recommendation 10: Future Substance Reviews
The 2013 Electricity Framework Review Project Team recommends that:

> A multi-stakeholder Health and Environmental Assessment Task (HEAT) Group be convened as soon as possible after the 2018 Electricity Framework Review Project Team is established, and that it be provided with the terms of reference from the 2013 HEAT Group, to adjust as the new Group deems necessary.

6 Emissions Trading System

The project charter for the 2013 Five-Year Review included two objectives for the Emissions Trading System (ETS):

> 11. Complete an assessment of the implementation of Recommendation 8 regarding the NOx and SO_2 emissions management approach. This work may include reviewing whether the Emissions Trading System is achieving, and will continue to achieve, the intended objectives of providing incentives and rewards for better than required or expected performance, encouraging early shutdown of older units, and encouraging implementation of new emissions controls at existing units.
>
> 12. Complete an assessment of the implementation of Recommendation 9 regarding the implementation of the management approach for NOx and SO_2.

Recommendation 8 has been implemented through approvals, the Air Emissions Standards for Electricity Generation, and the Emissions Trading Regulation. With respect to Recommendation 9, advice was received from the original Emissions Trading Technical Advisory Group. Opportunities to move to a province-wide system or a cap and trade system have been discussed internally within ESRD. Any changes would require stakeholder input and involvement.

To complete this task, the Electricity Framework Review team directed each caucus (industry, government and NGO members) to independently assess the implementation of the ETS. All three caucuses agreed that, overall, the recommendations have been implemented as intended but it is difficult to assess if the system is working as intended. Some stakeholders are of the view that the ETS has not delivered much in the way of early reductions, while other stakeholders noted that it is up to operators to be willing to generate, buy, and sell credits based on their specific needs and circumstances. The ETS was designed as a flexibility mechanism for end of design life compliance until 50 years of life (for coal) and 40 years of life (for gas).

Recommendation 11: Implementation of the Emissions Trading System

The 2013 Electricity Framework Review Project Team recommends that:

> Implementation of the Emissions Trading System be assessed as part of the 2018 five-year review of the Alberta Electricity Emissions Management Framework.

7 Particulate Matter Management System

Based on Recommendation 22 in the 2003 Framework, this task entailed considering the feasibility of developing a PM management system for existing generation units.

Based on discussions over the course of three meetings, there was general agreement that the current PM Management process is satisfactory. However, there is still uncertainty about whether all operators are optimizing their existing systems. The group agreed that there was a need to clarify the diversity of perspectives on a number of outstanding issues and as such, each member agreed to develop a discussion paper detailing their interests and views. These discussion papers will be amalgamated into a report, with the intention of providing input for any future policy development the Government of Alberta might undertake on this issue.

8 Public Consultation and Communications

The goal for the current work is to inform and increase the public's awareness and understanding of:

- The 2013 five-year review process and outcomes.
- The implications of the implementation of recommendations resulting from the 2013 five-year review.
- The 2003 Electricity Framework and how it works to improve performance and reduce emissions.

As a means of publicising the team's final report, public communications and outreach, particularly to communities near power generation facilities, will be undertaken following the completion and approval by the CASA Board of the final report and recommendations. Various approaches will be used, including social media, print and electronic media, and face-to-face presentations if requested.

Based on the implementation of previous recommendations, the team has also made a recommendation on future public consultations. See Recommendation 12 in Section 9 of this report.

9 Implementation of Previous Recommendations

This component of the five-year review focused on:

a) Reviewing the 2010 report on implementation of recommendations from the 2003 Framework and updating as appropriate, and
b) Reviewing the implementation of recommendations in the 2010 report.

The report of the first five-year review, published in 2010, contained 11 recommendations. Industry, government and non-government members of the team independently reviewed the implementation progress of each recommendation and provided their assessment on a scale from 0 (if no action had been taken) to 10 (if the recommendation was fully implemented). If implementation was given a low rating (from 0 to 3), further analysis was undertaken to consider if the recommendation was still relevant and, if so, what would be needed to implement it and whether the CASA board could provide any assistance.

The team discussed each assessment and reached consensus on whether it could be considered to have been implemented, as reflected in Table 1.

- Six of the recommendations (1, 2, 4, 5, 8, and 11) were viewed as implemented.
- With respect to recommendation 3, at the June 24, 2009 CASA Board meeting, the GoA committed to report back on the status of implementation of the renewable and alternative energy recommendations and recommendations on energy efficiency and conservation. This item came up again at the March 24, 2010 CASA Board meeting and Alberta Energy agreed to provide updates on the Renewable and Alternative Energy Framework and the Energy Efficiency Framework at a future Board meeting. From a review of CASA Board minutes, it appears that no update has been provided, and thus the CASA Board has not reviewed the status of implementation of the renewable and alternative energy recommendations and the energy efficiency and conservation recommendations. The team concluded that recommendation 3 has not been implemented, and feels it has a responsibility to advise the CASA Board of this situation.

- Regarding recommendations 6 and 7, the GoA has not formally adopted recommendations related to coal-fired generation, and no new coal plants have been approved since January 1, 2011. No consensus was reached on NOx standards for gas-fired generation.
- For recommendation 9, the non-consensus material was forwarded to the GoA for a decision, in accordance with the CASA process, but no decision has yet been made.
- The team responded to Recommendation 10 by developing a new recommendation.

Table 3: Assessment of Implementation of Previous Recommendations from 2010 Review

Recommendation		Implemented?	Comments
1	**Implementation Status of Emissions Trading Recommendations** In 2013, the next five-year review team should complete a detailed evaluation of the implementation of recommendations 8 and 9 of the 2003 Framework, regarding the Emissions Trading System.	Yes	Implemented as envisioned, but unclear whether the regulation is as effective as intended.
2	**Public Availability of Monitoring, Reporting and Compliance Data** Alberta Environment ensure that monitoring, reporting, and compliance data is made available to the public in an easily accessible manner, and that this be considered a high priority in Alberta Environment's Integrated Monitoring and Reporting Framework expected to be completed by March 31, 2010.	Yes	Information is available and accessible, and should continue to be so, with further improvements as opportunities arise. The new Alberta Environmental, Monitoring and Reporting Agency may also have a role.
3	**Recommendations from CASA Renewable and Alternative Energy Project Team and Electrical Efficiency and Conservation Project Team** The CASA board review the status of implementation of the recommendations made by the Renewable and Alternative Energy project team and Electrical Efficiency and Conservation project team by the end of 2009.	No	This remains an outstanding item for the CASA Board. The team notes, however, that the GoA is undertaking policy development and renewal in two areas related to this recommendation, and a net billing policy has been implemented.
4	**Health and Environmental Effects Information** No additional work or revisions to the Framework are required at this time based on new or additional health and environmental effects information.	Yes	The current Health and Ecological Assessment Task Group completed a review to determine if further work is needed.
5	**Analysis of Health and Environmental Effects Research** For future five-year reviews, a multi-stakeholder group with appropriate representation be struck to oversee a study to identify any new and relevant studies or research findings regarding potential environmental or health effects from air emissions from electricity generation, and that an independent peer review be completed on the results.	Yes	The current Health and Ecological Assessment Task Group completed its literature review. A peer review was deemed unnecessary as the group had sufficient expertise to draw conclusions from the reviews and communicate conclusions to non-expert readers.
6	**Source Standards for New Coal-Fired Thermal Generation Units:** The following standards apply to coal-fired boiler generating units without carbon capture technology that are approved on January 1, 2011 or later: **Nitrogen Oxides (NOx)**	No	The consensus recommendations are being used informally by ESRD but have not been formally incorporated into standards, in part because no new plants

