MANITOBA HYDRO

Brandon Generating Station – Unit 5

Environmental Impact Statement

Volume 4 – Response to TAC Review

Prepared by:

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September 2007

Manitoba Hydro

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2007 09 14

Ms. Tracey Braun
Director
Environmental Assessment and Licensing Branch
Manitoba Conservation
123 Main Street, Suite 160
Winnipeg, MB R3C 1A5

Dear Ms. Braun:

BRANDON GENERATION STATION LICENCE REVIEW - RESPONSE TO TAC COMMENTS

Enclosed for your review are Manitoba Hydro's responses to the Technical Advisory Committee (TAC) comments for the Brandon Generating Station Environment Act Licence review that were forwarded to our office on May 4, May 10 and June 26, 2007. We have enclosed 12 bound copies of the responses, which is consistent with the number of copies of the Environmental Impact Statement (EIS) sent to your office, for your distribution.

Should you require any additional information, please contact me at 474-3690.

Yours truly,

W.A. Brown
Manager
Environmental Licensing & Protection Department
Power Planning

WAB/scw/070914-Cover Letter to MB Cons.doc

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INTRODUCTION

INTRODUCTION

This document is Volume 4 of the Environmental Impact Statement (EIS) that has been prepared as part of the Environment Act Licence Review (EALR) for the Brandon Generating Station (Brandon G.S.) – Unit 5. Manitoba Hydro submitted Volume 1 – Report, Volume 2 - Appendices (A to K) and Volume 3 – Appendices (L to P) to Manitoba Conservation on December 21, 2006.

Volumes 1, 2 and 3 have been reviewed by the interdepartmental Technical Advisory Committee (TAC) and placed into the relevant public registries. Comments on the volumes were received from ten members of the TAC. This document provides Manitoba Hydro's response to these TAC comments.

Manitoba Hydro's responses to the TAC review of the EIS are contained within the following tabbed sections. Each tab is indexed to a particular TAC reviewer's comments. The abbreviations used on the tabs are provided below:

- MC-AQS – Manitoba Conservation – Air Quality Section
- MC-MIS – Manitoba Conservation – Municipal and Industrial Section;
- MC-EO – Manitoba Conservation – Environmental Operations
- MWS-ESD – Manitoba Water Stewardship – Ecological Services Division; and
- MWS-GMS – Manitoba Water Stewardship – Groundwater Management Section
- MH - ABRHO – Manitoba Health – Assiniboine and Brandon Regional Health Office
- MSTEM – Manitoba Science, Technology, Energy and Mines Department
- CEAA – Canadian Environmental Assessment Agency
- DFO – Department of Fisheries and Oceans Canada
- EC – Environment Canada;

For ease of reference, the original TAC reviewer comments are included in their entirety at the beginning of each section. Within each section, the particular comments being responded to are re-stated, followed by Manitoba Hydro's response.

MC-AQS

MANITOBA CONSERVATION

AIR QUALITY SECTION

TO: Mr. David Bezak, Manager
Air Quality Section
Manitoba Conservation
160 - 123 Main Street
Winnipeg MB R3C 1A5

FROM: Jean Van Dusen, M.A.Sc., P.Eng.

DATE: April 30, 2007

SUBJECT: **Manitoba Hydro Brandon Generating Station (Unit 5) - Environmental Impact Statement (EIS) Prepared by UMA Engineering Ltd. in association with North/South Consultants Inc. and SENES Consultants Ltd., (December 2006)**

I have reviewed the air quality-related aspects of the environmental impact statement (Volumes I and associated appendices, in particular Appendix K Air Quality Impact Assessment) as submitted by UMA Engineering Ltd. for the Manitoba Hydro Brandon Generating Station (Unit 5).

The air quality assessment was done appropriately with acceptable methodology (*e.g.*, choice of air dispersion models and meteorological data, use of source sampling data to estimate emission rates, use of background air quality data for Brandon and Winnipeg, choice of scenarios, selection of discrete and gridded receptors, *etc.*). The emission rates were appropriately and conservatively overestimated, especially for the long-term calculations.

The air dispersion modelling identified two situations in which the calculated air pollutant concentrations were above the relevant air quality criteria:

- NO_2 (as a 1-hour average) for the modelling scenario in which the conservative assumption that 100% of the NO was converted to NO_2 at the stack tip was combined with the least efficient burner configuration (OS2).
- Suspended particulate matter (as a 24-hour average) due to fugitive emissions from the coal stack when combined with the high background levels measured in Brandon.

In the first situation (NO_2), I agree with the consultant that the assumption of 100% conversion is overly conservative since significant time is required for the NO to be converted to NO_2 in the atmosphere. When the conversion was modelled using the empirical approach based on the Janssen equation for NO conversion, no exceedances were reported.

For the suspended particulate matter ($PM_{2.5}$, PM_{10}, and TSP), the modelling indicated that fugitive emissions from the coal pile have the potential to contribute a significant portion (15 $\mu g/m^3$, 27 $\mu g/m^3$, and 105 $\mu g/m^3$, respectively) of the relevant air quality criteria (30 $\mu g/m^3$, 50 $\mu g/m^3$, and 120 $\mu g/m^3$, respectively). When combined with the background particulate levels measured in Brandon, exceedances of the criteria are likely.

While the consultant indicates that the dust mitigation measures taken with the coal pile are not accounted for in the modelling, the modelling results indicate both the importance

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of the coal pile as a potential source of fugitive dust and the importance of taking measures to reduce fugitive emissions from this source. Consequently, the portion of Clause 10 relating to fugitive emissions should be retained in the *Environment Act* licence for this facility.

In addition, two clauses relating to mercury air releases should be added to this facility's *Environment Act* licence. The first clause should cap the total mercury air releases from Manitoba Hydro's Unit 5 at 20 kg/year, consistent with the limit set in the Canadian Council of Ministers of the Environment (CCME) *Canada-wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants* (endorsed by Environment Ministers on October 11, 2006). In Annex A of this Canada-wide Standard (CWS), Manitoba's implementation plan for existing electric power generation (EPG) facilities states that "the cap of 20 kg on mercury releases from the Brandon GS by 2010 (representing an annual generation capacity of about 75%) will be instituted by an *Environment Act* Licence amendment or other arrangement". In this EIS for the Brandon Generating Station (Unit 5), Manitoba Hydro has indicated that it has already committed to voluntarily limiting mercury air emissions to 20 kg/year as of 2006. (See Section 5.3.2.5 Mercury, page 122.)

The second mercury clause should require Manitoba Hydro to implement the CCME *Monitoring Protocol in Support of the Canada-Wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants,* once this protocol has been completed. Again, Manitoba Hydro has already indicate that it will implement the proposed protocol. (See Section 5.3.1.1 Mercury, page 119.)

In summary, the air dispersion modelling was done appropriately in this environmental impact statement. The only air quality issue of concern identified by the modelling is the potential for fugitive emissions from the coal stockpile, which can be addressed by a clause in the *Environment Act* licence. In addition, two clauses relating to mercury releases should be added, consistent with the requirements of the mercury CWS for EPG plants.

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MC-AQS MANITOBA CONSERVATION - AIR QUALITY SECTION

This section contains the responses to comments from J. Van Dusen provided in a memorandum to D. Bezak (MC-AQS), dated April 30, 2007.

COMMENT: *"For suspended particulate matter (PM2.5, PM10 and TSP), the modelling indicated that fugitive emissions from the coal pile have the potential to contribute a significant portion (15 µg/m^3, 27 µg/m^3, and 105 µg/m^3, respectively) of the relevant air quality criteria (30 µg/m^3, 50 µg/m^3, and 120 µg/m^3, respectively). When combined with the background particulate levels measured in Brandon, exceedances of the criteria are likely.*

While the consultant indicates that the dust mitigation measures taken with the coal pile are not accounted for in the modelling, the modelling results indicate both the importance of the coal pile as a potential source of fugitive dust and the importance of taking measures to reduce fugitive emissions from this source. Consequently, the portion of Clause 10 relating to fugitive emissions should be retained in the Environment Act Licence for this facility."

RESPONSE: As stated in the EIS report, the maximum contributions of particulate matter from the coal handling and storage to maximum predicted ambient PM concentrations occur in non-residential areas near the facility property line, and do not contribute significantly to the observed exceedances of the criteria for PM_{10} (and by extension for TSP) that have been reported at the monitoring station in Brandon. It is not the contribution of fugitive emissions from the Brandon Generating Station that results in exceedances of the criteria, but rather the existence of very high background levels of fugitive dust in the area. As for $PM_{2.5}$, the Brandon area currently remains well below the Canada Wide Standard (CWS) and there is no evidence to suggest that the CWS cannot be met with the current method of coal pile storage and current mitigation measures in place at the station.

However, Manitoba Hydro agrees with the comment that fugitive emissions from the coal pile have the potential to contribute a portion of the relevant criteria for particulate matter at the locations indicated in the EIS report in the immediate vicinity of the facility, and thus, as indicated in Section 9.2.4 of the EIS, agrees with the need to retain Clause 10 in the Environment Act Licence. In addition to currently described operating procedures mentioned in the EIS to control coal dust emissions, Manitoba Hydro intends to initiate a study to determine what further engineering controls could be added to those already present at Brandon GS to control fugitive dust emissions. Once complete, this study would be submitted to Manitoba Conservation and any recommendations would be implemented by Manitoba Hydro.

MC - MIS

MANITOBA CONSERVATION

MUNICIPAL AND INDUSTRIAL SECTION

Manitoba **Memorandum**

DATE: April 13, 2007

TO: Clem Moche, P. Eng.

FROM: Ryan Coulter, P.Eng.
Environmental Engineer
Municipal & Industrial Section
123 Main Street
Ste. 160 Union Station
Winnipeg, Mb R3C 1A5
Ph: 945-7023

SUBJECT: **Brandon Generating Station EIS**

I have reviewed the Brandon Generating Station – Unit 5 environmental impact statement and Environment Act Licence and have the following comments and concerns:

EIS

1. The EIS adequately addressed the major air emissions of concern including NO_x, CO, SO_2, Particulate Matter (PM_{10}, $PM_{2.5}$) and greenhouse gases.

2. The ongoing work to reduce fugitive dust emissions from the ash lagoons is positive.

3. The air dispersion modelling indicates that Manitoba Hydro is not causing excursions in air quality over the air quality criteria, with the exception of NO_2 when assuming 100% conversion of NO to NO_2. However, a more realistic estimate of NO conversion to NO_2 (Janssen method) indicates that air quality criteria would not be exceeded.

4. Fugitive coal dust remains a significant source of particulate matter and ongoing care is required in a coal dust management plan. This plan should likely include a limit on the quantity of coal allowable for storage on site. Hydro may need to provide additional justification for maintaining a stockpile of a 90 day supply

5. While Hydro has stated its intention that future coal supplies will meet or exceed the quality of existing coal supplies, consideration should be made to include a licence clause related to this.

6. Are the values presented in Table 2.5 correct? I note that the TSP and NOx emission rates have no significant variation between the 25% and 100% plant loads, whereas the CO emission rates differ by a factor of 100.

7. The mercury emission limit of 20 kg/year should be considered as a regulatory limit.

8. Given the NO_2 concentrations near air quality criteria, Hydro should investigate the usefulness of a predictive tool for air emissions that would allow for production decreases when conditions favour higher ground level concentrations.

Licence Review

The licence changes proposed by Hydro in relation to air emissions appear to be acceptable, with the exception of the following:

1. The definition of fugitive emissions is a standard departmental definition and should not be changed.
2. I am not certain that the definition of an hour needs to be changed.
3. I do not agree that the clause should contain specific reference to Unit 5. The updated licence will be for Unit 5 only and therefore it is redundant to specify that this clause applies only to Unit 5.
4. The emission rate limits should be consistent with the CCME National Emission Guideline for Commercial /Industrial Boilers and Heaters. Hydro should be asked to complete the necessary conversions for comparison.
5. Clause 7 should be replaced with a standard air pollution control equipment (ESP in this case) maintenance and recordkeeping clause.
6. Clause 10 as proposed is generally ok, but should also include good management practices for the ESP.
7. I would recommend removing clause 12. Air dispersion modelling has been required to demonstrate compliance with air quality criteria.
8. Clause 13 should be replaced with the noise nuisance clause.
9. The usefulness of proposed clause 26c is highly dependent on the reliability of the CEM, which at this point of time is uncertain.
10. Clause 28 should be removed.
11. The odour nuisance clause should be added.

Ryan Coulter, P.Eng.

MC-MIS MANITOBA CONSERVATION – MUNICIPAL AND INDUSTRIAL SECTION

This section contains responses to comments by R. Coulter (MC-MIS) contained in a memorandum sent to C. Moche (MC), dated April 13, 2007.

In his review of the EIS, Mr. Coulter states that:

COMMENT 4: *"Fugitive coal dust remains a significant source of particulate matter and ongoing care is required in a coal dust management plan. This plan should likely include a limit on the quantity of coal allowable for storage on site. Hydro may need to provide additional justification for maintaining a stockpile of a 90 day supply."*

RESPONSE: The reader is referred to Manitoba Hydro's response to comments contained in MC-AQS (Manitoba Conservation – Air Quality Section) above. For clarification, the primary emissions of fugitive coal dust result from coal handling operations (coal train unloading and reclaim) at the active storage pile, not from wind erosion of the long-term storage pile. Therefore, limiting the quantity of coal stored in the long-term storage pile will have little effect on reducing emissions of fugitive dust.

The long-term coal storage pile is maintained at a 90-day supply level due to operational and coal procurement logistics.

Operational Logistics – Unit 5 does not operate continuously or according to a predetermined pattern. It operates to support Manitoba Hydro's integrated hydraulic generation system, to provide power during drought conditions, to provide replacement power during transmission or generation system maintenance activities, and to provide emergency replacement power during transmission or generation system equipment failures or malfunctions. For these reasons, Unit 5 must be capable of operating continuously for long periods of time with little or no advance notice. Maintaining a 90-day coal stockpile ensures that coal is always available when Unit 5 is dispatched and allows sufficient lead time to procure additional coal if the unit must operate continuously for a long period of time.

Coal Procurement Logistics – Unlike natural gas, which is supplied by pipelines that bring fuel to the Brandon G.S. site, coal is supplied at the mine site and must be transported by rail to the generating station site. "Just-in-time" delivery of coal is not possible for stations like Brandon Unit 5, which are located far from the mine site. Manitoba Hydro purchases coal from mines in Montana and Wyoming due to the environmentally preferable properties of coal from these mines (i.e., low in sulphur, ash, mercury, and other trace constituents). The procurement of coal for Unit 5 must therefore be arranged well in advance of when it is required in order to ensure that it can be delivered to the Brandon G.S. site on time. Currently, Manitoba Hydro must purchase coal one year or more in

advance to ensure a secure supply of environmentally preferable coal at reasonable prices. Maintaining a 90 day coal stockpile ensures that environmentally preferable coal is always available in the event of delays in scheduled rail deliveries, coal supply chain disruptions, or if new supply contracts must be arranged when Unit 5 is called upon to operate continuously for drought or emergency conditions.

COMMENT 5: *" While Manitoba Hydro has stated its intention that future coal supplies will meet or exceed the quality of existing coal supplies, consideration should be made to include a licence clause related to this."*

RESPONSE: Manitoba Hydro does not agree with the suggestion to include a clause potentially restricting Unit 5 fuel feed stocks. It is Manitoba Hydro's view that Environment Act licences protect the quality of the environment by applying specific terms and conditions to a development's environmental outputs. Should future circumstances necessitate the use of a coal with less favourable quality characteristics compared to those studied in the EIS, Manitoba Hydro would continue to remain responsible to meet all output and discharge limits, terms and conditions set forth in the licence. Continuous emissions monitoring will ensure real-time compliance with licence terms, while periodic stack testing will continue to verify all provincial and federal emission reporting.

COMMENT 6: *"Are the values presented in Table 2.5 correct? I note that the TSP and NOx emission rates have no significant variation between the 25% and 100% plant loads, whereas CO emission rates differ by a factor of 100."*

RESPONSE: The values for CO and TSS emissions for Units 6&7, presented in Table 2.5 of the EIS are the correct design maximum emissions rates. As noted in Section 3.7 of Appendix K of the EIS, CO emission rates for startup (25% load factor) increase considerably at low loads due to incomplete combustion.

The NOx emission rates originally shown in Table 2.5 were incorrect. The design maximum emission rates for NO_x in Table 2.5 should have been 19.17g/s for 100% load factor and 7.78 g/s for 25% load factor (not the 29.33 g/s shown for both load factors). The corrected values for NO_x are lower than the values used for the modeling analysis. Therefore, the modeling analysis results presented in the EIS are very conservative and overstate the NOx emissions contributed by Units 6 & 7. The use of the corrected values in the modeling does not change the conclusions presented in the Unit 5 EIS.

COMMENT 8: *"Given the NO_2 concentration near air quality criteria, Hydro should investigate the usefulness of a predictive tool for air emissions that would allow for production decreases when conditions favour higher ground level concentrations."*

RESPONSE: As indicated in Table 5.7, Appendix K (page 79) of the EIS, the maximum predicted 1-hour average NO_2 concentrations do not in fact approach ambient air quality criteria when the NO to NO_2 conversion is based on the more realistic Janssen method. As discussed in Section 6.1.1, Appendix K (page 137) of the EIS, the provincial Maximum Acceptable objective would not be exceeded even if the background NO_2 concentration observed in Brandon were added to the maximum predicted contribution from Unit 5 at the maximum point of impingement based on the Janssen conversion method. Even when the conversion is assumed to include 100% of the NO at the stack tip, the predicted NO_2 levels are below 73 µg/m^3 99.95% of the time. In other words, even assuming an extremely conservative (i.e. unrealistically high) rate of conversion for NO to NO_2, the predicted 1-hour average NO_2 concentrations would not exceed 100 µg/m^3 on more than 4 hours per year, even if Unit 5 were operated every hour of the year [i.e. 100% capacity factor (C.F.)]. Since the Unit does not operate at 100% C.F., such a predictive tool would only be trying to prevent exceedingly rare events; perhaps only 1-2 hours a year at the maximum point of impingement. In residential areas of Brandon, the impact of Unit 5 emissions is even lower, making it that much less likely that NO_2 concentrations would approach any existing ambient air quality criteria. Therefore, the value of a predictive tool in such circumstances is questionable.

COMMENT 4: In his review of the Licence, Mr. Coulter states, *"the licence changes proposed by hydro in relation to air emissions appear to be acceptable, with the exception of the following"*:

"The emission rate limits should be consistent with the CCME National Emission Guideline for Commercial/Industrial Boilers and Heaters. Hydro should be asked to complete the necessary conversions by comparison."

RESPONSE: The emission rates for SO_2 and particulate matter in Table 3.5 of Appendix K (page 44) are already expressed in the form of the CCME guidelines (i.e. kg per MWh of energy output). The nitrogen oxide (NO_x) emissions in this table are listed as NO_2 assuming 100% conversion of NO to NO_2. For comparison with the CCME guidelines, the NO_x emission rates would be as follows:

- OS1 2.25 kg/MWh
- OS2 2.96 kg/MWh
- OS3 2.96 kg/MWh

MC - EO

MANITOBA CONSERVATION

ENVIRONMENTAL OPERATIONS

Moche, Clem (CON)

From: Crocker, Peter (CON)
Sent: Monday, March 26, 2007 15:59
To: Moche, Clem (CON)
Cc: Wright, Bruce (CON); Love, Pauline (CON)
Subject: Manitoba Hydro - Brandon Generating Station EIS CF 3252.00

Clem,

I have completed a review of the EIS provided by Manitoba Hydro for the Brandon Thermal Generating Station – Unit 5. I have no immediate concerns with the material or their suggested changes to the existing license that would impact the Western Region. The only issue that we have had with that plant is release events from the ash lagoon. One was for floating ash that escaped the lagoon (we believed these to be cenospheres, and it was a one-time event), the other two were releases or higher pH water due to equipment failures at the control structure of the lagoon (water level too low for CO^2 bubbler nozzle to be submerged and lower the pH of the water, I believe the other one was a sensor failure). Could it be appropriate to ask for a summary of the discharge events that exceeded the license limits and how they fixed the problem and ensure that there are sufficient controls or redundancy in place to ensure it doesn't happen again? I'm not sure if such actions would necessarily have to be incorporated into the license.

Peter Crocker B.Sc.
Acting District Supervisor / Environment Officer
Environmental Operations
Manitoba Conservation
1129 Queens Avenue
Brandon, MB R7A 1L9
Phone 204-726-6565 Fax 204-726-6567
Email: Peter.Crocker@gov.mb.ca

MC-EO MANITOBA CONSERVATION – ENVIRONMENTAL OPERATIONS

This section contains responses to comments by Peter Crocker (MC-EO) contained in an e-mail message sent to C. Moche (MC), dated March 26, 2007.

COMMENT: *"Could it be appropriate to ask for a summary of the discharge events (re: effluent release from the ash lagoon) that exceeded the license limits and how they fixed the problem and ensure that there are sufficient controls or redundancy in place to ensure it doesn't happen again?"*

RESPONSE: A summary of discharge events is included in the EIS in Appendix H. Figure 1.1 illustrates pH results in the effluent (page 14) and Figure 1.3 shows the Total Suspended Solids results in the effluent (page 16) of all testing that occurred until the end of 2004.

Manitoba Hydro samples effluent weekly during discharge events. The table below lists pH and TSS exceedances in the period from 2005 to the present. During that period, a number of improvements were made to the equipment and procedures to improve performance to ensure the pH adjustment system works correctly. In the summer of 2006, a significant, $500,000 project was undertaken to remove ash from the active lagoon to improve suspended solids settling by decreasing the flow through velocities in the lagoon. While conducting this work, sections of the liner were found to be below current design standards and a decision was made to empty the lagoon and repair all sub-standard areas. Finally, as discussed in section 4.2.1.2 of the EIS, other, planned improvements to the pH control system, as well as the construction of new lagoon cells are expected to improve the effluent quality in terms of pH and TSS further.

pH and Total Suspended Solids Exceedances – 2005 01 04 through 2007 04 24

Date	pH*	Total Suspended Solids (TSS)** Exceedance (mg/L)
2005 01 04	9.09	
2005 06 07	10.83	
2005 06 28	9.07	
2005 11 14		9
2005 11 29		13
2005 12 06		4
2006 05 02	10.08	
2006 11 28	9.01	

***The Environment Act Licence pH limit is 9**

**** The TSS value presented is the concentration above the Environment Act Licence limit, which is equal to 25 mg/L above baseline TSS concentration.**

The table above shows that since the ash lagoon work was completed in the summer of 2006, there have been no exceedances of TSS. There has only been one insignificant exceedance of pH since procedural changes were made to pH adjustment system operation during the summer of 2006.

MWS - ESD

MANITOBA WATER STEWARDSHIP

ECOLOGICAL SERVICES DIVISION

Manitoba

DATE: April 23, 2007

Memorandum

TO: Clemens Moche, P.Eng.
Municipal, Industrial &
Hazardous Waste Approvals
Section
Environmental Assessment &
Licensing
123 Main St., Suite 160
Winnipeg, MB. R3C 1A5

FROM: Jeremy Angus
Policy Analyst
Ecological Services Division
Manitoba Water Stewardship
200 Saulteaux Cres.
Winnipeg, MB
R3J 3W3

PHONE: 945-1007
FAX: 945-7419
FILE: **3252.00**

SUBJECT: **Manitoba Hydro – Brandon Generating Station - Environmental Impact Statement**

Manitoba Water Stewardship has reviewed the above noted proposal and submits the following comments for your consideration:

Nitrate contamination may be present in the upper part of the sand aquifer at this location. Shallow wells which would obtain water from the upper 10-20 feet of the aquifer would not be recommended. Further comments from Groundwater Management Section are attached as Appendix A to this memo.

In light of the province's commitment to reduce nutrient loading to waterways, MB Hydro should calculate their annual phosphorus load to the Assiniboine River from the station drain effluent and the ash lagoon effluent. In addition, total nitrogen should be monitored from these discharge points; and a total nitrogen load should be calculated.

In Section 4.1.3 Aquatic Habitat and Biota, both habitat and species are discussed including species listed on schedule 1 and schedule 3 of the Species at Risk Act. There is no mention of sturgeon which is currently being reviewed for listing as Endangered under SARA. Lake Sturgeon was extirpated from the river by harvest. Re-introduced in 1996 they are now being caught and released in the sport fishery near Brandon. If listed there may be more stringent conditions required on activities that have the potential to impact this species.

While it is recommended to remove Clause 31 (page 186) as the raw water intake is now screened; should there be something in the licence that reflects the need to further assess the performance of the fish protection system given during peak withdrawal, the approach velocity and flow specified in the authorization for the intake screen may be exceeded and these factors may have been exceeded even at the previously estimated water withdrawal rates based on the specified intake size and screen type (page 64). Or perhaps indicate that the fish protection system will be modified if it is determined modifications are required to protect local fish populations. Regarding the 2002 and 2003 impingement and entrainment study did the monitoring include larval fish?

In Clause 37 (page 189) if the station drain system is being modified (page 34) to redirect effluent from some of the waste streams to the ash lagoon should the frequency of sampling at the ash lagoon during discharge reflect once each week for soluble boron, total iron and acid-soluble copper instead of once every two weeks and should oil and grease (milligrams / l) now be included as one of the parameters. Also with the re-modification of the station drain system (page 34) to re-direct effluent from ash hopper seal trough overflow, boiler blowdown and chemical sump overflow from the station drain to ash lagoon – will the redirected effluent still go through the oil mitigation system or is there now no need?

Ensure Clause 41 with respect to groundwater monitoring captures the proponent's intent to additional monitoring to confirm the interpretation of a lack of adverse affects to the groundwater resources and the river including as well the other recommendations given by UMA in Appendix P.

As DFO has jurisdiction over habitat under the federal Fisheries Act, our comments do not take precedent over their review. As long as they are involved in reviewing this proposal and manage fish habitat to meet the intent of their no net loss policy, provincial fisheries management interests should be met.

Jeremy Angus

cc. R. McDougal
R. Matthews
L. Janusz
B. Betcher
N. Armstrong
T. Makuch

MWS – ESD MANITOBA WATER STEWARDSHIP – ECOLOGICAL SERVICES DIVISION

This section contains responses to comment by J. Angus (MWS-ESD) contained in a memorandum to C. Moche (MC), dated April 23, 2007.

COMMENT: *"Nitrate contamination may be present in the upper part of the sand aquifer at this location. Shallow wells which would obtain water from the upper 10 – 20 feet of the aquifer would not be recommended."*

RESPONSE: After conferring with the author, it was determined that the comment was not intended to be addressed to Manitoba Hydro or the operation of Unit 5 and therefore, the author agreed that no response by Manitoba Hydro was necessary.

COMMENT: *"In light of the province's commitment to reduce nutrient loading to waterways, MB Hydro should calculate their annual phosphorus load to the Assiniboine River from the station drain effluent and the ash lagoon effluent. In addition, total nitrogen should be monitored from these discharge points; and a total nitrogen load should be calculated."*

RESPONSE: Phosphorus loads based on measured, median monthly concentrations and maximum estimated discharges from the station drain (2974 m^3/d) and the future discharges from the ash lagoon (8741 m^3/d) are provided below. The estimated total annual load of P to the river is 874 kg. A breakdown of the source by month is provided in the table below.

	Loads (kg/d)		Loads (kg/month)
	Station Drain	**Ash Lagoon**	**Combined**
January	0.7	2.9	112
February	0.7	3.1	107
March	0.7	2.3	95
April	0.9	1.6	74
May	0.5	1.3	56
June	0.7	1.0	52
July	0.7	0.7	43
August	0.5	0.8	38
September	0.4	1.1	47
October	0.4	1.3	54
November	0.5	1.9	72
December	0.6	3.3	122
			874

Total nitrogen is not measured in the station drain or ash lagoon effluent, but Manitoba Hydro agrees to measure it for 6 months following issuance of a revised licence, so that loading of nitrogen from this source can be estimated.

COMMENT: *"While it is recommended to remove Clause 31 (page 186) as the raw water intake is now screened; should there be something in the licence that reflects the need to further assess the performance of the fish protection system…Or perhaps indicate that the fish protection system will be modified if it is determined modifications are required to protect fish populations. Regarding the 2002 and 2003 impingement and entrainment study did the monitoring include larval fish?"*

RESPONSE: Manitoba Hydro is currently planning to conduct additional measurement of velocity at the intake screen and will assess velocities to determine whether additional mitigation measures (e.g. modification of the intake screen) are required, and will discuss the results with DFO. It should be noted, however, that given the small percentage of the total flow that is withdrawn during the spring period, as seen in Table 4-3 of the EIS (page 63), the overall effect to fish populations is expected to be negligible. The 2002 and 2003 studies did include larval fish.