	Recommendation	Implemented?	Comments
	Emission standard: 0.47 kg/MWh net Design specification: 0.40 kg/MWh net (Note: In addition to requiring compliance with the NOx emission standards, the environmental approval will include a condition that requires the proponent to design the NOx control equipment with the capability to reduce emissions to 0.40 kg/MWh net, or less). **Sulphur Dioxide (SO_2)** Emission standard: 0.65 kg/MWh net or 90% removal, whichever is less stringent. **Particulate Matter (filterable)** 6.4 ng/J of heat input (~0.066 kg/MWh) **Mercury** 75% capture design target Optimization plans to meet 80% capture by 2013 The standards are conditional on emissions during startups and shutdowns (using best practices) excluded from compliance measurement and reasonable flexibility by Alberta Environment during new technology commissioning period.		have been approved since January 1, 2011.
7	**NOx and SO_2 Credit Generation Thresholds** The following deemed credit thresholds for the 2011 BATEA standards be applied to new coal-fired and gas-fired units: A. NOx (coal-fired) – 0.38 kg/MWh net B. SO_2 – 0.55 kg/MWh net C. NOx (gas-fired) – "A" factor = 0.07 kg/MWh net and "B" factor = 0.008 kg/GJ Non-Peaking Standard Formula: NOx (kg/h) = [Net Power Output (MW net) x A] + [Heat Output (GJ/h) x B]	No	GoA has not formally adopted recommendations related to coal-fired generation, and no new coal plants have been approved since January 1, 2011. No consensus was reached on gas-fired NOx standards.
8	**Credit for Early Action on Mercury Capture** The initiative on Credit for Early Action on Mercury Capture be implemented as follows: • The Credit for Early Action on Mercury initiative will enable operators to gain recognition for past and upcoming Mercury capture before the regulation deadline. • Operators will earn credits for kilograms of Mercury captured (as a result of Mercury control activity demonstration, early installation of Mercury control equipment and other combustion process modifications). • Credits can only be used on a site-basis (no trading) and only when plants experience upset conditions impacting their ability to achieve target removal requirements. • The credits for early action recognition cannot be used to delay installation of Mercury control equipment.	Yes	Credit for early action was available and some companies did initiate their mercury control systems early, but this early action was not formally tracked. The use and need for these credit provisions was examined as part of the current five-year review.

	Recommendation	Implemented?	Comments
	• January 1, 2011 is the compliance date. Companies will earn credits for Mercury capture rates greater than 75% before January 1, 2011. • Between January 1, 2011 and January 1, 2013, companies will earn credits for Mercury capture rates greater than 80%. • All credits will be earned at a discount value of 50%. • All credits will expire on December 31, 2015.		
9	**Source Standards for New Gas-Fired Non-Peaking Thermal Generation Units** No consensus	No consensus	
10	**Pre-Consultation Phase for Next Five-Year Review** The working group formed to develop terms of reference and timelines for the next five-year review build in a pre-consultation phase, which would involve focused public outreach about CASA as well as the Electricity Framework and progress in its implementation.	No	See new Recommendation 2
11	**Higher Profile for the Electricity Management Framework** CASA maintain a website that is updated twice a year with information about the Framework and its implementation.	Yes	The website has been updated regularly with relevant information. Links should be checked periodically.

The team agreed that it would be useful to hear from the GoA as to the status of its decision process related to recommendations 6, 7 and 9 from the 2010 report.

Recommendation 12: GoA Decision on Previous Recommendations

The 2013 Electricity Framework Review Project Team recommends that:

> The CASA Board request an update on the status of the GoA decision process related to recommendations 6, 7 and 9, as found in the 2010 report from the first five-year review.

The role of and methodology for public engagement have changed since the original Electricity Project Team and a different approach was taken for the current five-year review. The team responded to Recommendation 10 in the 2010 report by developing a new recommendation.

Recommendation 13: Public Consultation

The 2013 Electricity Framework Review Project Team recommends that:

> The 2018 Five-Year Review Project Team consider the role of public consultation and develop a plan at the beginning of its process.

The team also reviewed the implementation status of outstanding recommendations from the original 2003 Framework (Table 2) and concluded that most of these recommendations are now complete.

Table 4: Assessment of Implementation of Outstanding Recommendations from 2003

Recommendation	Status
5. Design Life	Considered implemented and is included in approvals and related work. However, there remains some confusion regarding design life and application

Recommendation	Status
	of PM BATEA limits at the end of design life for existing units. This issue is being discussed by the PM Task Group.
22. Co-benefits of Mercury Control	There may be an outstanding issue related to how existing coal units at the end of design life are treated in terms of PM limits. The PM Task Group is working on this issue, which will remain outstanding if consensus cannot be reached on a PM Management Plan.
23-28, 47, 61. GHG-related	GHG emissions-related recommendations under CASA have been superseded by both the Specified Gas Emitters Regulation and the federal GHG regulations for coal-fired power plants.
31. Responsibility for Implementing the Outcome of the Five-Year Reviews	Even though Recommendations 6, 7, and 9 from the 2010 report were agreed to by consensus, they are only being used informally by ESRD and have not been formally incorporated into standards. No new coal plants have been approved. This situation could potentially create problems for new plants and for credit generation, as it is uncertain which standards apply. (See the team's new Recommendation 1 above)
32. Hotspots	Sectors other than electricity generation are contributing to this issue in the Capital Region and the hotspots protocol is not solely confined to the Electricity Framework. The protocol is being managed by ESRD.
34. Emissions Growth Review Trigger	Lessons learned regarding the implementation of this recommendation are addressed by the Base Case Working Group.
43. Public Availability of Mercury Monitoring Data	It is assumed that mercury emission data from coal-fired power plants will continue to be available through AESRD and possibly the Alberta Environmental Monitoring, Evaluation and Reporting Agency (AEMERA) in the future.
49. Public Input to Sectoral and Other Industry-Specific Agreements	The team agreed this recommendation is no longer its responsibility as it has no control over implementation.
67-68. Encouraging and funding electrical energy efficiency and conservation	Climate Change Central previously had responsibility for these functions. Climate Change Central no longer exists and the GoA has not yet made a decision as to which agency will assume these activities.

10 Future Five-Year Reviews

Based on the experience and learnings of the EFR project team, the following advice is provided to build a solid foundation for the work of the 2018 EFR project team:

- The 2018 Five-Year Review team should reconsider team membership based on any additional tasks in the project charter. For example, if reciprocating engines and biomass are to be included, there should likely be some additional representation from these industries on the team.

- The team envisions a master document of all 71 recommendations that provides appropriate linkages to any subsequent work that has been done related to each recommendation. For example, under the 2003 source standards, it should be noted that the standards were updated in 2008 and 2013, with a link to the appropriate reference. The Team agreed that this task should be undertaken by the secretariat and interested stakeholders to develop this master document.

Glossary

AESO (Alberta Electric System Operator)
The AESO is responsible for the safe, reliable and economic operation and planning of Alberta's interconnected power system and the facilitation of Alberta's real-time wholesale electricity market.

Atmospheric emissions
Pollutants emitted into the atmosphere. These are onsite air releases from sources at a facility and include: stack (or point source) emissions; emissions from storage and handling; fugitive emissions; and emissions from other sources such as spills.

BATEA (Best Available Technology Economically Achievable)
BATEA refers to technology that can achieve superior emissions performance and that has been demonstrated to be economically feasible through successful commercial application across a range of regions and fuel types. BATEA is used to establish emission control expectations or limits. Generally it is the emission limit that is specified and not the specific BATEA. Facilities can opt for other technologies or emission strategies as long as the emission limit is met.

Cap and trade
A type of emission trading system. In a "cap and trade" system, the regulatory authority sets a cap on total emissions from the participants (or sector) in the trading system. The regulator then creates and allocates allowances to each participant, the total of which is equal to the overall cap. The allowances held by each participant must balance with their emissions at the end of each compliance period; the allocation is typically done annually, and thus the compliance period is also one year. Allowances are based on an absolute amount of emissions produced (that is, tonnes or kilograms) per year. If a participant can reduce emissions below their allocated allowances, the surplus amounts can be traded or banked.

CO_2 (carbon dioxide)
A greenhouse gas that is produced in the burning of fossil fuels

Co-benefits
When a technology to reduce a specific emission also has the benefit of reducing other emissions

Co-generation
Co-generation is the combined production of electricity and heat for use in manufacturing processes; in general, the energy remaining after electricity generation is used in the production of process heat or steam. These types of units are often part of industrial complexes with the electricity not used within the complex offered into the competitive electricity market.

Cumulative impact
The impact of multiple emissions sources and/or developments in a given region.

Design life
The Design Life for coal-fired units, except for the Wabamun generating facility, is defined as the date of expiry of the PPA term or 40 years from the date of commissioning, whichever is greater. The end of Design Life for Wabamun units 1, 2, and 4 is December 31, 2010, according to their EPEA approval (Approval 10323-02-00), which states that, "a decision must be made by December 2005 whether to modify the unit to meet applicable environmental standards or to commence decommissioning by 2010."

Design Life for gas-fired units is the date of expiry of the PPA term or 30 years from the date of commissioning, whichever is greater.

Design Life for peaking gas-fired units is the date of expiry of the PPA term or 60 years from the date of commissioning, whichever is greater.

Emissions trading
The use of allowances or credits to motivate improved performance while allowing some flexibility for facilities to achieve emission controls in the least cost manner. The experience has been that emissions trading encourages greater reductions earlier. This system was highly successful in reducing lead in gasoline, and has also been used to manage and reduce SO_2 and NOx in the U.S.

Existing units
For the purposes of this management framework, an "existing" thermal generation unit be defined as follows:

An existing coal or gas unit is one that, prior to the most recent review and update of the BATEA emission limits,

1) has valid AER and Alberta Environment and Sustainable Resource Development approvals in place for the eventual unit start-up dates contemplated in the approvals, or planned by the project proponent, AND

2) in addition to any conditions of AER and Alberta Environment and Sustainable Resource Development approvals regarding dates for commencement of construction or formal commissioning of the units, has

a) within three years of receiving its Alberta Environment and Sustainable Resource Development approval

- continuous and substantive onsite construction, or
- boiler foundation in place.

AND

b) has received formal commissioning and is available for commercial service within eight years of receiving its Alberta Environment and Sustainable Resource Development approval for coal-fired units, or within five years of receiving its Alberta Environment and Sustainable Resource Development approval for gas-fired units.

Fossil fuels
Fuels such as coal and natural gas that are derived from the Earth's fossilization process.

Generation unit
For the purposes of the 2003 Emissions Framework, a "generation unit" refers to separate components of a power plant facility that result in the production of electricity energy and, where relevant, the combustion of fossil fuel (e.g., a boiler-generator pair or a gas turbine-generator pair).

GHG (greenhouse gas(es)
These gases enhance the Earth's natural greenhouse effect and are major contributors to global climate change. GHGs covered by federal and provincial legislation include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride.

GWh (Gigawatt-hour)
A Gigawatt-hour equals 1000 megawatt-hours or 1,000,000 kilowatt-hours. A kilowatt-hour is the number of kilowatts used in one hour.

Hg (mercury)
A natural element that is widespread in the environment. It is toxic and bioaccumulates. It is present in coal and therefore the burning of coal results in mercury releases to the environment.

MW (Megawatt)
A megawatt equals 1,000,000 watts or 1000 kilowatts); it is a unit of capacity.

New units
For the purposes of the 2003 Framework, a "new" thermal generation unit, be defined as any unit that does not meet the criteria for an "existing" unit and will therefore be required to comply with the BATEA or other emissions limits in effect at the time.

NGCC (Natural Gas Combined Cycle)
With NGCC, gas is combusted in a gas turbine and the expanding gas drives a generating turbine and the hot exit gases are used in a heat recovery steam generator to produce high-pressure steam, which drives a steam turbine generator that also produces electricity (sometimes supplementary gas is used in the steam generation cycle).

NGO (Non-government organization)
NGOs are usually non-profit or community groups. ENGOs are environmental non-government organizations.

NOx (nitrogen oxides, also called oxides of nitrogen)
Emissions produced in the burning of fossil fuels, arising largely from the oxidation of the nitrogen present in air that is used to support fuel combustion. NOx includes NO (nitrogen oxide) and NO_2 (nitrogen dioxide) but not N_2O (nitrous oxide).

PAHs (polycyclic aromatic hydrocarbons)
PAHs are a group of more than 100 chemicals formed during the incomplete combustion of fossil fuels and other organic substances. They are usually found as a mixture of several compounds. Some PAHs are manufactured.

Primary PM (particulate matter)
Small particles produced in the burning of fossil fuels that are emitted into the atmosphere

SCR (Selective Catalytic Reduction)
SCR is a control technology for nitrogen oxides (NOx) that uses ammonia and a catalyst to convert NOx to N_2.

SO_2 (sulphur dioxide)
An emission produced in the burning of fuels containing sulphur. All coals contain some sulphur.

Appendix A: Project Charter

March 4, 2013

Project goal

To ensure the *Emissions Management Framework for Alberta's Electricity Sector* (the Framework) reflects current circumstances, the project team will conduct a Five-Year Review, as outlined in Recommendation 29 of the Framework. The team will also consider whether a review of the structure of the Framework itself is warranted and develop recommendations as appropriate.

Background

In January 2002, Alberta Environment asked the Clean Air Strategic Alliance (CASA) to develop a new way to manage air emissions from electricity generation in Alberta. Using a multi-stakeholder collaborative approach, CASA developed innovative solutions in the form of 71 recommendations comprising a management framework and presented it to the Government of Alberta in November 2003. The report, *An Emissions Management Framework for the Alberta Electricity Sector*, was accepted by the Government of Alberta and implemented through regulations, standards and facility approvals (see Appendix I). The first emission standards were effective January 1, 2006.

To ensure continuous improvement and to keep the Framework timely and relevant, a formal review of the framework is to be undertaken every five years (Recommendation 29). This review should include a multi-stakeholder group consisting of industry, government, non-government organizations, and communities with an interest in electricity generation in Alberta. The intent of the Five Year Review is to assess new emission control technologies, update emission standards for new generation units, determine if emission standards for new substances need to be developed, review implementation progress, and determine if the Framework is achieving its emission management objectives.

A full review of the structure of the Framework itself would be triggered by the environmental and health factors noted in recommendation 34 (emission forecast is 15% higher than projected in the previous Five Year Review) and the economic factors noted in recommendation 35 (economic assumptions are significantly different so as to adversely affect the viability of the electricity sector). A full structural review would consider changes to the Framework to reflect current circumstances.

First Five Year Review

The first Five Year Review started in 2008 and the Electricity Framework Review Team submitted their report and recommendations to the CASA Board in June 2009. The report contained ten consensus recommendations and one non-consensus item. The consensus items included revisions to the Particulate Matter (PM), Nitrogen Oxides (NOx) and Sulphur Dioxide (SO_2) emission standards for new coal-fired units based on improvements in emission control technologies, effective January 1, 2011. The non-consensus item pertained to NOx emission standards for new gas-fired generation for both peaking and non-peaking units. At the June 2009 meeting, the Board directed the team to continue work to reach consensus. This work provided further clarification of the issues, but the participants could not reach consensus. A final report, including the interests and rationale with respect to the non-consensus recommendation, was forwarded to the Government of Alberta in May 2010 for decision.