COMMENT: *"In Clause 37 (page 189) if the station drain system is being modified (page 34) to redirect effluent from some of the waste streams to the ash lagoon should the frequency of sampling at the ash lagoon during discharge reflect once each week for soluble boron, total iron and acid-soluble copper instead of once every two weeks and should oil and grease (mg/L) now be included as one of the parameters? Also with the re-modification of the station drain system…will the redirected effluent still go through the oil mitigation system or is there now no need?"*

RESPONSE: Sampling of the ash lagoon effluent, even with additional inputs from the station drain, every two weeks for parameters such as boron, iron and copper, is considered adequate. The ash lagoon effluent is subject to treatment by passage through the ash lagoon prior to discharge and other parameters (total dissolved solids and total suspended solids) that are monitored on a weekly basis provide proxies for the overall quality of effluent (including both dissolved and suspended constituents). The waste streams being re-directed to the ash lagoon are not considered as a source of oil and grease, so Manitoba Hydro feels these parameters do not need to be added to the suite of parameters analyzed in the ash lagoon effluent. Effluent from the floor drains within the station will still be directed through the oil mitigation system.

MWS - GMS

MANITOBA WATER STEWARDSHIP
GROUNDWATER MANAGEMENT SECTION

Manitoba

Memorandum

DATE: March 9, 2007

TO: Jeremy Angus
Planning & Coordination Branch
Ecological Services Division

FROM: Graham Phipps, Ph.D., P.Geo.
Groundwater Management Section
Water Branch

PHONE: 945-8359
FAX: 945-7419
FILE: 5.7.1

Via email: jeremy.angus@gov.mb.ca

SUBJECT: Comments re: Manitoba Hydro Brandon Generating Station – Unit 5, Environment Impact Statement Report

I have reviewed the above report and am providing comments regarding groundwater aspects of the report and comments for consideration of the licensing review.

There are several statements and conclusions within the report which I was unable to find supporting information. The report and conclusions would benefit by providing this supporting information.

The EIS outlines that new ash lagoons will be developed (section 2.5.1) with future operation. There was no information provided on the subsurface conditions or groundwater at the proposed location or of potential impacts on groundwater at the proposed new ash pond location.

6.2.3.1 Groundwater "Due to the low permeability of the soil materials in this area, the groundwater flow rate to the river is low, and any additional contributions of groundwater to the river would be negligible relative to the direct discharge of effluent to the river."

There is no information provided within the report of hydraulic conductivity measurements or estimated groundwater flow rates. There was also no information provided such as cross-sections illustrating the types of material encountered in drill holes, the probable extent or connectivity of the sediments.

6.3.3 GROUNDWATER "The groundwater monitoring program results indicate that arsenic in groundwater, first observed in 2003, has increased near the ash lagoon, but that it is not adversely affecting the Assiniboine River due to groundwater seepage."

Based on the information provided on water elevations and well locations there are no monitoring points and therefore supporting evidence of the above statement located along expected flow lines between OW4, 6, and 7 wells which have had elevated As concentrations, and the Assiniboine River. There was no evidence provided to support the above statement. It should also be noted that the Health Canada MAC guideline value for arsenic as of May 2006 is 10 ug/L. The report consistently refers to the old guideline value of 25 ug/L.

The EIS report should include information regarding the subsurface conditions at the site preferably along estimated flow directions and also provide estimated groundwater velocities. This information would then be used in support of statements made in the report and in the design of the proposed expansion of the on site groundwater monitoring. However the conclusions from future monitoring should be made only after interpretation of the new data.

6.3.3 GROUNDWATER "Therefore, the groundwater monitoring program will continue, consistent with the current program; additional monitoring wells will be added to the groundwater monitoring program, primarily between the ash lagoon and the river, as a precautionary measure to confirm that there is no effect on the river due to groundwater flow from the study area. The additional wells will primarily confirm the interpretation of a lack of adverse affects to the groundwater resources and the river."

Appendix I - Table 1 Water Quality Analytical Results shows a relatively thorough analysis of water chemistry differences between raw intake water and lagoon effluent water. These results provide a good indication of elements that may become enriched in water that has been contact with the ash for a relatively short period of time. Using the values which have become enriched after contact with the ash and potential trace elements of concern originating in the coal, it is suggested that the analytical parameters should be expanded to include additional elements that may or may not currently have a water quality guideline value but have the potential to degrade water quality. The additional analytes to consider should include: mercury, cesium, molybdenum, thallium, titanium, vanadium, uranium and tungsten. It is also suggested that all parameters be measured quarterly instead of some measured quarterly and others annually.

Appendix P Fig 6: If the water level elevations are correctly plotted (OW1; 357.45 m) there is an error in the water level contours on this diagram. However, the same general conclusions regarding flow direction remain valid.

It is not apparent if there is groundwater monitoring in the fuel oil storage area (used for start-up of #5) or if hydrocarbons in this area are part of the monitoring parameters.

Reference

Health Canada, 2006. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document - Arsenic. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

Graham Phipps

GCP/gcp/jb

cc: bob.betcher@gov.mb.ca

MWS – GMS MANITOBA WATER STEWARDSHIP – GROUNDWATER MANAGEMENT SECTION

This section contains responses to G. Phipps (MWS-GMS) contained in a Memorandum to J. Angus (MWS-ESD), dated March 9, 2007.

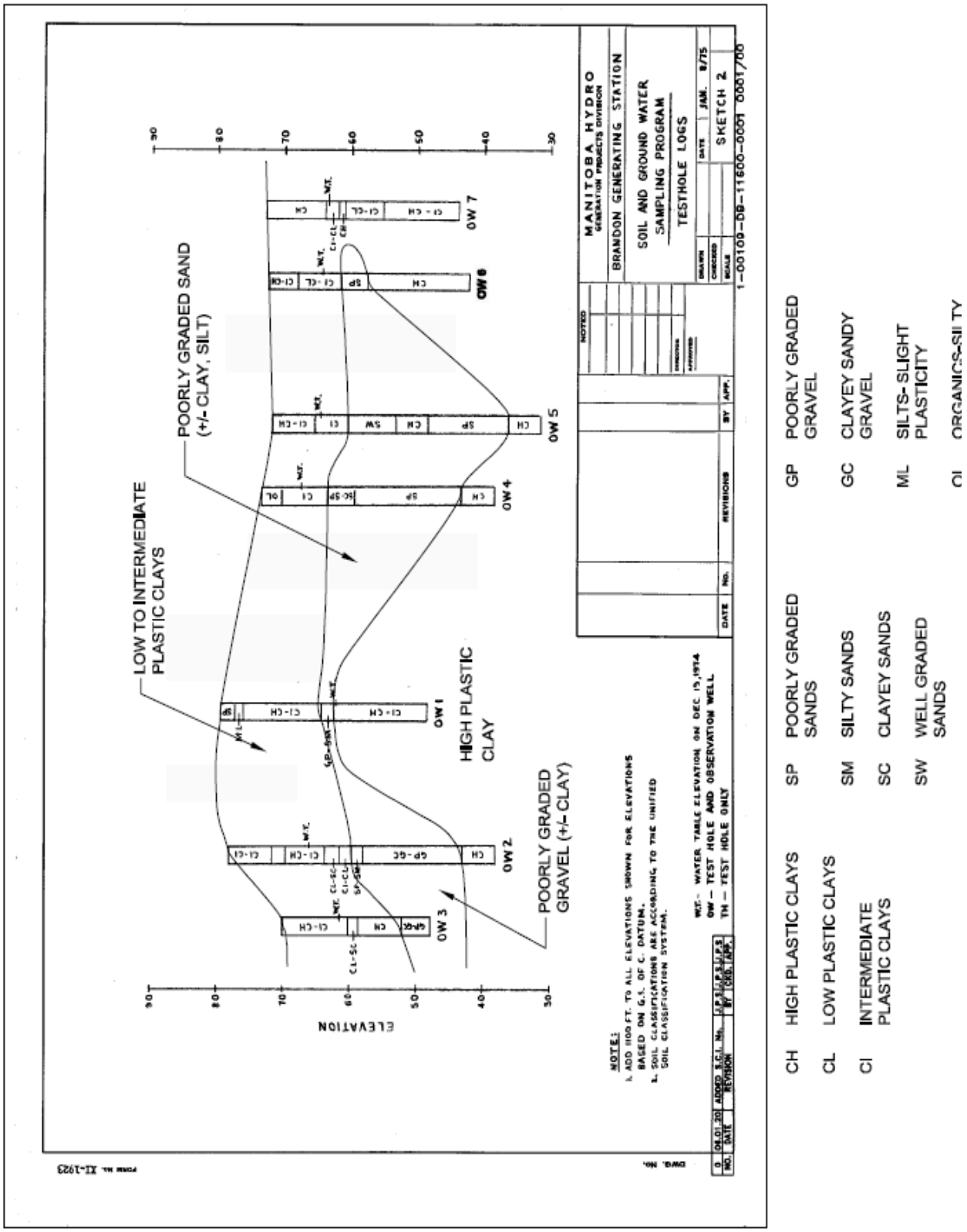
COMMENT: *"The EIS outlines that new ash lagoons will be developed (section 2.5.1) with future operation. There is no information provided on the subsurface conditions or groundwater at the proposed location or of potential impacts on groundwater at the proposed new ash pond location."*

RESPONSE: Manitoba Hydro is conducting preliminary design work, including a full groundwater impact assessment, for the proposed, new ash lagoon. This information will be submitted to Manitoba Conservation for formal approval once the design and timeline for implementation is established.

COMMENT: *"6.2.3.1 Groundwater "Due to the low permeability of the soil materials in this area, the groundwater flow rate to the river is low, and any additional contributions of groundwater to the river would be negligible relative to the direct discharge of effluent to the river."*

There is no information provided within the report of hydraulic conductivity measurements or estimated groundwater flow rates. There is also no information provided such as cross-sections illustrating the types of material encountered in drill holes, the probable extent or connectivity of the sediments."

RESPONSE: The attached cross-section has been excerpted from the historical documentation for this site. The cross-section shows the geology of the bore holes drilled along the north side of the ash lagoon, as well as the interpreted geology based on the available information. As shown on the cross section, the geology at this specific location consists of an upper sequence of low to intermediate plasticity clays underlain by poorly graded sands on the north side of the ash lagoon (wells OW4, OW5 and OW6). The base of the sequence consists of high plastic clays. Poorly graded gravels were encountered near the Assiniboine River in wells OW2 and OW3. Based on the available information, it is likely that these gravels are part of a fluvial channel that would roughly parallel the river. The drilling results from the OW1 location indicate that there is limited interconnectivity between the poorly graded sands and the poorly graded gravels.


POORLY GRADED SAND
(+/- CLAY, SILT)
LOW TO INTERMEDIATE
PLASTIC CLAYS
HIGH PLASTIC
CLAY
POORLY GRADED
GRAVEL (+/- CLAY)
ELEVATION
MANITOBA HYDRO
GENERATION PROJECTS DIVISION
BRANDON GENERATING STATION
SOIL AND GROUND WATER
SAMPLING PROGRAM
TESTHOLE LOGS
SKETCH 2
1-00109-DB-11600-0001 0001/00
NOTES:
1. ADD 1100 FT. TO ALL ELEVATIONS SHOWN FOR ELEVATIONS BASED ON G.S. OF C. DATUM.
2. SOIL CLASSIFICATIONS ARE ACCORDING TO THE UNIFIED SOIL CLASSIFICATION SYSTEM.
W.T.- WATER TABLE ELEVATION ON DEC 19,1974
OW – TEST HOLE AND OBSERVATION WELL
TH – TEST HOLE ONLY
CH HIGH PLASTIC CLAYS
CL LOW PLASTIC CLAYS
CI INTERMEDIATE PLASTIC CLAYS
SP POORLY GRADED SANDS
SM SILTY SANDS
SC CLAYEY SANDS
SW WELL GRADED SANDS
GP POORLY GRADED GRAVEL
GC CLAYEY SANDY GRAVEL
ML SILTS- SLIGHT PLASTICITY
OL ORGANICS-SILTY

For this hydrogeologic setting, the bulk of the groundwater flow from the ash lagoon area towards the river is expected to occur within the poorly graded sands. Typically, sands will have a hydraulic conductivity of 10^{-3} to 10^{-5} m/s. Sands with a significant component of clays and silts will typically have a hydraulic conductivity at the lower end of that range, as is the case at this site. Neglecting any groundwater movement through the clays and assuming all flow occurs within the roughly triangular shaped sands from wells OW1 to OW6, the estimated groundwater flow towards the river is in the range of 17 m^3/day to 1,700 m^3/day (assuming a hydraulic gradient of 0.008 found in UMA (1995 and 1996). This represents approximately 2 to 21% of the direct discharge from the ash lagoon (Badiou et al. (2006)). The estimated groundwater velocity is 0.7 to 0.007 m/d.

The installation of additional wells to the north of the ash lagoon was recommended in Section 5.2 of Appendix P of the EIS. These wells will provide additional information on the geology and hydraulic gradients in that area. The groundwater flow estimate can be refined when that information is available.

COMMENT: *"6.3.3 Groundwater "The groundwater monitoring program results indicate that arsenic in groundwater, first observed in 2003, has increased near the ash lagoon, but that it is not adversely affecting the Assiniboine River due to groundwater seepage."*

Based on the information provided on water elevations and well locations there are no monitoring points and therefore supporting evidence of the statement located along expected flow lines between OW4, 6 and 7 wells which have had elevated arsenic concentrations, and the Assiniboine River. There is no evidence provided to support the above statement. It should also be noted that the Health Canada MAC guideline for arsenic as of May 2006 is 10 µg/L. The report consistently refers to the old guideline value of 25 µg/L."

RESPONSE: As discussed in the previous response, the discharge of groundwater to the river is estimated, based on the available information, to be approximately 2 to 21 % of the direct discharge of water from the ash lagoon. As documented in Badiou et al. (2006), the direct discharge of water from the ash lagoon is not having an adverse effect on the Assiniboine River. Given that the groundwater wells tested contain a range of arsenic concentrations that are the same as measurements taken in the lagoon effluent, and given that groundwater discharge to the river is a small percentage of the total ash lagoon discharge, it is reasonable to conclude that groundwater is also unlikely to have an adverse effect.

Health Canada revised the March 2006 Canadian Drinking Water Quality Guidelines for arsenic from 25 µg/L to 10 µg/L, in May 2006. Although the revised guideline was not cited in the Brandon

Groundwater Wells Monitoring Report, found in Appendix P of the EIS, arsenic concentrations in wells OW2, OW5, OW8, OW9, OW12, OW13 and Control Well OW15 were generally lower than 10ug/L.

COMMENT: *"The EIS report should include information regarding the subsurface conditions at the site preferably along estimated flow directions and also provide estimated groundwater velocities. This information would then be used in support of statements made in the report and in the design of the proposed expansion of the on site groundwater monitoring. However, the conclusions from future monitoring should be made only after interpretation of the new data."*

RESPONSE: The subsurface conditions and groundwater flow rates and volumes have been discussed above in response to Dr. Phipps' second comment (beginning "Section 6.2.3.1 Groundwater…"). The additional well locations to the north have been selected to provide additional information on the geology, groundwater flow directions and rates to the north of the ash lagoon, and in consideration of drilling equipment accessibility to the area. Once the information from the drilling and monitoring of these new wells is available, updated cross-sections will be prepared, and updated estimates of groundwater flow rates and directions will be submitted to Manitoba Conservation.

COMMENT: *"Appendix I – Table 1 Water Quality Analytical Results shows a relatively thorough analysis of water chemistry differences between raw intake water and lagoon effluent. These results provide a good indication of elements that may become enriched in water that has been contact with the ash for a relatively short period of time. Using the values which have become enriched after contact with the ash and potential trace elements of concern originating in the coal, it is suggested that the analytical parameters should be expanded to include additional elements that may or may not currently have a water quality guideline value but have the potential to degrade water quality. The additional analytes to consider should include: mercury, cesium, molybdenum, thallium, titanium, vanadium, uranium and tungsten. It is also suggested that all parameters be measured quarterly instead of some measured quarterly and others annually."*

RESPONSE: The Effluent Quality and Toxicity Report, provided in Appendix I of the EIS, was undertaken as part of Manitoba Hydro's EIS in support of the licence review and is directed at the assessment of the effects to the aquatic environment of existing and future operation of Unit 5. Additional parameters were included specific to this study to assess aquatic toxicity, but are not included as part of Manitoba Hydro's Environment Act licence monitoring requirements for the Ash Lagoon effluent quality. The groundwater monitoring program is directed at assessing the potential

impacts of the Ash Lagoon to groundwater quality and the parameters are based on the Environment Act licence requirements for the Ash Lagoon effluent. Monthly monitoring of all the parameters was conducted by Manitoba Hydro pursuant to the Environment Act licence requirements between 1993 and 1997 when based on a review of the data, Manitoba Conservation (formerly Manitoba Environment) reduced the sampling frequency requirement to quarterly.

COMMENT: *"It is not apparent if there is groundwater monitoring in the fuel storage area (used for start-up of Brandon Unit 5) or if hydrocarbons in this area are part of the monitoring parameters."*

RESPONSE: The fuel storage tanks are operated under a "Permit to Operate a Petroleum Storage Facility", No. 22769, dated March 15, 2005. Their primary function is to store an alternate fuel supply for Units 6 & 7 (Environment Act Licence No. 2497 R) which normally operate on natural gas. Hydrocarbon monitoring of groundwater in the fuel storage area is not a requirement of the Brandon Generating Station Environment Act licence. During the development of the fuel storage area, a synthetic liner was installed in accordance to Manitoba Conservation's requirements.

COMMENT: *"Appendix P Fig 6: If the water level elevations are correctly plotted (OW1; 357.45 m) there is an error in the water level contours on this diagram."*

RESPONSE: The groundwater elevation of 357.45 m is correctly plotted at well OW-2 on Figure 6. Well OW-1 is inactive and as such, no data for that well is available. However, on Figure 6, the values for wells OW-10 and OW-11 are plotted incorrectly but the contours are correct. The correct groundwater elevations for those wells on Figure 6 are OW-10 – 356.27 m and OW-11 – 357.67 m.

MH - ABRHO

MANITOBA HEALTH

ASSINIBOINE AND BRANDON REGIONAL HEALTH OFFICE

Manitoba

Dr. Elise Weiss, Medical Officer of Health
Assiniboine and Brandon Regional Health Authorities
Unit A5 – 800 Rosser Avenue, Brandon, Manitoba R7A 6N5
T 204 571-8395 **F** 204 726-8743
E Elise.Weiss@gov.mb.ca

March 9, 2007

Mr. Clem Moche
Environmental Management
Suite 160
123 Main Street
Winnipeg, Manitoba
R3C 1A5

Dear Mr. Moche:

RE: Manitoba Hydro – Brandon Generating Station
Environmental Impact Statement
Client file: 3252.00

I have read the proposal, particularly Annex N Human Health and Ecological Risk Assessment Report, and have the following comments:

I support the need for CEMS (continuous emissions monitoring system) for ongoing monitoring of NO_x and SO_2. Will monitoring also include $PM_{2.5}$ and PM_{10}?

Monitoring is especially important for SO_2 as SO_2 monitoring was discontinued in Brandon in 1989 "because readings prior to that were too low to be registered by the instrument" (Annex N page 6-6). Given the 2005 WHO 24 hour ambient air quality objective for SO_2 is now 20 $\mu g/m^3$, with an interim objective of 125 $\mu g/m^3$, and that the air modeling estimates levels of 19.5 $\mu g/m^3$ (less but close to the 20 $\mu g/m^3$ level), and given that detection limits are probably lower now than in 1989, monitoring of SO_2 would be an important consideration.

Is the generating station a potential emitter of EMF? Although it is recognized that studies have not demonstrated public health risk from exposure to EMFs, ongoing monitoring by Manitoba Hydro of worldwide research programs is essential in order to take appropriate action should information regarding potential effects become available. It might be useful for the human health risk assessment to include a statement about whether the station is a potential source or not, and if it is, a current literature review and statement on this matter would be useful.

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Sincerely,

Dr. Elise Weiss, MD, FCFP, MSc
Medical Officer of Health – Assiniboine and Brandon Regional Health Authorities

cc. Dr. M. Routledge

MH – ABRHO MANITOBA HEALTH – ASSINIBOINE AND BRANDON REGIONAL HEALTH OFFICE

This section contains the responses to comments from Dr. E. Weiss (MH-ABRHO) provided in a letter to C. Moche (MC), dated March 9, 2007.

COMMENT: *"I support the need for CEMS (continuous emissions monitoring system) for ongoing monitoring of NOx and SO_2. Will monitoring also include PM2.5 and PM10?"*

RESPONSE: CEMS only provide monitoring of particulate matter emission rates for total particulate, not for different size fractions (e.g., PM_{10} or $PM_{2.5}$). $PM_{2.5}$ and PM_{10} emissions will continue to be determined through periodic stack sampling using the same methods that have been used to date.

COMMENT: *"Monitoring is especially important for SO_2 as SO_2 monitoring was discontinued in Brandon in 1989 'because readings prior to that were too low to be registered by the instrument' (Annex N page 6-6). Given the 2005 WHO 24 hour ambient air quality objectives for SO_2 are now 20 µg/m^3, with an interim objective of 125 µg/m^3, and that the air modelling estimates levels of 19.5 µg/m^3 (less but close to the 20 µg/m^3 level), and given that detection limits are probably lower now than in 1989, monitoring of SO_2 would be an important consideration."*

RESPONSE: Manitoba Hydro has carefully evaluated future coal suppliers to ensure that coals which could potentially lead to higher concentrations than those listed in the EIS are excluded from consideration for future use at Unit 5 (see Table 3.2 (page 40), Appendix K of the EIS). In fact, some of the coal mines that might be used in the future would result in SO_2 emissions that would be from 10% to 37% lower than the maximum predicted SO_2 impacts indicated in the EIS. Furthermore, while the maximum predicted 24-hour average SO_2 concentration at the maximum point of impingement (POI) was predicted to be 19.5 µg/m^3, the location of the maximum POI north of the Brandon G.S. near the banks of the Assiniboine River is not located near any residential area of Brandon (see Figure 5.1 (page 68), Appendix K of the EIS). The probability distribution for 24-hour average SO_2 concentrations at this location would be as follows:

Percentile	SO_2 Concentration (µg/m^3)	Number of Days per Year
100	19.5	1
99.5	10.6	2
99	9.8	3-4
98	5.7	7
90	0.8	37
50	0.0	365

Therefore, even with the highest sulphur content coal that might be used in the future and Unit 5 operating at 100% C.F, which is a conservative estimate, the maximum predicted SO_2 concentration would approach the WHO guideline value on only one day per year, and be greater than one-half the WHO guideline on only two days per year. The frequency of days greater than half the WHO guideline could be even less when the Unit is operating at less than 100% C.F. Ninety percent of the time during the year, the 24-hour average SO_2 concentration would be less than 1 $\mu g/m^3$, which is essentially undetectable.

Moreover, the maximum predicted 24-hour average SO_2 concentration in the residential areas of Brandon (see Discrete Receptors 4, 5 and 7, Table C.6, Appendix K (page 243) of the EIS) would be only 8-9 $\mu g/m^3$ if the highest sulphur content coal were to be used in the future. Therefore, with the maximum potential SO_2 emissions and the Unit 5 operating at 100% C.F, the highest SO_2 concentrations in residential areas would be only half the WHO guideline on only one day per year. Any monitoring station located in Brandon would likely be recording 24-hour average SO_2 concentrations on the order of 4 $\mu g/m^3$ or less 98% of the time, and would be unlikely to ever record a concentration approaching the WHO guideline value. Ninety percent of the time, observed SO_2 concentrations in the residential areas of Brandon would be 1 $\mu g/m^3$ or less, which means they will be essentially undetectable on most days of the year. On this basis, the value of establishing an SO_2 monitor in Brandon is questionable.

COMMENT: *"Is the generating station a potential emitter of EMF? Although it is recognized that studies have not demonstrated public health risk from exposure to EMFs, ongoing monitoring by Manitoba Hydro of worldwide research programs is essential in order to take appropriate action should information regarding potential effects become available. It might be useful for the human health risk assessment to include a statement about whether the station is a potential source or not, and if it is, a current literature review and statement on this matter would be useful."*

RESPONSE: While Manitoba Hydro is sensitive to public concerns regarding potential health effects from electric and magnetic fields, there is at present no scientific evidence to justify modification of existing practices respecting facilities for the generation, transmission and distribution of electricity (CEC, 2001). Manitoba Hydro continues to undertake the following actions regarding the issue with respect to all of its electrical operations:

- monitoring of worldwide research programs on electric and magnetic fields;
- participation in, and support of, on-going health and safety research on the local, national and international levels; and

- maintenance of active communications and provision of technical information to interested parties, including the public and agencies responsible for public and occupational health and the environment.

MSTEM

MANITOBA SCIENCE, TECHNOLOGY, ENERGY AND MINES DEPARTMENT

Manitoba **Memorandum**

DATE: June 22, 2007

TO: Mr. Clem Moche
Manitoba Conservation

FROM: Jane Gray – Exec. Director Climate Change Branch
Shaun Loney – Director Energy Policy

PHONE NO.: Jane Gray – 945-1404
Shaun Loney – 945-5801

SUBJECT: Manitoba Hydro
Brandon Generating Station
Licence Review

Dear Mr. Moche

Thank you for the opportunity to comment on the Brandon Generating Station Unit 5 Environmental Impact Statement. The comments provided represent those from the Climate Change and Green Initiatives Branch and Energy Development Branch of the Department of Science, Technology, Energy, and Mines (STEM).

Our comments are organized into general comments and questions.

General Comments

The Brandon coal-fired generating station began operation in 1957 (50 years ago) when Unit 1 was commissioned. Units 2, 3, and 4 were commissioned in 1958 and Unit 5 was commissioned in 1969. Units 1 to 4 were taken off-line between 1992 and 1996 after 35 and 38 years of service respectively. Since Unit 5 was commissioned, it is our understanding that the only major upgrades to the station occurred in 1996 with the addition of an electrostatic precipitator and cooling towers. Unit 5 has therefore been operating for approximately 38 years on an as-required basis. This would make the facility approaching the end of its useful life.

Historically, Unit 5 has been operated only on an intermittent basis. Capacity factors were often in the order of 10-15% depending on conditions. These capacity factors would increase during drought years to augment our hydro generating assets. Over the last few years however, it is our impression that Brandon Unit 5 has been operating at greater annual capacity factors than in the past. This increase in operation results in significant increases to Manitoba's greenhouse gas emissions. Manitoba Hydro reports greenhouse gas emissions from Unit 5 as follows:

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Year	Greenhouse gas emissions in tonnes
2000	505,313
2001	395,973
2002	275,662
2003	673,000
2004	375,817
2005	578,526
2006	445,000

*Note that Environment Canada figures for 2005 actually report the facilities emissions at 588,000 tonnes or approximately 10,000 tonnes more than Manitoba Hydro data.

The Brandon facility is listed as Manitoba's third highest emitting source of green house gas emissions as reported by Environment Canada in 2005. As noted in the Environmental Impact Statement, Unit 5 can produce up to 1.04 Mt/yr. of CO2e/yr when operated at full capacity. Again, fluctuations in usage, as listed above, do not appear to be wholly consistent with the presence of drought conditions and / or lack of supply during peak periods. With Manitoba's relatively low emissions overall, Unit 8 operation is enough to significantly affect Manitoba's overall emissions profile from one year to the next. Increases and decreases in the use of the facility correspond with overall increases and decreases in Manitoba's emissions profile from year to year. When placed into context of Manitoba's reduction target of approximately 2- 3 Mts, the facility represents approximately 0.5 Mts or 500,000 tonnes of the total reduction target on average/ year.

The EIS acknowledges there is no formal decommissioning plan to date; such plans would be developed when decommissioning timelines are understood. In planning for decommissioning it would be helpful to reference the capacity for new renewable electrical generation including the 200 MW Wuskwatim dam, the 100 MWs of wind power from the St. Leon farm, plans for a further 300 MWs of wind development in the coming years and projected energy savings from expanded Demand Side Management efforts and any other renewable energy development projects that can augment the loss of 100 MWs of power as the Brandon facility is wound down.