A sub-group of the team continued to meet to develop a Particulate Matter (PM) System for existing units, as per Recommendation 22 of the Framework. In June 2010, the Federal Minister of Environment announced a proposed regulation for CO_2 emissions from coal-fired power plants. The specific details of the proposed federal coal regulation were not to be available until it was published in the Canada Gazette, making it difficult for the sub-group to reach agreement on a PM management system for existing coal units. As such, the Board put the sub-group into abeyance until the details of the proposed regulation were available.

Electricity Working Group
At the same time, the CASA Board was alerted to the potential misalignments between the Framework, the proposed Base Level Industrial Requirements (BLIERs) for existing coal-fired electricity generation units (as part of the Air Quality Management System), and the proposed federal regulation for CO_2 emissions from coal-fired power plants (GHG Regulations). The Board emphasized the need for CASA to respond to these issues in a strategic manner and struck a Working Group to develop a report on the potential misalignments, including suggestions on addressing these issues in a collaborative way. In December 2011, the working group presented their final report to the Board and, upon the Board's approval, the Government of Alberta committed to presenting the report at the Canadian Council of Ministers of the Environment Champion's table.

On September 12, 2012, the federal GHG Regulations were published in the Canada Gazette, Part II: Official Regulations. As such, the working group updated their report in October 2012 and resubmitted it to the CASA Board and the Government of Alberta.

Project Objectives

The project charter serves as guidance for the scope and direction of the project. At the convening meeting of the project team, members should engage in a review of the project charter with a view to reach agreement on each of the components of the charter which together make up the foundation for their process. This agreement signals their buy-in and ownership for the process and their commitment to effective collaboration.

Initial Assessment
An initial assessment will assist the team in determining if a review of the structure of the Framework itself is warranted. A structural review would involve a renewal of the Framework to reflect current circumstances, as appropriate.

1. Identify potential implications and emissions management issues for the CASA Framework, created by the implementation of Canada's GHG Regulations.

Inputs may include:
• The Regulations are published in the Canada Gazette, Part II, Vol. 146, No. 19, September 12, 2012.

2. Update the emissions forecast for NOx, SO_2, PM and Mercury and determine if the emissions are 15% higher for a five-year period than projected in the previous Five-Year Review.

3. Determine if the economic assumptions underlying the framework are significantly different, as to adversely affect the viability of the electricity sector.

Structural Review
Based on the results of the initial assessment, team members would determine if a full structural review of the Framework is warranted. A structural review may include the identification of possible issues and opportunities for Framework renewal and the development of general terms for the agreement based on emerging themes. The development of a suite of management options for Framework renewal and the evaluation of the various options using the economic and environmental base cases may also be part of this work.

Information Collection/Analysis
The team should carry out the tasks described in Recommendation 29 (Five-Year Review) and Recommendation 22 (PM Management System) in the Framework, and Recommendation 1 of the 2010 Five-Year Review Report (implementation status of emissions trading recommendations), including commissioning information gathering, as required. If a structural review is not deemed necessary, the team should develop recommendations to update the elements of the Framework described in Recommendation 29, based on this information. If a structural review is deemed necessary, the team may still need to develop recommendations to update the elements of the Framework described in Recommendation 29, subject to the nature and scope of any structural changes that may arise.

Control Technologies and Reduction Strategies

4. Determine emission standards and corresponding deemed credit threshold for new thermal generation units, including gas-fired new peaking units, based on the Best Available Technology Economically Achievable (BATEA).

Inputs may include:
• A technical review of current emission control technology. • Potential implications and emissions management issues for the Framework, created by the implementation of Canada's GHG Regulations. • Review of Natural Gas definitions.

5. Determine emission standards for new reciprocating engines and diesel engines for electrical generation, based on the Best Available Technology Economically Achievable (BATEA), with consideration for any related work of the reciprocating engine BLIERs group.

6. If available, review the proposed BLIERs for the electricity sector and consider if/how they will impact the Framework (i.e. new reciprocating engines, new gas turbines, new non-utility heaters and boilers, and new coal-fired units).
7. Review the electricity sector Continuous Improvement Report relative to the previous continuous improvement goal statements and propose, where appropriate, recommendations for modifications to the framework that result in improved opportunities for supporting continuous improvement efforts.

Inputs may include:
• Industry to provide an update to the 2009 Continuous Improvement Report.

Substance Review

8. Review air emission substances emitted by electricity generation that are subject to formal control, including existing List 2 substances and possible new substances. Identify if further action is required.

Key Tasks may include:
- Review new/emerging information related to:
  - Air emission substances subject to standards, limits or formal management in Alberta, including List 2 substances.
  - Possible new air emission substances not yet regulated in Alberta.

9. Form a multi-stakeholder group with appropriate representation to oversee a review to identify any new and relevant studies or research findings regarding potential environmental or health effects from air emissions from electricity generation, including an independent peer review on the results.[8]

Inputs may include:
- United States Environmental Protection Agency National Air Toxics Assessments.
- United States Environmental Protection Agency Mercury and Air Toxics Standards for Power Plants.

PM Management System

10. Develop a PM Management system for existing units.[9]

Inputs may include:
- *Evaluation of Existing Particulate Matter Management in Alberta*. September 2010. Prepared by Eastern Research Group for CASA.
- Minutes of CASA PM Management System Task Group, July 2010 to February 2011, including discussions on a straw-dog PM Management Plan.

[8] Recommendation 5. *Report on the First Five Year Review of the Emissions Management Framework for the Alberta Electricity Sector*. May 2010.
[9] Recommendation 22. *Emissions Management Framework for the Alberta Electricity Sector.* November 2003.

Emissions Trading System

11. Complete an assessment of the implementation of Recommendation 8, regarding the NO_X and SO_2 emissions management approach[10].

    This work may include reviewing whether the Emissions Trading System is achieving, and will continue to achieve, the intended objectives of providing incentives and rewards for better than required or expected performance, encouraging early shutdown of older units, and encouraging implementation of new emissions controls at existing units.

12. Complete an assessment of the implementation of Recommendation 9, regarding the implementation of the Management Approach for NO_X and SO_2[11].

Review of Implementation of Recommendations

13. Review the 2010 report on the implementation of recommendations from the 2003 Framework and make updates as appropriate.

14. Review the implementation of recommendations in the 2010 report.

Public Consultation

The consensus-based process at CASA incorporates consultation in many forms. Public consultation for this project would be determined by the scope of work being undertaken (e.g. a structural review may require more extensive public engagement). Public consultation should, at the least, increase awareness of the Electricity Framework.

15. Develop and implement a strategy and action plan for communicating and engaging with stakeholders and the public. Consider timing for public consultation.

Potential Future Work

If revisions are made to the Framework, the project team should update the October 2012 report from the Electricity Working Group. The team should re-evaluate the projected outcomes of the mid-life BLIERs for existing coal units and the Framework, including the environmental and economic gains and losses if the proposed mid-life BLIERs were to be applied in Alberta.

Inputs may include:

- Electricity Working Group Report, prepared for the CASA Board of Directors, October 5, 2012.
- Information/documentation on the most recent Environment Canada proposal for BLIERs for existing coal units.

[10] Recommendation 1. *Report on the First Five Year Review of the Emissions Management Framework for the Alberta Electricity Sector.*

[11] Recommendation 1. *Report on the First Five Year Review of the Emissions Management Framework for the Alberta Electricity Sector.*

Project Scope

To ensure the Framework reflects current circumstances, a formal review of the framework is to be undertaken every five years (Recommendation 29).