Questions

Based on these factors we submit the following questions:

- For the purpose of this environmental assessment, can Manitoba Hydro describe the system conditions that result Hydro's decision to operate Units 5, 6 and 7. What had been the capacity factors and resulting greenhouse gas emissions from Units 5, 6 and 7 over the last five years?
- Can Manitoba Hydro comment on future capacity factors expected for Unit 5, 6 and 7 given our overall generating system, domestic demands and export commitments?
- What are the expected greenhouse gas emissions expected from Unit 5 alone and Units 5, 6 and 7 based on Hydro's anticipated use of these assets into the future?
- What facility requirements and associated costs are forecasted to extend the life of Unit 5, including any proposed infrastructure costs for compliance with proposed federal regulations?

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- Given units 1-4 are off-line and close to 50 years old, are there any decommissioning plans for these units? What would be involved in decommissioning the entire coal-fired facility?
- Given that Unit 5 is close to 40 years old, what are the specific decommissioning plans for Unit 5.
- What are the alternative sources of power being considered by Manitoba Hydro as the Brandon Unit 5 facility nears the end of its operation?

Additional Environmental Impact Observations

While our Branches defer to the expertise of our colleagues in the Departments of Water Stewardship and Conservation, we offer the following observations and questions on other matters raised in the EIS.

Brandon Generating Station

- Ash Lagoon – Please show the location of the proposed new ash lagoon including a description of size and construction details. Are there future plans to segregate fly ash from bottom ash? Is there a potential market for fly ash given its pozzolanic properties? What are the circumstances by which Manitoba Hydro can use collected ash for other beneficial uses? Will changes in coal properties from varying sources impact beneficial use options for ash? What are the characteristics of the ash in the existing lagoon and is it a considered a hazardous waste? How will the existing ash lagoon be decommissioned?

Aquatic Environment

- Assiniboine River Impacts – During low flow periods, operation of the Brandon generating facilities may withdraw up to 10% of river flows. Given the increased use of Brandon generation assets (in particular Unit 5), and their operation during drought conditions, what impacts if any can be expected to downstream water users? How are water allocations managed during drought conditions for users downstream of the generating station? With the construction of the cooling towers, did Manitoba Hydro forfeit a portion of their water allocation or were there any changes in their Water Rights License? What is the extent of the "mixing zone" during low flow conditions?
- What sorts of spill response or emergency procedures are in place to manage a spill event into the Assiniboine River?
- Weir – Are their future plans to decommission the weir assuming the station is decommissioned.

Air and Noise

- When would Manitoba Hydro operate burner configurations that result in the least efficient emissions output from the facility?

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- What would be typical mercury emissions loads from Unit 5 if operating at 100% capacity for various coal types? How does this compare to Manitoba's cap of 20 kg/year?
- What is the most problematic exposure pathway for human health impacts? Ecological impacts?

Groundwater

- Has there been any monitoring of groundwater wells outside of the generating station property to confirm contaminants are not propagating to possible receptor wells?
- What is Manitoba Hydro's schedule to install additional monitoring wells on the property?
- Has ash lagoon integrity been examined in terms of its construction ánd permeability? What sort of closure plan and ash lagoon liner designs are contemplated to ensure the decommissioned ash lagoon is as impermeable as possible?

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MSTEM CLIMATE CHANGE AND GREEN INITIATIVES BRANCH

This section contains the responses to comments from Jane Grey, Executive Director Climate Change Branch and Shaun Loney, Director Energy Policy, provided in a memorandum to C. Moche, MC, dated June 22, 2007.

The scope of the Environment Act Licence Review includes regulated emissions and discharges directly associated with the operation of Unit 5. The Environmental Assessments summarized in the EIS indicate that Unit 5 operation will not produce significant or measurable incremental long-term adverse effects on the environment or human health. While some of the questions posed by STEM are directly related to the assessments in the EIS, others appear to fall outside of the scope of the Licence Review. Manitoba Hydro has volunteered responses to all questions and comments in order to enhance the review process and ensure that all potential environmental effects associated with operations are thoroughly reviewed.

PARAGRAPH 1 COMMENTS: *"The Brandon coal-fired generating station began operation in 1957 (50 years ago) when Unit 1 was commissioned. Units 2, 3, and 4 were commissioned in 1958 and Unit 5 was commissioned in 1969. Units 1 to 4 were taken off-line between 1992 and 1996 after 35 and 38 years of service respectively. Since Unit 5 was commissioned, it is our understanding that the only major upgrades to the station occurred in 1996 with the addition of an electrostatic precipitator and cooling towers. Unit 5 has therefore been operating for approximately 38 years on an as required basis. This would make the facility approaching the end of its useful life."*

RESPONSE: From 1995 to 1997, extensive rehabilitation work was undertaken to upgrade the environmental performance of Unit 5. Emission reduction equipment (an electrostatic precipitator) was installed on Unit 5 to remove virtually all the suspended fly ash from flu gases. A cooling tower was also built to cool the circulated water that condenses used steam, thus allowing the same water to be recirculated as well as substantially reducing the amount of water taken from the Assiniboine River and, in turn, reducing any impacts on the aquatic ecosystem. Environmental assessments conducted for the EIS, and their conclusion that unit operation will not produce significant environmental effects, attest to the continuing benefit of these investments. In addition to these environmental upgrades, extensive rehabilitation and modernization of the generating equipment was also conducted to upgrade the operating performance of the unit. This work included the installation of a modern digital control system, steam supply system upgrades, and coal handling system upgrades. These investments ensure that environmental effects from Unit 5 operation are minimized, while at the same time establishing it as Manitoba Hydro's most economic thermal resource.

In 2002, as part of the installation of Units 6&7 at Brandon Generating Station, the raw water, water treatment, and auxiliary fuel systems were also upgraded as these systems are shared with the new gas turbines.

The useful life of a coal-fired generating station is not based on chronological age, but on generating unit operating hours. Unit 5 has historically been operated on an intermittent basis and, for this reason, the generating equipment has very low operating hours relative to its chronological age. Manitoba Hydro also diligently maintains the unit and optimizes its operational performance. In fact, Unit 5 is currently the most thermally efficient unit in Manitoba Hydro's thermal fleet. Due to its combination of low operating hours and diligent maintenance practices, Unit 5 is in excellent condition and is capable of many more years of service.

PARAGRAPH 2 COMMENTS: *"Historically, Unit 5 has been operated only on an intermittent basis. Capacity factors were often in the order of 10-15% depending on conditions. These capacity factors would increase during drought years to augment our hydro generating assets. Over the last few years however, it is our impression that Brandon Unit 5 has been operating at greater annual capacity factors than in the past. This increase in operation results in significant increases to Manitoba's greenhouse gas emissions. Manitoba Hydro reports greenhouse gas emissions from Unit 5 as follows:*

Year	Greenhouse gas emissions in tonnes
2000	505,313
2001	395,973
2002	275,662
2003	673,000
2004	375,817
2005	578,526
2006	445,000

**Note that Environment Canada figures for 2005 actually report the facilities emissions at 588,000 tonnes or approximately 10,000 tonnes more than Manitoba Hydro data."*

RESPONSE: Unit 5 has historically been operated on an intermittent basis. The maximum theoretical annual generation from Unit 5 is 920 GWh, and while the generation levels have on occasion been as low as 10-15% of this maximum, operation of the Unit varies from year to year. The historical average generation from Unit 5 is 219 GWh/year, which is equivalent to a lifetime capacity factor of 24%. The highest annual generation from Unit 5 to date is 640 GWh during the drought of 2003, which was the third lowest flow year in Manitoba Hydro's history.

Operation of Unit 5 has been higher since upgrades completed in 1997 established it as Manitoba Hydro's most efficient and economic thermal resource. Prior to upgrades in 1997, the lifetime average annual output was 160 GWh/year. Since the completion of the environmental and performance upgrades to Unit 5, and with the corresponding closure of Units 1-4 at the end of 1996, Unit 5 operation has remained intermittent, but has increased to an average of 420 GWh/year.

Manitoba Hydro operates Unit 5 as part of a fleet of thermal resources that produce greenhouse gases. While operation of Unit 5 has increased in recent years, operation of Manitoba Hydro's other thermal resources has decreased accordingly. Manitoba Hydro's cumulative average gross emissions since 1990 are equal to 1990 levels. Considering offsets, Manitoba Hydro's average net emissions were 15% below 1990 levels in 2005, surpassing the target of 6% below 1990 levels (note that for 2006, Manitoba Hydro's GHG emissions decreased to 27% below 1990 levels). On the basis of GHG intensity, Manitoba Hydro produced 38% fewer GHG emissions per unit of electricity produced in 2005 than it did in 1990 (for 2006, GHG emissions were 55% lower than 1990 levels). At the same time, Manitoba Hydro's thermal fleet GHG emissions have decreased from 5% of Manitoba's total emissions in 2000 to 3% of Manitoba's total GHG emissions in 2005. Therefore, Manitoba Hydro's GHG emissions, including emissions from increased operation of Unit 5, have not increased Manitoba's overall emissions.

Figure 1, contained in the response to Question 1(b), illustrates Manitoba Hydro's GHG emissions since 1998, while Appendix M of the EIS contains Manitoba Hydro's 2005 GHG Summary.

In response to the table footnote, it is noted that Environment Canada reporting is on a facility basis. Therefore, although Unit 5 produced 0.578 MT of GHG emissions in 2005, the Brandon G.S. facility produced a total of 0.588 MT including emissions from Unit 6&7.

PARAGRAPH 3 COMMENTS: *"The Brandon facility is listed as Manitoba's third highest emitting source of green house gas emissions as reported by Environment Canada in 2005. As noted in the Environmental Impact Statement. Unit 5 can produce up to 1.04 Mt/yr. of C02e/yr when operated at full capacity. Again, fluctuations in usage, as listed above, do not appear to be wholly consistent with the presence of drought conditions and I or lack of supply during peak periods. With Manitoba's relatively low emissions overall, Unit 8* [5] *operation is enough to significantly affect Manitoba's overall emissions profile from one year to the next. Increases and decreases in the use of the facility correspond with overall increases and decreases in Manitoba's emissions profile from year to year. When placed into context of Manitoba's reduction target of approximately 2- 3 Mts, the facility represents approximately 0.5 Mts or 500,000 tonnes of the total reduction target on average / year."*

RESPONSE: Manitoba Hydro operates a fleet of gas and coal-fired generating resources that produce greenhouse gases. The maximum potential GHG production of the fleet is 3.37 Mt in any single year if all units are operated at 100% capacity factor for that year: 1.64 Mt from natural gas-fired Brandon Units 6 & 7, 1.04 Mt from coal-fired Brandon Unit 5, and 0.69 Mt from natural gas fired Selkirk Units 1 & 2. However, Manitoba Hydro has managed cumulative average net GHG emissions from its thermal operations to a level of approximately 0.42 MT, or 11.3% of fleet potential, as of 2005.

Gas-fired generation accounts for 69% of Manitoba Hydro's potential thermal fleet GHG emissions in a single year with Unit 5 accounting for the remaining 31%. Manitoba Hydro recognizes the implications of the GHG emissions from its thermal fleet and has been balancing its requirement to operate thermal generation within its voluntary management of its GHG emissions since 1997. A variety of actions have enabled Manitoba Hydro to meet the increasing demand for electricity without the need to substantially increase thermal generation levels. These actions have included aggressive demand side management programs, efficiency enhancements at existing generating stations, and purchased wind energy. Through these combined efforts, Manitoba Hydro has been able to provide low cost, reliable power and protect Manitobans against the financial consequences of drought, while reducing its global GHG emissions. On the basis of GHG intensity, Manitoba Hydro produced 38% fewer GHG emissions per unit of electricity produced in 2005 than it did in 1990.

PARAGRAPH 4 COMMENTS: *"The EIS acknowledges there is no formal decommissioning plan to date; such plans would be developed when decommissioning timelines are understood. In planning for decommissioning it would be helpful to reference the capacity for new renewable electrical generation including the 200 MW Wuskwatim dam, the 100 MWs of wind power from the St. Leon farm, plans for a further 300 MWs of wind development in the coming years and projected energy savings from expanded Demand Side Management efforts and any other renewable energy development projects that can augment the loss of 100 MWs of power as the Brandon facility is wound down."*

RESPONSE: Manitoba Hydro engages annually in a formal integrated resource planning process that considers a full range of resource options to meet future supply requirements to determine the optimal sequence and timing of resource additions and retirements on a system-wide basis. The particular resources noted in the comment above comprise Manitoba Hydro's near-term system expansion plans and are required over and above the existing supply portfolio to meet future forecasted provincial demand growth. These resources would be developed in addition to the requirement for continued operation of the thermal fleet. Since Manitoba Hydro's near-term system expansion plan is comprised of renewable resources that exhibit similar weather-dependent

characteristics inherent to existing hydroelectric resources, they too will require support from the thermal fleet. For more information, refer to the response to question 7 below.

Questions (Note, numbering added by Manitoba Hydro)

QUESTION 1(a): *"For the purpose of this environmental assessment, can Manitoba Hydro describe the system conditions that result* [in] *Hydro's decision to operate Units 5, 6 and 7".*

RESPONSE: As a primarily hydroelectric utility, Manitoba Hydro is dependent on river flows for over 95 per cent of its electricity, on average, and is, therefore, vulnerable to low river flows or droughts. To protect customers from the impacts of low water flows and meet demand during times of peak usage, Manitoba Hydro operates a fleet of thermal generating units that are not dependent on river flows: four natural gas-fired generating units and one coal-fired generating unit. The thermal units also help manage the variability associated with the wind energy that Manitoba Hydro has added to its portfolio of generating resources.

In addition to providing an alternative source of electricity, the thermal units also offset the concentration of hydroelectric generation and HVDC transmission in the north. While 85 per cent of Manitoba Hydro's electricity is generated in the north, 85 per cent of the utility's customers are in the south. In the event of a major transmission or generation failure, the thermal fleet can provide electricity for a significant portion of Manitoba Hydro's customers in the south. This important back-up capability is also an asset for enhancing Manitoba Hydro's electricity exports.

Manitoba Hydro plans its generating system to be capable of supplying energy under a recurrence of the worst drought on record. Most of the time water flows are higher than the assumed minimum, resulting in excess water that can be used to generate electricity for sale on the export market. However, Manitoba Hydro cannot determine with absolute certainty when the next drought will occur.

The availability of the thermal generating units allows Manitoba Hydro to meet its commitment to serve Manitoba customers and optimize its water supply, thereby firming up its export sales of electricity, essentially guaranteeing the electricity will be available to fulfill contracts regardless of water conditions. This guarantee means Manitoba Hydro can sell electricity further in advance on the lucrative long-term export market.

Maximizing revenues from export sales is a key component to maintaining the low electricity rates enjoyed by Manitoba Hydro customers. Unit 5 is the primary option for fulfilling these roles, followed by the gas-fired units due to the significantly higher cost associated with using natural gas.

Due to the abundance of water in most years, the thermal generating units are typically operated well below their maximum capability. In addition to variations in river flows, system operation is dependent on many dynamic factors that include: generation and transmission constraints, generation and transmission outages and failures, variations in anticipated demand and demand peaks, export market opportunities, Midwest Independent Transmission System Operator (MISO) system support requirements, and variations in ambient temperatures from anticipated conditions. Since thermal generation is used to support the base loaded hydroelectric generators, the operation of the thermal units is directly influenced by the variation in these factors, which cannot be forecasted in a simple manner. Therefore, the future capacity factors of the thermal units cannot be reliably predicted and, for this reason, Manitoba Hydro conservatively assumed operation at 100% capacity factor for the purpose of this and other thermal generating unit environmental assessments. This ensures that the maximum potential environmental effects associated with thermal operation are not underestimated.

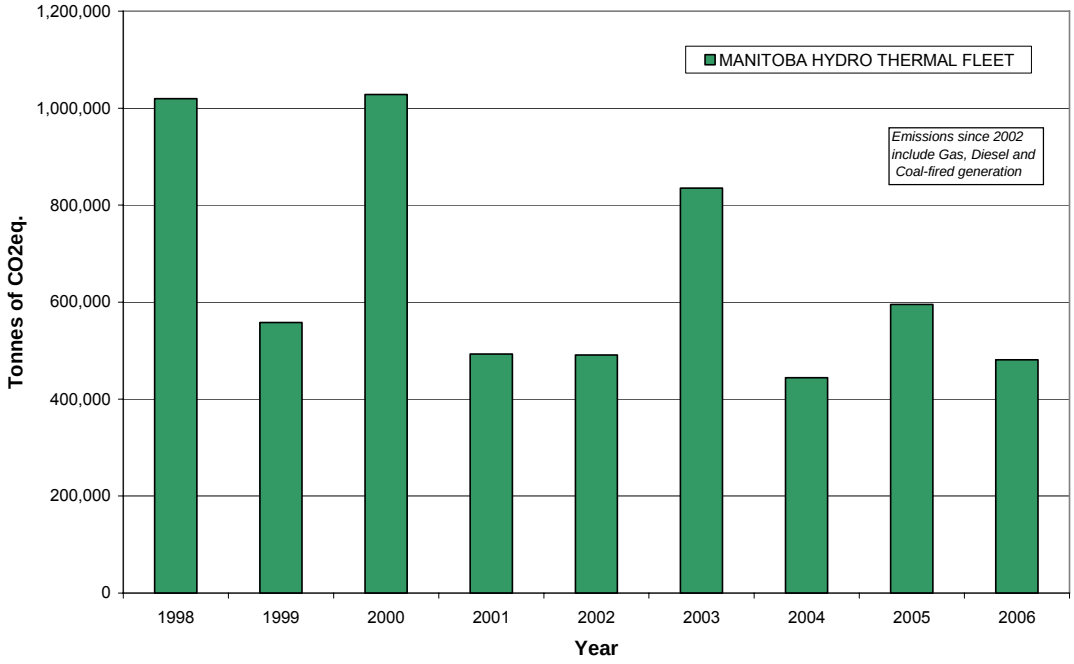
For additional information on Manitoba Hydro's thermal fleet, please visit the Facilities & Operations page of Manitoba Hydro's website at www.hydro.mb.ca.

QUESTION 1(b): "*What had been the capacity factors and resulting greenhouse gas emissions from Units 5, 6 and 7 over the last five years?*

RESPONSE: The table below provides the information requested.

STATION UNIT	units	1998	1999	2000	2001	2002	2003	2004	2005	2006
Brandon GS Unit 5	MT CO_2 equiv.	0.5	0.3	0.5	0.4	0.3	0.7	0.4	0.6	0.4
(1 @ 105 MW)	GWh	440	326	488	435	297	640	316	486	369
	% Capacity Factor	48%	35%	53%	47%	32%	70%	34%	53%	40%
Brandon GS Units 6&7	MT CO_2 equiv.					0.0	0.1	0.0	0.0	0.0
(2 @ 133 MW)	GWh					50	76	21	9	21
	% Capacity Factor					2%	3%	1%	0%	1%
Selkirk GS Units 1&2	MT CO_2 equiv.	0.5	0.2	0.5	0.1	0.2	0.1	0.0	0.0	0.0
(2 @ 66 MW)	GWh	544	219	514	88	156	76	37	1	3
	% Capacity Factor	47%	19%	44%	8%	14%	7%	3%	0.1%	0.3%
Thermal Fleet	MT CO_2 equiv.	1.0	0.5	1.0	0.5	0.5	0.8	0.4	0.6	0.5
(503 MW post 2002)	GWh	985	545	1,002	523	502	791	374	496	392
	% Capacity Factor	47%	26%	48%	25%	11%	18%	8%	11%	9%

Figure 1 - Recent Manitoba Hydro GHG Emissions



QUESTION 2: *"Can Manitoba Hydro comment on future capacity factors expected for Unit 5, 6 and 7 given our overall generating system, domestic demands and export commitments?"*

RESPONSE: As indicated in section 2.3 of the EIS, and again in the response to question 1 above, Manitoba Hydro is unable to predict with certainty the usage requirement of its thermal generating assets for any given year in the future. In addition to domestic and export demand, thermal unit operation is dependent on many dynamic factors that cannot be predicted in the long term with certainty. Thermal fleet generation in any given year could reasonably vary from lows of 200 to 300 GWh to the maximum combined output from all of Manitoba Hydro's thermal resources, which is in the order of 4,000 GWh.

Since potential thermal requirements in any given year can be significant, the most recent environmental assessments not only for Unit 5, but for Selkirk G.S. (2005) and for Brandon Units 6&7 (2000) were conservatively conducted assuming the facilities are operated at full capacity over the entire assessment period (i.e. 100% capacity factor for the full period).

QUESTION 3: *"What are the expected greenhouse gas emissions expected from Unit 5 alone and Units 5, 6 and 7 based on Hydro's anticipated use of these assets into the future?"*

RESPONSE: As discussed in the response to question 2 above, Manitoba Hydro is unable to predict the levels of thermal generation required in any given year and therefore is unable to predict corresponding GHG production. However, despite annual variability in GHG production, Manitoba Hydro has successfully maintained its net corporate GHG emissions levels to 15% below 1990 levels as of 2005, and 27% below 1990 levels as of 2006. This reduction in GHG emissions surpasses Canada's target under the Kyoto Protocol. On the basis of GHG intensity, Manitoba Hydro produced 38% fewer GHG emissions per unit of electricity produce in 2005 than it did in 1990.

Manitoba Hydro anticipates that future Federal regulations for electricity sector GHG emissions will come into force in 2010. Manitoba Hydro will manage its GHG emission within any future mandatory GHG constraints and compliance mechanisms. The following table presents thermal fleet average emissions as well as the theoretical maximum annual GHG emissions.

	Brandon Unit 5 *(1990 - 2005)*	**Brandon Units 6 & 7** *(2003 - 2005)*	**Selkirk Units 1 & 2** *(2003 - 2005)*	**Thermal Fleet GHG Emissions**
Emission Average (CO_2e in MT/year)	0.28	0.04	0.04	0.36
Theoretical Maximum (CO_2e in MT/year)	1.04	1.64	0.69	3.37

Notes: Selkirk Units 1 & 2 values reflect gas-fired operations. Thermal Fleet GHG Emissions excludes remote diesel generating stations and other corporate GHG sources.

QUESTION 4: *"What facility requirements and associated costs are forecasted to extend the life of Unit 5, including any proposed infrastructure costs for compliance with proposed federal regulations?"*

RESPONSE: As indicated in the response to Paragraph 1, the current physical condition of Unit 5 is such that it does not require specific investments to continue service, due to a combination of low operating hours and diligent maintenance practices. Ongoing operations merely require a continuation of routine maintenance activities and these costs are projected to remain at or below current levels.

There are no facility modifications or infrastructure requirements anticipated for any of Manitoba Hydro's thermal facilities to comply with the Federal Clean Air Action Plan regulations that have been

proposed thus far. Any costs related to the management of GHG emissions are anticipated to be related to offsets and would be treated as incremental operating costs. These costs are expected to be in the order of the costs that Manitoba Hydro currently incurs for managing GHG emissions under its voluntary commitment.

QUESTION 5(a): *"Given units 1-4 are off-line and close to 50 years old, are there any decommissioning plans for these units?"*

RESPONSE: Units 1 to 4 were taken off-line in 1995 after Manitoba Hydro concluded that even though the units had significant remaining service life, capital investments to improve the environmental performance of Unit 5 would be more prudent in the long-term due to the higher efficiency and lower operating hours of Unit 5 relative to Units 1 to 4. Units 1 to 4 are now officially retired and Manitoba Hydro is in the process of selling components of the generating equipment as opportunities to do so arise. In addition, parts of Units 1-4 were removed in 2001 to accommodate systems related to Units 6 & 7. However, the infrastructure of the facility, the administrative offices, and many of the auxiliary systems also serve Units 5, 6, and 7 and will remain in service as long as these units remain in service. Therefore, decommissioning of the facility is not planned at this time and the only plan currently associated with Units 1 to 4 is the sale or salvage of components on an opportunity basis.

QUESTION 5(b): *" What would be involved in decommissioning the entire coal-fired facility?"*

RESPONSE: As discussed above, there are no plans to decommission the entire coal-fired facility. However, when a decision is made to do so, a formal Closure Plan will be developed and submitted to regulatory authorities for approval. This plan will recognize the existing decommissioning standards of the time. Decommissioning activities will likely take a number of years to develop and implement to maximize environmental effectiveness and re-use of materials and equipment.

QUESTION 6: *"Given that Unit 5 is close to 40 years old, what are the specific decommissioning plans for Unit 5?"*

RESPONSE: As stated previously, the useful life of a coal-fired generating station is not based on chronological age, but on generating unit operating hours. Unit 5 has historically been operated on an intermittent basis and, for this reason, the generating equipment has very low operating hours

relative to its chronological age. Due to its combination of low operating hours and diligent maintenance practices, Unit 5 is in excellent condition and is capable of many more years of service

As indicated in Section 2.8 of the EIS, Manitoba Hydro does not have a formal decommissioning plan for Unit 5 or for the entire Brandon G.S. as there are no plans to close or salvage either. However, progressive decommissioning practices have occurred concurrently with station operations as specific plant infrastructure becomes redundant.

Some progressive decommissioning actions were undertaken in 2006 at the Ash Lagoon where a portion of the contents of the east cell were excavated and placed in the west cell. Ash in the west cell was contoured to minimize ponding and precipitation infiltration while enhancing positive drainage into the east cell. The 2006 activities can be considered a major step towards obtaining final west cell ash grades and contours prior to placement of a final soil cover over the ash.

Sale or salvage of retired Units 1 to 4 components is also currently underway. In addition, a surplus, 60,000 L, underground petroleum storage tank was decommissioned in 2003 in compliance with applicable provincial regulations.

When a decision is made to decommission Unit 5, a formal Closure Plan will be developed and submitted to regulatory authorities for approval. This plan will recognize the existing decommissioning standards of the time. Decommissioning activities will likely take a number of years to develop and implement to maximize environmental effectiveness and re-use of materials and equipment.

QUESTION 7: *" What are the alternative sources of power being considered by Manitoba Hydro as the Brandon Unit 5 facility nears the end of its operation?"*

RESPONSE: As discussed in the responses to questions 4 and 5, Manitoba Hydro is not currently planning to decommission Unit 5 and, as such, is not considering alternative resources to replace Unit 5. Manitoba Hydro's integrated resource planning process considers a full range of resource options to meet future supply requirements to determine the optimal sequence and timing of resource additions and retirements on a system-wide basis. In the future, when the planning process indicates that retirement of Unit 5 should be considered, generating resources with similar technical characteristics that can provide the same type of service that Unit 5 provides will be considered as alternatives. These resources may be based on fossil fuels, nuclear, or renewable sources of energy, depending on the state of technological development of the resource options available at the time.

Additional Environmental Impact Observations

"While our Branches defer to the expertise of our colleagues in the Departments of Water Stewardship and Conservation, we offer the following observations and questions on other matters raised in the EIS."

Brandon Generating Station

"Ash Lagoon - Please show the location of the proposed new ash lagoon including a description of size and construction details. Are there future plans to segregate fly ash from bottom ash? Is there a potential market for fly ash given its pozzolanic properties? What are the circumstances by which Manitoba Hydro can use collected ash for other beneficial uses? Will changes in coal properties from varying sources impact beneficial use options for ash? What are the characteristics of the ash in the existing lagoon and is it a considered a hazardous waste? How will the existing ash lagoon be decommissioned?"

REQUEST: "*Please show the location of the proposed new ash lagoon including a description of size and construction details."*

RESPONSE: Engineering design, including siting and sizing detail, for a new ash lagoon has not commenced and therefore more specific information is not yet available. Generally, the new lagoon cells will be situated east of the existing east cell covering the same approximate area as the east cell. The redeveloped lagoon system is intended to be comprised of 2 primary cells, 1 secondary cell and 1 tertiary cell. Consistent with Section 2.5.1 of the EIS and subject to the Environment Act, design details including geotechnical information and an environmental assessment of potential effects will be submitted to Manitoba Conservation for approval when finalized.

QUESTION: *"Are there future plans to segregate fly ash from bottom ash?"*

RESPONSE: Currently, Manitoba Hydro manages fly ash and bottom ash in such a way as to prevent both waste streams from becoming pollutants in the local environment. Segregation of the ash is dependent upon potential end users expressing an interest in collection and eventual use of either or both types of ash. Although Manitoba Hydro has entered into discussions with interested parties in the past, and continues to monitor our ash quality, a committed end user has not come forward. As such, there are no immediate plans for segregation.