Requirements

Recommendation 29 (2003)

This recommendation outlines the following elements of the Framework that must be reviewed by the project team:

1. A technology review to identify the Best Available Technology Economically Achievable (BATEA) emission standards
2. The air emission substances subject to limits or formal management,
3. Co-benefits for priority substances and List 2 substances;
4. A review of economic and environmental triggers as set out in the framework in recommendations 34 and 35;
5. Additional information that illustrates potential health effects associated with emissions from the electricity sector; and
6. A report from the electricity sector on continuous improvement.

Recommendation 22 (2003)

This recommendation states that if mercury control does not provide the anticipated co-reduction of primary particulate matter, then the Five-Year Review should develop a primary particulate matter management system for existing units.

Recommendation 1 (2010)

This recommendation states that the 2013 Five-Year Review team should complete an assessment of the implementation of Recommendations 8 and 9 of the 2003 Framework, regarding the Emissions Trading System.

Further, the project team must identify the implications of the implementation of Canada's GHG Regulations. It is anticipated by the Government of Alberta that federal-provincial discussions regarding the implementation of the GHG Regulations will conclude at the end of 2013. To provide effective input to these discussions, the project team would have to provide recommendations before that date.

It should also be noted that the 2003 Framework was a set of consensus recommendations, negotiated by the team and agreed to as a package. All elements were considered to be equally important.

Assumptions

Due to some uncertainty regarding federal/national initiatives, the project team should proceed with their work based on the following assumptions:

- The GHG Regulation will be implemented, as published in Canada Gazette, Part II: Official Regulations and any inconsistencies with the CASA Framework will need to be identified, considered, and addressed; and
- Mid-life BLIERs for existing units will not be implemented in Alberta and need not be considered at this time.

Project Deliverables

A final report and recommendations for updating and/or revising the Framework.

Project Structure and Schedule

- See road map.
- The project team should develop a thorough project schedule (e.g. Gantt Chart) when they convene.

Project Risk Analysis

Identifying, analyzing and mitigating project risks is a key component to executing a successful project. Incorporating proactive risk management into the project that includes strategies to manage risks will assist in minimizing potential impacts to the project's scope, schedule and costs.

Risks	Possible Mitigation Strategies
The team's work schedule does not align with that of the mid-life BLIERs and GHG Regulations discussions. (It is anticipated by the Government of Alberta that these discussions will conclude at the end of 2013.)	• Focus on existing coal units first. (The GHG Regulation and mid-life BLIERs both apply only to existing coal units). • Compress the anticipated work schedule.
Mid-life BLIERs for existing coal units is required to be implemented in Alberta.	• Remain up-to-date on developments for mid-life BLIERs. • Update the Electricity Working Group report (comparing the outcomes of the Framework and mid-life BLIERs). • Develop a contingency plan.
Funding is not sufficient or not timely.	• Be clear about funding requirements. • Be aware of how funding delays will impact timelines and plan accordingly.
The work can not be completed in the required timeframe.	• Seek clarity from key stakeholders about their anticipated timeframes. • Be prepared to prioritize objectives and tasks. • Explore the possibility of updating previous reports rather than starting over. • Be aware that timely completion of the project is heavily reliant on some preliminary information gathering. This work should be started as soon as possible.
The schedule of Board of Directors meetings causes delays.	• Seek Executive Committee input when appropriate.
CASA Secretariat and/or CASA stakeholders do not have the capacity (i.e. human resources) to participate effectively.	• Be prepared to prioritize objectives and tasks. • Consider that key tasks may happen sequentially, rather than in parallel.

Risks	Possible Mitigation Strategies
Consultant contracts take longer than anticipated and/or reaching agreement on consultant reports is difficult.	• Ensure that Terms of Reference for consultants provide clarity and have a high level of endorsement from team members. • Consider consultant reports as one input into the final decision.
Key stakeholders are not engaged until late in the process.	• Identify all interested parties, including those that have a vital interest in electricity generation. • Ensure all interested parties understand the options available to be engaged, including active participation if they have a vital interest in electricity generation.
Information gathered does not contribute to reaching a final agreement.	• Consider how the information gathered will be used. • Ensure that Terms of Reference for consultants are clear.
Updates to the Framework misalign with initiatives on water and/or the Land Use Framework and regional plans.	• Remain up-to-date on developments in related initiatives.
Framework updates/revisions do not offer equivalent or better environmental outcomes than mid-life BLIERs.	• Provide justification for the overall Framework approach representing a more justifiable and practical approach to emissions management.

Projected Resources

The working group foresees the following potential external costs over the life of the project team, consistent with the objectives outlined in this document. The accompanying figures are estimates and as the work of the project team progresses a clear idea of the required resources will emerge.

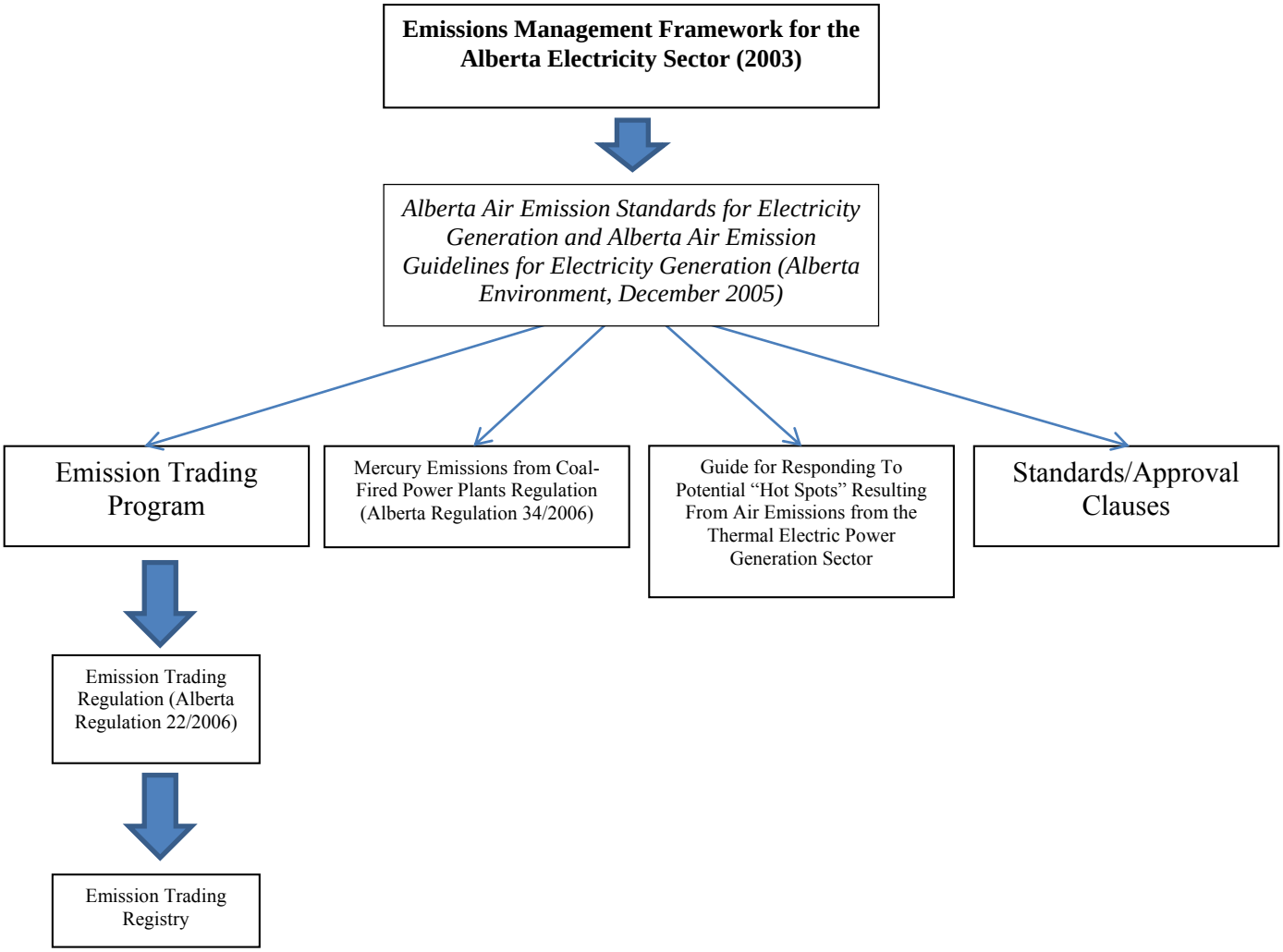
Key Task	2008 Budget	2013 Budget
Economic Analysis (Recommendation 35)		$80,000
Emissions Growth (Recommendation 34)	$24,000 $10,000 (2009 update, based on new recommendations)	$35,000
BATEA Review	$160,000	$60,000
Environmental Effects Literature Review	$10,000	$20,000
Health Effects Literature Review	$10,000	$20,000
PM Management System consideration		$20,000
Other consultant work, as required		$20,000
Public Consultation	$35,000	$60,000

Key Task	2008 Budget	2013 Budget
TOTAL	**$249,000**	**$315,000**
NOx/Co-Gen Review * The CASA Board directed the team to undertake this work in an attempt to reach consensus. These were extenuating circumstances and this additional cost is not anticipated for the 2013 Five-Year Review.	$192,000	
TOTAL	$441,000	

Stakeholder Analysis and Engagement Plan

Following due process, the CASA Board of Directors would be asked to propose interested parties to be engaged in the project team. Please see Appendix II for a list of previous participants, for both the 2003 Electricity Project Team and the 2008 Electricity Framework Review team.

Appendix I – Managing Air Emissions in the Electricity Sector



Appendix II – Electricity Framework Review Working Group Members

Name	Organization
David James	Alberta Energy
David Spink	Prairie Acid Rain Coalition
Don Wharton	TransAlta
Jim Hackett	ATCO
Krista Brindle	Alberta Energy
Randy Dobko	Alberta Environment and Sustainable Resource Development
Tom Marr-Laing	Pembina Institute
Robyn-Leigh Jacobsen	Clean Air Strategic Alliance
Celeste Dempster	Clean Air Strategic Alliance

Appendix III – Past Participants on the 2003 Electricity Project Team and the 2008 Electricity Framework Review Team

Government		
Federal	Environment Canada	Project Team
Provincial	Alberta Energy	Project Team
	AB Environment & Sustainable Resource Development	Project Team
	Alberta Health	Project Team
	Alberta Energy and Resource Conservation Board	
	Alberta Utilities Commission	Project Team
Local	AB Association of Municipal Districts & Counties	Project Team
	Alberta Urban Municipalities Association	Project Team
Aboriginal	First Nations Energy Task Force	
	Metis	

Industry		
Agriculture	Wild Rose Agricultural Producers	Project Team
Alternate Energy	Vision Quest Wind Electric	Project Team
	Howell-Mayhew Engineering	Sub-Group
	ENMAX	Project Team
Chemical Manufacturers	Chemistry Industry Association of Canada (formerly CCPA)	Project Team
Forestry	Calpine Canada Alberta Forest Products Association	Project Team
Mining	Coal Association of Canada Luscar	Project Team
Oil and gas (large producers)	CAPP	Project Team
Oil and gas (small producers)		
Petroleum Products	Canadian Fuels (formerly Canadian Petroleum Products Institute)	Project Team
Utilities	TransAlta Corporation ATCO Power Canada Ltd Capital Power TransCanada	Project Team
Other	Power Purchase Arrangement Buyers	Project Team

Non-Government Organizations		
Health Issues	Canadian Public Health Association	Project Team
Pollution Issues	Pembina Institute Mewassin Community Council Lake Wabamun Enhancement Protection Association Toxics Watch	Project Team
Wilderness Issues	Prairie Acid Rain Coalition Western Canadian Wilderness Committee	Project Team Sub-Group
Consumer/Transportation	Climate Change Central	Project Team
Members of Affected Communities (MACs)	There were two MACs on the 2008 Electricity Framework Review team	Project Team
Other	Environmental Law Center	Project Team
	Sierra Club	Project Team
	Residents for Accountability in Power Industry Development	Sub-Group

Appendix B: EFR Project Team Members and Sub-group Members

EFR Team

Ahmed Idriss	Capital Power
Anamika Mukherjee	Canadian Association of Petroleum Producers
Ben Thibault	Pembina Institute
Brian Jackowich	Alberta Urban Municipalities Association
David James	Alberta Energy
David Lawlor	Enmax
David Spink	Prairie Acid Rain Coalition
Don Wharton	TransAlta
Jim Hackett*	ATCO Power
Kristi Anderson	Mewassin Community Council
Peter Moore	Alberta Energy
Randy Dobko*	Alberta Environment and Sustainable Resource Development
Robyn Jacobsen	CASA
Shaun McNamara	Maxim Power Corp.
Srikanth Venugopal	TransCanada
Steven Flavel	Alberta Energy
Tom Marr-Laing*	Pembina Institute
Wayne Ungstad	Friends of Chain Lakes

** designates a chair or co-chair of the group*

Alternate Members, Corresponding Members and Former Project Team Members

Al Schulz	Chemical Industry Association of Canada
Andre Chabot	Alberta Urban Municipalities Association
Celeste Dempster	CASA
Colin Dumais	Enmax
Daniel Jurijew	Capital Power
Glynis Carling	Canadian Association of Petroleum Producers
Kelly Scott	ATCO Power
Krista Brindle	Alberta Energy
Marlo Raynolds	BluEarth Renewables
Michelle Riopel	CASA
Leonard Standingontheroad	Friends of Chain Lakes
Lorna Young	Chemical Industry Association of Canada
Lynn Meyer	Capital Power
Njoroge Ngure	TransCanada
Oliver Bussler	TransAlta
Paul DiJulio	Slave Lake Pulp
Rob Watson	Maxim Power Corp.
Rod Crockford	ENCANA
Sushmitha Gollapudi	Alberta Environment and Sustainable Resource Development
Tim Weiss	Pembina Institute
Tom Watson	Milner Power
Vinson Banh	Alberta Energy

N.B. The affiliations of some former team members and sub-group members may have changed. The affiliation shown for each person was accurate at the time the individual was active with the team or sub-group.

Sub-groups listed below include current, former, alternate, and corresponding members.

Base Case Working Group

Rob Watson	Milner/Maxim Power
Oliver Bussler	TransAlta
Randy Dobko	AB Environment and Sustainable Resource Development
Colin Dumais	ENMAX
Jim Hackett	ATCO Power Canada Ltd.
Ahmed Idriss	Capital Power Corporation
Robyn Jacobsen	Clean Air Strategic Alliance
Tom Marr-Laing	Pembina Institute
Peter Moore	Alberta Energy
Anamika Mukherjee	Cenovus Energy Inc.
Njoroge Ngure	TransCanada
Srikanth Venugopal	TransCanada Transmission

Communications Task Group

Nora Mortemore	Alberta Environment and Sustainable Resource Development
Wayne Ungstad	Friends of Chain Lakes
Karen Walters	ATCO Power
Robyn Jacobsen	Clean Air Strategic Alliance

Control Technologies and Reduction Strategies Task Group

Vinson Banh	Alberta Energy
Colin Dumais	ENMAX
Sushmitha Gollapudi	Alberta Environment & Sustainable Resource Development
Jim Hackett	ATCO Power Canada Ltd.
Ahmed Idriss	Capital Power Corporation
Robyn Jacobsen	Clean Air Strategic Alliance
Anamika Mukherjee	Cenovus Energy Inc.
David Spink	Prairie Acid Rain Coalition
Wayne Ungstad	Friends of Chain Lakes
Srikanth Venugopal	TransCanada Transmission