QUESTION*: "Is there a potential market for fly ash given its pozzolanic properties?"*

RESPONSE: Fly ash is widely used as an additive to concrete mixes throughout North America. Chemically, fly ash can be referred to as a "pozzolan" which when mixed with lime (calcium hydroxide) combines to form cementitious compounds. Concrete containing fly ash becomes stronger, more durable, faster setting and more resistant to chemical attack. The quality of a fly ash produced from Brandon GS Unit 5 that would be suitable for use as a pozzolan would be required to meet Canadian Standards Association (CSA) and American Society for Testing and Materials (ASTM) standards. The carbon content of fly ash, as expressed in terms of a percentage loss-on-ignition (LOI), can adversely affect a concrete mix if the LOI exceeds 6% loss. Fly ash produced from the Brandon GS has not been shown to consistently maintain LOI losses of less than 6% in the past, which limits its attractiveness as a pozzolan.

QUESTION: *"What are the circumstances by which Manitoba Hydro can use collected ash for other beneficial uses?"*

RESPONSE: Although many uses for ash generated by Brandon GS Unit 5 have been identified from a theoretical and regulatory perspective there has not been wide-spread interest from local industry in utilizing the ash. In the Brandon area, two significant uses of fly ash by road construction contractors have occurred. They are:

- Use as a Stabilized Base Course where the aggregate or the underlying soil are cement/fly ash stabilized. Typical Stabilized Base Course materials are blends consisting of 64 to 87% aggregate; 10 to 30% fly ash; and 3 to 6% Portland Cement. and
- Use as Filler in Subbase and Base Course materials allowing locally available aggregates to meet construction gradation specifications.

The circumstances under which Manitoba Hydro could collaborate on ash collection could only be identified once a potential end user identified parameters such as quality standards, quantity requirements and collection logistics, including intended on site or off site storage. All of these conditions could potentially facilitate incorporation of ash generated from Unit 5 into a beneficial product for an interested end user. Manitoba Hydro continues to investigate new technologies for incorporation of ash into existing products and processes and will continue to communicate with local and national industries in an attempt to understand potential needs related to ash use.

General industry and utility research has identified uses for ash (depending on user specifications), with varied success, in the following areas:

- As a supplementary cementing material.

- In road repair
- Road base material
- As structural fill material
- As cenospheres (floating particles in lagoon)
- For construction of landfill liners
- Autoclaved concrete products, plastic filler
- Mineral wool and waste stabilization
- Agricultural amendment
- Use with mine tailings

QUESTION: *"Will changes in coal properties from varying sources impact beneficial use options for ash?"*

RESPONSE: In general, ash characteristics are affected by the characteristics of the originating coal. Assuming an end user's quality standards and intended use remain static; changing the characteristics of the source material (coal) could potentially impact the quality of the ash, and therefore the product's suitability to the end user. Section 5.3.2.2 of the EIS refers to a comprehensive review of coal chemistry and associated environmental significance that was conducted in parallel with the EIS. This review allowed Manitoba Hydro to identify a number of environmentally preferred mines by screening out coals from other suppliers that produced unacceptable emissions. Identified coals from the preferred sources do not substantially differ in characteristics, and therefore would be anticipated to produce similar quality ash to that which is currently produced.

QUESTION: *"What are the characteristics of the ash in the existing lagoon and is it a considered a hazardous waste?"*

RESPONSE: The ash in the lagoon has the chemical properties consistent with the sub-bituminous coal from which it is a by-product. Ash quality is dependent upon the characteristics of the coal, boiler configurations and air pollution equipment. Ash composition includes oxides of silicon, iron, aluminum and calcium, along with trace elements and metals.

Pursuant to Manitoba Regulation MR 282/87, the Classification Criteria for Products, Substances and Organisms Regulation under the Transportation of Dangerous Goods handling and Transportation Act, the coal ash is not classified as hazardous. Furthermore, since October 29, 1998, Manitoba

Conservation's predecessor, Manitoba Environment, approved the use of Brandon Generating Station ash for the following uses (pursuant to Clause 24 of the existing Environment Act Licence 1703R):

- As a cement or concrete products additive
- As a backfill additive for stopes in mines
- As a pozzolanic component of cement-stabilized road bases
- As a course mineral fines for unstabilized base and sub-base course aggregates
- As an embankment material for roads, area fills and dikes
- As an unstabilized sub-base or base course in roads
- As a daily cover for local municipal sanitary landfill cover

QUESTION*: How will the existing ash lagoon be decommissioned?"*

RESPONSE: Following regulatory approval of a formal Closure Plan it is anticipated the existing ash lagoon will be decommissioned by consolidating and contouring the ash into as small a footprint as practicable followed by securing the ash by placing a clay cap over the top. The clay cap will be topped with a soil amendment and seeded with native grasses to protect the cap from erosion. The contouring of the clay cap will promote positive drainage away from the capped ash and reduce or minimize the potential for downward percolation of precipitation and runoff through the capped ash deposit.

Aquatic Environment

"Assiniboine River Impacts - During low flow periods, operation of the Brandon generating facilities may withdraw up to 10% of river flows. Given the increased use of Brandon generation assets (in particular Unit 5), and their operation during drought conditions, what impacts if any can be expected to downstream water users? How are water allocations managed during drought conditions for users downstream of the generating station? With the construction of the cooling towers, did Manitoba Hydro forfeit a portion of their water allocation or were there any changes in their Water Rights License? What is the extent of the "mixing zone" during low flow conditions?"

QUESTION: "*Assiniboine River Impacts - During low flow periods, operation of the Brandon generating facilities may withdraw up to 10% of river flows. Given the increased use of Brandon generation assets (in*

particular Unit 5), and their operation during drought conditions, what impacts if any can be expected to downstream water users?"

RESPONSE: As discussed on page 62 of the EIS, under extreme low flow conditions (1Q10 or the lowest flow on one day with a given month in a 10 year period), Brandon Unit 5 may withdraw up to 8% of the river's flow in March, September and October, but 70% is returned, either via the ash lagoon or station drain discharge. Therefore, the net effect to downstream water users in the worst case (1 day period) is a reduction of 2% in the flow.

QUESTION: *"How are water allocations managed during drought conditions for users downstream of the generating station?"*

RESPONSE: This is a question for Manitoba Water Stewardship and it would be inappropriate for Manitoba Hydro to comment on it.

QUESTION: *"With the construction of the cooling towers, did Manitoba Hydro forfeit a portion of their water allocation or were there any changes in their Water Rights License?"*

RESPONSE: Water Rights Licence No. 90-37 (Renewal of Licence No. 70-6) was issued for Brandon GS on 1990 04 10. This licence was amended according to a 1996 08 29 letter from Water Resources Branch. Following construction of Units 6&7 at the Brandon G.S., Water Rights Licence No. 2001-049 was issued on 2001 09 10 to replace Licence No. 90-37. Further modifications to Licence No. 2001-049 have been requested in a 2006 11 22 letter from Manitoba Hydro to Manitoba Water Stewardship. Manitoba Hydro is currently waiting for a response.

QUESTION: *"What is the extent of the "mixing zone" during low flow conditions?"*

RESPONSE: There are no empirical data related to the length of the mixing zone created by discharge from the ash lagoon. A rough rule of thumb is that the mixing zone is 100 to 350 times the width of the stream. Assuming a river width of 75-100 m, the length of the mixing zone would range from 5.6 to 35 km. It should be noted that within this mixing zone the effluent is considerably diluted from end-of-pipe conditions.

QUESTION: *"What sorts of spill response or emergency procedures are in place to manage a spill event into the Assiniboine River?"*

RESPONSE: Four pages extracted from the current Brandon Generating Station emergency response plan are included on the following pages in response to the above question.

5.0 RESPONSE TO RELEASES THAT HAVE ENTERED THE ASSINIBOINE RIVER

5.1 Background Information

The response actions to be taken for released oil that has entered the Assiniboine River will be dictated by a number of conditions at the time of the release, including:

- River flow
- Weather and available daylight (visibility)
- Time of year
- Availability of staff

When conditions are not suitable or safe, as determined by the Acting Senior Site Authority, such as at times of high river flow during spring runoff, containment of the released oil by booms will not be possible and the response will consist of river surveillance and notification of external and Corporate authorities.

When conditions are suitable and safe, as determined by the Acting Senior Site Authority, the station's oil containment booms can be deployed in order to prevent further downstream movement of the oil.

In the event that oil enters the river, the steps described in the following sections should be followed:

- Notify the appropriate external and Corporate authorities (Section 2.0).
- Initiate a surveillance program to locate the released oil and assess the follow-up action that is required (Section 5.4).
- If the inspection of the river reveals that there are larger accumulations of oil than cannot be contained using available station resources, MB Conservation should be contacted for assistance (see Section 6.0).
- If possible, contain the released oil, protect sensitive areas, and minimize any potential environmental damage.

5.2 Reportable Release Quantity

All releases (of any volume) to the river **must** be reported.

5.3 Confirming the Release Event and Reporting

The following actions should be taken in the event of a release to the river:

Shift Engineer

Confirm that a release to the river has occurred. Estimate the type and quantity of oil that has entered the river.

Plant Manager or Acting Senior Site Authority

Contact the following authorities as soon as possible after the release:

- Brandon Gen Stn Area Release Response Coordinator
- System Control Center
- Manitoba Hydro's Safety & Occupational Health Division
- Manitoba Hydro Public Affairs
- Manitoba Conservation (204) 944-4888 or (204) 945-4888
- Environment Canada (204) 981-7111
- Rural Municipalities should be contacted in the event of a significant release to the Assiniboine River

5.4 Actions to be Taken

Initiate the following surveillance/monitoring program to locate the released product and to help determine the follow-up actions to be taken:

No Ice Cover on River

Summer and Times of Generation in Winter

- Note: When working on or near the Assiniboine River, approved personal flotation devices must be worn.
- Deploy the emergency response trailer to the access location, which is anticipated to be the closest location to the leading edge of the released oil. Using the zodiac, inspect the river and shoreline to:

- Locate the furthest downstream point of the released oil.
- Locate any large accumulations of oil.
- Decide if and where the containment booms can be deployed.

- Concurrent with the inspection using the zodiac, other personnel should make a visual inspection (on foot) for the presence of oil along the shoreline areas, immediately downstream of the release location.
- If the inspection reveals that there are visible accumulations of oil along the shoreline or an oil slick/sheen moving on the water surface, actions should be

initiated to contain the oil and minimize any potential environmental damage. In the event that large accumulations of oil are located, the primary emphasis should be placed on containing it and secondary emphasis on cleanup. Depending on the particular situation, one or more of the following may be potential options:

- Proceed to a suitable location downstream of the leading edge of the released oil and deploy oil containment booms to contain the oil and prevent any further downstream movement.
- Short segments of portable oil containment boom can be used to protect sensitive shoreline areas, or prevent the entry of oil into stream mouths and other sensitive areas.
- Short segments of oil containment boom can be used to "corral" pockets of accumulated oil along the shoreline in order to prevent further downstream movement.
- Sorbent sheets can be used to absorb visible oil. All accumulated oil and visible sheens should be removed. Oil-soaked sheets should be placed in waste drums.

- Based on the findings or the inspection of the river, specific instructions on containment may be given by provincial and/or federal regulatory authorities.
- If conditions are such that it is expected that water users may be affected by the released oil, Manitoba Conservation or the Rural Municipalities should be requested to make contact with these individuals or companies.

Samples

The following samples should be obtained by station personnel and sent to Manitoba Hydro's Central Laboratory in Selkirk for analysis as soon as possible after the release has occurred:

- Sample the oil from the failed system. This will be analyzed for metals and other potential contaminants to determine if the oil is classified as a hazardous material. The sample may be taken in a 1 L high-density polyethylene bottle. The bottle should be completely filled.
- Sample the surface water in areas where oil may be expected to accumulate (e.g., back bays off of the main river channel). Samples should be taken whether or not there are visible signs of oil. In addition, samples should be taken at all locations where there are visible signs of oil. The locations of the samples should be marked on a map. These samples will be analyzed to determine the concentration of oil in the water. A sample is composed of:
  - i) a 1 L high-density polyethylene bottle, and
  - ii) a 1 L dark-brown glass bottle with a Teflon-lined cap.

  Both bottles should be completely filled.

Ice Cover on River

<u>Winter</u>

- With cooling tower in operation, there should not be any open water in the Assiniboine River during winter conditions; with the possible exception of small ice-free areas at the locations where the station drainage and ash lagoon effluent enter the river.

- In the event of a release, inspect (by foot) these open water areas.
- If significant quantity has entered the river, MB Conservation should be notified for assistance.

Due to the safety hazards and the difficulty of containing released oil in winter conditions, no further action should be taken without further consultation with regulatory and Corporate authorities. The follow-up actions will depend on a number of factors such as the volume of the release, potential environmental impact, ice conditions, weather, and other factors.

5.5 Downstream Movement and Location of Released Oil

The speed that an oil slick will move on a stream or river will depend on surface currents, whether or not there is ice cover and wind conditions. Oil will move at the same speed as the surface current of the water. Surface current speed varies across a river, therefore, oil will move faster in the main current (which tends to follow the deepest part of the river) and more slowly if it is in a side channel or backwater. Wind conditions will be a major influence in determining the path a slick will take. Generally, the current determines the speed of slick movement downstream, while wind determines which side of the river the slick will move toward or follow.

Based on a number of surface velocity measurements taken near Holland, Manitoba, the following oil movement time table can be used to estimate the possible downstream location after a release:

Downstream Movement of Released Oil Estimated Oil Slick Velocities (km/h)			
Month	Stream Flow		
	Below Normal	Normal	Above Normal
January	3.0	5.0	5.2
February	3.2	4.8	5.1
March	3.1	5.1	5.8
April	5.5	7.1	12.0
May	4.2	7.1	10.0
June	4.0	6.2	8.2
July	2.5	5.6	7.5
August	3.3	5.2	6.3
September	2.5	5.0	6.0
October	3.0	5.0	6.3
November	3.2	5.1	5.9
December	3.2	5.0	5.7

QUESTION: *"Weir - Are their future plans to decommission the weir assuming the station is decommissioned."*

RESPONSE: As indicated in Section 2.8 of the EIS, Manitoba Hydro does not have formal decommissioning plan for Unit 5 or for the entire Brandon G.S. as there are no plans to close or salvage either. When a decision is made to decommission the facility, a Closure Plan will be developed and submitted to regulatory authorities for approval. This plan will consider all aspects of the facility, including the weir, and will meet the existing decommissioning standards of the time.