Health and Ecological Assessment Task Group

Alison Anaka	Enmax
Colin Dumais	Enmax
Colin L. Soskolne	Prairie Acid Rain Coalition
David Lawlor	Enmax
Debra Hopkins	Alberta Environment and Sustainable Resource Development
Kaitlyn Wall	Alberta Environment and Sustainable Resource Development
Kristi Anderson	Mewassin Community Council
Merry Turtiak	Alberta Health
Michelle Riopel	CASA
Robyn Jacobsen	CASA

PM Management System Task Group

Shaun McNamara	Milner Power Inc.
Srikanth Venugopal	TransCanada Transmission
Kristi Anderson	Mewassin Community Council
Randy Dobko	Alberta Environment and Sustainable Resource Development
Jim Hackett	ATCO Power Canada Ltd.
Ahmed Idriss	Capital Power Corporation
Robyn Jacobsen	Clean Air Strategic Alliance
Njoroge Ngure	TransCanada
David Spink	Prairie Acid Rain Coalition

Appendix C: August 2014 Letter from Hon. Robin Campbell

59863

ALBERTA
ENVIRONMENT AND SUSTAINABLE RESOURCE DEVELOPMENT

Office of the Minister
MLA, West Yellowhead

RECEIVED
AUG 15 2014
CASA

August 13, 2014

Ms. Wendy Boje, Executive Director
Clean Air Strategic Alliance
10th Floor, 10035 - 108 Street
Edmonton AB T5J 3E1

Dear Ms. Boje:

Thank you for your July 23, 2014, letter regarding the Clean Air Strategic Alliance's interim report on the five-year review of Alberta's electricity framework.

Environment and Sustainable Resource Development is working with the departments of Energy and Health to develop a cross-ministry plan to review the interim report and determine the next steps for Alberta's electricity emissions framework. Upon completion of this government review, our department will notify the Clean Air Strategic Alliance board of the process and results.

The Government of Alberta is committed to the current emissions management framework. Until a carefully weighed decision has been made on the interim report and the framework, the government will continue to make regulatory decisions in accordance with the existing framework.

The Government of Alberta recognizes the value of our vital partnership with the Clean Air Strategic Alliance. The alliance's readiness to tackle complex air quality issues spanning a large spectrum of key industrial sectors, commercial interests, and plant processes speaks to the success of the collaborative process.

Thank you to the Clean Air Strategic Alliance and the framework review project team for their work in preparing this interim report. We look forward to working co-operatively with the alliance on the best way forward.

Sincerely,

Robin Campbell
Minister

cc: Honourable Diana McQueen, Minister of Energy
Honourable Fred Horne, Minister of Health
Bill Werry, Deputy Minister of Environment and Sustainable Resource Development
Rick Blackwood, Environment and Sustainable Resource Development
Shannon Flint, Environment and Sustainable Resource Development

323 Legislature Building, 10800 - 97 Avenue, Edmonton, Alberta T5K 2B6 Canada Telephone 780-427-2391 Fax 780-422-6259
6, 554 Carmichael Lane, Hinton, Alberta T7V 1S8 Canada Telephone 780-865-9796 Fax 780-865-9760

Appendix D: Documents Prepared for this Five-Year Review

A number of documents were prepared as part of this five-year review, all of which are publicly available as noted below.

[A list of all reports done by sub-groups and consultants along with a url where they are posted will be inserted here.]

Eastern Research Group, Inc. (ERG). 2014. *Control Technologies Review for Gas Turbines in Simple Cycle, Combined Cycle and Cogeneration Installations, Final Report*. September 1, 2014.

EDC Associates. 2014. *Electricity Framework 5 Year Review 2013 Phase I Report*, issued April 8, 2014.

EDC Associates. 2014. *Electricity Framework 5 Year Review - Generation & Emissions Forecasts*, issued October 29, 2014.

Appendix E: Categorized Substance List

Substance	Category 1: Priority List Rationale and Considerations
Total Particulate Matter (includes $PM_{2.5}$, PM_{10}, and TSP)	These are priority substances from the electricity sector that require management, as identified by the 2003 PSG: SO_2, NO_x, Mercury, PM, and GHGs. HEAT did not find sufficient information to remove them from the priority list.
Mercury	
SO_2	• There is extensive literature to show the health effects. • Constitutes a high proportion of emissions from electricity generation (especially coal).
NO_2	• Emitted in all forms of electricity generation combustion. • Note: the focus is on NO_2 rather than NO_x because NO_x is largely NO_2, and the Alberta Ambient Air Quality Guideline is for NO_2.
GHGs	• Management is covered by Alberta's 2008 Climate Change Strategy.[12]
Substance	**Category 2: Management Actions Need to be considered Rationale and Considerations**
Antimony	Metals identified as of potential concern as they have multiple pathways (see CSEEG section 6.6: Summary of Regulatory Applications)
Arsenic	
Barium	
Cadmium	
Cobalt	
Lead	
Manganese	
Selenium	
Chromium (i.e. Chromium III and Chromium VI for HEAT purposes)	• Metals identified as of potential concern as they have multiple pathways (see CSEEG section 6.6: Summary of Regulatory Applications • Chromium VI was ranked in the top 5 chemicals to contribute more than 5% of toxic potential (CSEEG section 3.3.3: Chronic Inhalation (carcinogens)). • The group agreed that although Chromium III was not listed in the top 5% of toxic potential for chronic inhalation, it would be included in Category 2 because the risk is unknown from a multiple pathways perspective.
Formaldehyde	• CSEEG Table 4 shows that it contributes more than 0.1% to acute toxic potency. • CSEEG Table 5 shows that it contributes more than 0.1% to chronic toxic potency. • CSEEG Table 6 shows that it contributes more than 0.1% to carcinogenic toxic potency. • New information has very recently emerged from the EPA.

[12] http://esrd.alberta.ca/focus/alberta-and-climate-change/climate-change-strategy/documents/AlbertaClimateChangeStrategy-2008.pdf

Benzene	• It is a known carcinogen • CSEEG Table 5 shows that it contributes more than 0.1% to chronic toxic potency • There is a public perception of risk • CSEEG Tables 4, 6, and D-1 show that it is emitted from coal combustion and natural gas, and contributes more than 0.1% to acute and carcinogenic toxic potency.
Hydrogen fluoride	• Historically it has been a priority for GoA. • CSEEG Tables 4 and 5 show that it is a chemical that contributes to more than 0.1% of acute and chronic toxic potency. • It is predicted to exceed Toxicity Reference Values based on predicted air concentrations on an acute basis. (CSEEG section 6.6: Summary of Regulatory Applications). • The point was made that because emissions are related to coal, the categorization of this substance may change as coal is phased out.
Substance	**Category 3: Ongoing Surveillance Rationale and Considerations**
Boron	Metals listed in CSEEG Table 12, indicating that they are bio-accumulative, persistent, and non-volatile.
Calcium	
Chlorine	
Copper	
Iron	
Magnesium	
Molybdenum	
Potassium	
Rubidium	
Silicon	
Silver	
Sodium	
Strontium	
Thallium	
Thorium	
Titanium	
Uranium	
Zinc	
Zirconium	
5–methylchrysene	
7, 12 dimethylbenz(a)anthracene	
2-Chloroacetophenone	
Aluminum	• A metal listed in CSEEG Table 12, indicating that it is bio-accumulative, persistent, and non-volatile. • CSEEG Table 5 shows that aluminum contributes more than 0.1% to chronic toxic potency.

	• It is ranked in the top five chemicals to contribute more than 5% of toxic potential (CSEEG section 3.3.2: Chronic Inhalation (non-carcinogens)).
Beryllium	• A metal listed in CSEEG Table 12, indicating that it is bio-accumulative, persistent, and non-volatile. • CSEEG Table 5 shows that it contributes more than 0.1% to chronic toxic potency. • CSEEG Table 6 shows that it contributes more than 0.1% to carcinogenic toxic potency.
Bromine	• A metal listed in CSEEG Table 12, indicating that it is bio-accumulative, persistent, and non-volatile. • CSEEG Table 4 shows that bromine contributes more than 0.1% to acute toxic potency.
Nickel	• A metal listed in CSEEG Table 12, indicating that it is bio-accumulative, persistent, and non-volatile. • CSEEG Table 4 shows that Nickel contributes more than 0.1% to acute toxic potency. • CSEEG Table 5 shows that it contributes more than 0.1% to chronic toxic potency.
Phosphorous	• A metal listed in CSEEG Table 12, indicating that it is bio-accumulative, persistent, and non-volatile. • CSEEG Table 4 shows that phosphorous contributes more than 0.1% to acute toxic potency.
Vanadium	• A metal listed in CSEEG Table 12, indicating that it is bio-accumulative, persistent, and non-volatile. • CSEEG Table 4 shows that vanadium contributes more than 0.1% to acute toxic potency. • CSEEG Table 5 shows that it also contributes more than 0.1% to chronic toxic potency.
2, 3, 7, 8 TCDD and 2, 3, 7, 8 TCDF	Although not shown to contribute to toxic potency, these should be under surveillance because: • There a high level of public perception of risk. • Health Canada considers them to be highly toxic and priority. • The National Pollutant Inventory shows that coal-fired electricity was responsible for 35 % of dioxin and furan emissions in Alberta in 2010 (a total of 1.5903g)[13] and 34% of dioxin and furan emissions in Alberta in 2011 (a total of 1.298g)[14]. • CSEEG Table D-1 shows them to be non-volatile, bio-accumulative, and persistent.

[13] 2010 Total Air Pollutants Emissions for Alberta, Environment Canada, Pollutant Inventories and Reporting Division, 2012. https://www.ec.gc.ca/inrpi-npri/

[14] 2011 Total Air Pollutants Emissions for Alberta, Environment Canada, Pollutant Inventories and Reporting Division, 2013. https://www.ec.gc.ca/inrp-npri/

Hydrogen chloride	• It is ranked in the top five chemicals to contribute more than 5% of toxic potential (CSEEG section 3.3.2: Chronic Inhalation (non-carcinogens)). • It is coal-specific and will not be an issue once phased out. • Although we know it is emitted, it seems to be in low amounts and there is very little data.
2, 4 dinitrotoluene	CSEEG Table 12 shows it as persistent, bio-accumulative, and non-volatile.
3-methylcholanthrene	CSEEG Table 12 shows it as persistent, bio-accumulative, and non-volatile.
Acetaldehyde	• There is a public perception of risk to human health. • CSEEG Table 4 shows that it contributes more than 0.1% to acute toxic potency. • CSEEG Table 6 shows that it also contributes more than 0.1% to carcinogenic toxic potency.
Acrolein	• From 2006-2010, acrolein came up often in Environmental Impact Assessments. Health Canada changed the exposure limit to be less conservative and it stopped appearing often. The issue was raised by the Alberta Air Quality Objectives group, and currently there is an Alberta Air Quality Objective being developed for it • CSEEG Table 4 shows that it also contributes more than 0.1% to acute toxic potency. • CSEEG Table 5 shows that it contributes more than 0.1% to chronic toxic potency.
Benzyl Chloride	• Table 5 of chemical screening shows that it also contributes more than 0.1% to chronic toxic potency. • Table 6 of chemical screening shows that it also contributes more than 0.1% to carcinogenic toxic potency. • Has not been assessed for persistence and bioaccumulation.
Bis(2-ethylhexyl)phthalate	CSEEG Table 12 shows it as persistent, bio-accumulative, and non-volatile.
Ethylbenzene	CSEEG Table 6 shows that it also contributes more than 0.1% to carcinogenic toxic potency.
Hexachlorobenzene	• CSEEG Table 6 shows it's an emitted substance. • In Alberta, coal-fired electricity emitted 1679.887g of hexachlorobenzene in 2010[15], and 1481.114g of hexachlorobenzene in 2011[16].
Propylene Oxide	CSEEG Table 6 shows that it also contributes more than 0.1% to carcinogenic toxic potency.
NH_3	• CSEEG Table 4 shows that it contributes more than 0.1% to acute toxic potency.

[15] 2010 Total Air Pollutants Emissions for Alberta, Environment Canada, Pollutant Inventories and Reporting Division, 2013 www.ec.gc.ca/inrp-npri

[16] 2011 Total Air Pollutants Emissions for Alberta, Environment Canada, Pollutant Inventories and Reporting Division, 2013 www.ec.gc.ca/inrp-npri

	• CSEEG Table 5 shows that it contributes more than 0.1% to chronic toxic potency. • It is ranked in the top five chemicals to contribute more than 5% of toxic potential (CSEEG section 3.3.2: Chronic Inhalation (non-carcinogens)). • It was noted that this could be from ammonia slip from the Selective Catalytic Reduction put in place to control NO_x. There is a need to consider that restrictions on NH_3 production could result in removing control technology.
Sulphuric Acid	• CSEEG Table 4 shows that it also contributes more than 0.1% to acute toxic potency. • CSEEG Table 5 shows that it also contributes more than 0.1% to chronic toxic potency.
PAHs (Includes alkylated PAHs: 2-methylfluorene and 2-methylnaphthalene; and chlorinated PAH: 2 chloronaphthalene)	• Although there are a number of substances listed under PAHs, it is difficult to look at them individually or as mixtures because most research uses an indicator substance (commonly benzo(a)pyrene) as a proxy for the whole group. • For future literature reviews, all substances in this category should be used as key search words, but for the categorization purposes HEAT will treat them as a group.
Substance	**Category 4: Insufficient Information** **Rationale and Considerations**
1, 1, 1 Trichloroethane	Can be toxic in high enough doses, and potentially in low doses over extended periods of time. However this information in not known.
Chlorobenzene	Identified by Health Canada as non-toxic under Section 11 of the Canadian Environmental Protection Act.
Dichlorobenzene	Information from Health Canada shows that the amount in the environment is 9000 times less than the threshold estimated for the most sensitive aquatic species.
CO	• CSEEG Table 4 shows that it contributes more than 0.1% to acute toxic potency. • There is a known health impact but CO concentrations from stack emissions are a measure of inefficiency of burning fossil fuel and can be very difficult to detect. In general, CO from electricity generation is not considered a major contributor to ambient air quality.
1,3 Butadiene	There is insufficient evidence to indicate that action is required on these substances (See CSEEG Table D-1)
Acetophenone	
Benzaldehyde	
Bromoform	
Carbon Disulphide	
Chloroform	
Cyanide	
Dimethyl Sulphate	
Ethyl Chloride	
Ethyl Dibromide	
Ethylene Dichloride	

HCFC-22	
Hexane	
Isophorone	
Isopropylbenzene	
Methyl Bromide	
Methyl Chloride	
Methyl Ethyl Ketone	
Methyl Hydrazine	
Methyl Methacrylate	
Methyl tert-butyl ether	
Methylene chloride	
Pentane	
Phenol	
Propane	
Propionaldehyde	
Propylene	
Styrene	
Tetrachloroethylene	
Toluene	
Vinyl Acetate	
Xylenes	
Hydrochloric Acid	
Radionuclides	