Air and Noise

QUESTION: *"When would Manitoba Hydro operate burner configurations that result in the least efficient emissions output from the facility?"*

RESPONSE: The Unit #5 boiler has four rows of burners and associated fuel delivery systems designated A, B, C, and D, with row A located at the highest elevation and row D located at the lowest. Each row has three individual burners for a total of 12 burners. The boiler can be operated at maximum load using only three of the four rows of burners and is usually operated in this configuration as operation with all four burner rows results in decreased boiler efficiency and increased fuel delivery system maintenance costs. For this reason there is usually a "spare" burner row and associated fuel delivery system that is not in service when the boiler is in operation at full load. The result is that there are five possible combinations of burner rows that can be used to operate the boiler at maximum load; ABC, ABD, ACD, BCD, and ABCD.

Each burner row combination has different operational and thermodynamic characteristics. Of the five possible burner row combinations, combination BCD provides the best operational and thermodynamic performance. This is the preferred combination for normal full-load operation, with the boiler being operated in the BCD burner row combination the majority of the time. Burner row combination ABC provides the least efficient operational and thermodynamic performance and operation of the boiler in the least efficient configuration is minimized to the furthest extent possible. However, periodically, situations can arise, such as fuel delivery system equipment maintenance activities and occasional operational problems, such as frozen coal plugging bunkers, chutes, and feeders in the winter, that necessitate boiler operation in one of the other four less efficient burner row combinations. It is estimated that operation in the least efficient combination occurs less than 10% of the time that Unit 5 is in operation. However, in order to ensure that the potential environmental effects associated with operation in the least efficient combination were not underestimated, this

combination was modeled at 100% capacity factor in the air quality impact assessment as Operational Scenario 2 (OS2), which is conservative.

For more information on the Unit 5 fuel delivery system and the air quality impact assessment, please see Appendix K, Volume 2 of the EIS.

QUESTION: *"What would be typical mercury emissions loads from Unit 5 if operating at 100% capacity for various coal types? How does this compare to Manitoba's cap of 20 kg/year?"*

RESPONSE: Manitoba Hydro has committed to early achievement of the proposed Canada-Wide Standard (CWS) emission cap for Unit 5 of 20 kg/year. At this level, the emission load would be as indicated in Table 2.4 of the EIS and Table 3.5 of Appendix K.

However, actual emissions could be somewhat lower than indicated in these two tables. Although the air quality impact assessment has been based on a hypothetical operational scenario of 100% capacity factor (C.F.), Unit 5 could not realistically operate at this level over an entire year. A more realistic maximum operating scenario would be 85% C.F. At this capacity factor, the total annual mercury emissions for the various candidate coals listed in Table 3.2 of Appendix K would be as follows:

Coal Mine	Hg Emissions (kg/year)
A	19.5
B	17.7
C	19.4
D	19.2
E	7.5
F	18.8
P	18.1

Of the remaining candidate coals that are deemed to be suitable for future operations at the Brandon Generating Station, the maximum capacity factors and mercury emission rates within the CWS limit are as follows:

Coal Mine	**C.F.** (%)	**Hg Emissions** (kg/year)
G	75	19.2
J	70	19.4
I	70	19.3
Q	80	19.8

QUESTION: *"What is the most problematic exposure pathway for human health impacts? Ecological Impacts?"*

RESPONSE: As indicated in Section 5.4 of the EIS and Appendix N, there are no problematic exposure pathways for either human health or ecological impacts from the operation of Unit 5. The conclusion of the human health and ecological risk analysis was that there will be no incremental, measurable adverse effects on humans or the environment from the operation of Unit 5. Please see Appendix N, Volume 3 of the EIS for the complete Human Health and Ecological Risk Assessments.

Groundwater

COMMENT: "*Has there been any monitoring of groundwater wells outside of the generating station property to confirm contaminants are not propagating to possible receptor wells?"*

RESPONSE: Manitoba Hydro does not have any monitoring wells located outside of the property limits nor is it aware of any monitoring wells owned and maintained by other agencies. There are very few groundwater users in the area of the Brandon G.S. The two major groundwater users in the area are Koch Fertilizer Canada Limited and Canexus Chemicals. The groundwater is used for industrial and not for potable supply purposes. Manitoba Hydro has established observation wells to assess the potential of groundwater impacts resulting from the Brandon G.S. activities. Groundwater results collected since 1993 indicate that in general, groundwater quality has not been adversely affected due to site activities. Manitoba Hydro's groundwater consultant has recommended installation of three

additional new sentry wells to obtain additional information on groundwater flow gradients and groundwater quality and to monitor any potential movement of impacted groundwater from the lagoon to the river.

QUESTION: *"What is Manitoba Hydro's schedule to install additional monitoring wells on the property?"*

RESPONSE: Manitoba Hydro intends to install additional monitoring wells once the Licence Review process is complete.

QUESTION: *"Has ash lagoon integrity been examined in terms of its construction and permeability? What sort of closure plan and ash lagoon liner designs are contemplated to ensure the decommissioned ash lagoon is as impermeable as possible?*

RESPONSE: During excavation of ash from the east cell in 2006 as part of progressive ash lagoon decommissioning, the liner integrity was assessed through a geotechnical investigation. Areas found to be sub-standard (approximately 60%) were remediated by the addition and integration of compacted clay to the liner. Clay was hauled onto the existing sub-standard areas and compacted in lifts ultimately to achieve a low permeability liner (permeability ≤ $1x10^{-9}$ m/s) that is the standard for lagoon liner design. Liner designs and closure plans will be developed to maintain or achieve permeability barriers between the compounded ash and the ground water and surface water. In addition, contouring and capping of the ash will also be designed to minimize the ash deposit from becoming a recharge source to the local groundwater aquifer. Finally, all closure plans and designs relating to the lagoon will meet applicable regulations.

CEAA

CANADIAN ENVIRONMENTAL ASSESSMENT AGENCY

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123 Main Street
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Agence canadienne d'évaluation environnementale
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Winnipeg (Manitoba)
R3C 4W2

May 10, 2007

CEAA File No.: MB/2007/013
MC File No.: 3252.00

Mr. Clem Moche
Manitoba Conservation
Environmental Approvals Branch
160 - 123 Main Street
Winnipeg, Manitoba R3C 1A5

Dear Mr. Moche:

SUBJECT: Brandon Generating Station

I am responding to the February 8, 2007 letter from Ms.Tracey Braun, Director, Environmental Assessment and Licensing Branch, to Dan McNaughton, Director, Prairie Region, Canadian Environmental Assessment Agency, regarding the project identified above.

I have completed a survey of federal departments with respect to determining interest in the project noted above. I can confirm that the project information that was provided has been reviewed by all federal departments with a potential interest. Based on the responses to the survey, application of the *Canadian Environmental Assessment Act* (the Act) will not be required for this project.

Environment Canada has provided comments on the project in the attached letter. I have also included a copy of an e-mail from Fisheries and Oceans Canada (DFO) which indicates that the department would like to provide specialist advice on the weir. This advice will be provided once DFO's review is complete.

If I can be of further assistance, please feel free to contact me by telephone at (204) 984-8020 or by e-mail at: *peter.boothroyd@ceaa.gc.ca*

Sincerely,

Peter Boothroyd
Senior Program Officer

Attach.

c.c.: Mr. E. Wojczynski, Manitoba Hydro
Mr. Reg Ejeckam, Environment Canada
Mr. Darryl Chudobiak, Fisheries and Oceans Canada

Canada

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Federal Contacts List

Project: **Brandon Generating Station**
CEAA File No.: **MP2007–013**
MC File No.: **3252.00**

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Email: chudobiakd@dfo-mpo.gc.ca

CEAA CANADIAN ENVIRONMENTAL ASSESSMENT AGENCY

This section summarizes P. Boothroyd's (CEAA) comments sent in a letter to C. Moche (Manitoba Conservation), dated May 10, 2007.

COMMENT: Mr. Boothroyd stated project information related to the Brandon EIS had been circulated to various federal departments and based on their feedback, an environmental assessment under the Canadian Environmental Assessment Act would not be required.

RESPONSE: No response necessary.

DFO

DEPARTMENT OF FISHERIES AND OCEANS CANADA

Boothroyd,Peter [CEAA]

From: Chudobiak, Darryl [ChudobiakD@DFO-MPO.GC.CA]
Sent: May 9, 2007 10:00 AM
To: Boothroyd,Peter [CEAA]
Subject: RE: Brandon Generating Station
Importance: High

Hi Peter,

As there is no works or undertakings that will affect fish habitat, DFO will not have a trigger on this project. However, we would like to provide speciaslist advice on the weir (Section 1.2.2.1.2; Appendix J). Currently, we are reviewing these sections with respect to fish passage.

Cheers,

Darryl Chudobiak
Telephone/ Téléphone: (204) 622-4071
Cellular / Cellulaire: (204) 648-7001
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A/Habitat Management Team Leader
Prairies Area, Manitoba District — Secteur des Prairies, District de Manitoba
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From: Boothroyd,Peter [CEAA] [mailto:Peter.Boothroyd@ceaa-acee.gc.ca]
Sent: April 30, 2007 11:22 AM
To: Chudobiak, Darryl
Subject: Brandon Generating Station

Hi Darryl:

Could you please let me know when you anticipate being able to provide your response on the above project. Thank you.

Peter

Peter Boothroyd
Senior Program Officer, Prairie Region
Agente principale des programmes, Région des Prairies

Ph: (204) 984-8020 Fax: (204) 983-1878
Email: peter.boothroyd@ceaa-acee.gc.ca http://www.ceaa-acee.gc.ca

10/05/2007

DFO DEPARTMENT OF FISHERIES AND OCEANS CANADA

This section contains a response to D. Chudobiak's (DFO) comment in an e-mail to P. Boothroyd (CEAA), dated May 9, 2007.

COMMENT: "*As there is no works or undertakings that will affect fish habitat, DFO will not have a trigger on this project. However, we would like to provide specialist advice on the weir (Section 4.2.2.1.2; Appendix J). Currently we are reviewing these sections with respect to fish passage.*"

RESPONSE: Manitoba Hydro confirms Mr. Chudobiak's observation that there are no planned works to the weir associated with Licence Review. Therefore, Manitoba Hydro understands that any advice on the weir would be addressed outside of the Licence Review process.

EC

ENVIRONMENT CANADA

Environment Canada / Environnement Canada

Environmental Protection Operations Division
Prairie & Northern
123 Main Street, Suite 150
Winnipeg, MB R3C 4W2

April 30, 2007

File: 4194-10-5/2846

Ms. Tracy Braun
Director
Environmental Assessment and Licensing Branch
Manitoba Conservation
123 Main Street, Suite 160
Winnipeg, MB. R3C 1A5

Dear Ms. Braun,

Re: Brandon Generating Station – Unit 5: Environmental Impact Statement.

Environment Canada (EC) received a copy of the above proposed project document from the Canadian Environmental Assessment Agency (CEAA) for review. EC has no trigger under section 5, of CEAA, however, would like to participate in the provincial review of the proposed project consistent with the intent of Clause 62 of the new Canada-Manitoba Agreement on Environmental Assessment Co-operation.

Environment Canada has reviewed the above project description proposed by Manitoba Hydro and appreciates the opportunity to comment on the Environmental Act Licence Review pertaining to Manitoba Hydro's coal-fired power plant, Brandon, Unit #5.

EC understand that the environmental assessment and licensing process is an important step in the planning and/or extension of a project to ensure that economic development occurs in an environmentally responsible manner for those projects that may have potential for significant environmental effects.

Given that Brandon Unit #5 is approaching the end of life of a typical coal-fired power plant (40 years in 2010), Environment Canada believes that there is a need to improve environmental performance, enhance the operation and maintenance of the unit and more effectively use the existing site, in order to justify its continued use. Environment Canada advocates that the project review should consider appropriate modifications to the unit within a holistic approach that addresses all environmental impacts including, but not limited, to greenhouse gases, criteria air contaminants, toxics such as mercury to all media, water issues, etc.

Canada

www.ec.gc.ca

Environment Canada Environnement Canada

In respect of air, within the proposed modifications to the site, there are currently no planned alterations to the boiler/generator, nor any plans to address emissions of air pollutants and greenhouse gases which will continue to be emitted, uncontrolled for the most part, for the next several years. There is potential for these emissions to have significant impacts on the environment and human health.

In 2003, Environment Canada released its CEPA 1999 "New Source Guidelines for Thermal Electricity Generation" which includes emission limits for air emissions of sulphur dioxide, nitrogen oxides and particulate matter. At the time, these limits were viewed as the minimum acceptable for new thermal power plants and were comparable to the U.S. New Source Performance Standards. As we move forward, expectations for reductions from the power sector are likely to become greater as evidenced by the revised 2006 U.S. New Source Performance Standards, which are more stringent that the current CEPA 1999 Guidelines, and the U.S. Clean Air Interstate Rule, which is requiring significant SO2 and NOx reductions from the power sector in general over the next decade. Within a similar timeframe, expectations on reductions in greenhouse gases from the power sector are also increasing in the global arena.

In 2006, the Federal and Provincial Environment Ministers, including Manitoba's, endorsed Canada-wide Standards (CWSs) developed under the Canadian Council of Ministers of the Environment (CCME),that is set to achieve by 2010 a 45% reduction of mercury emissions from coal-fired electricity generating plants, relative to 2003 emissions. Within this framework, it is our understanding that Brandon Unit #5 can be treated under the CWS as an existing unit whose mercury emissions cannot cause the province to emit more than its existing plant cap of 20 kg/yr of mercury emissions to air from 2010 onward. However, a possible review of the CWSs in 2012 could explore further reductions in mercury capture (i.e. 80% or more) from the power sector for 2018 and beyond. This would be comparable to limits of the second phase of the U.S. Clean Air Mercury Rule.

During this Environmental Act Licence Review, if it is intended that Brandon, Unit #5 is expected to continue its operation to at least 2019, it is suggested that Manitoba Hydro consider future expectations of coal-fired power plants for all pollutants. On April 26, 2007 the Government of Canada announced its intent to impose mandatory emission targets on industry related to greenhouse gases and air pollution. In 2010, facilities existing in 2006 will be required to reduce to meet challenging greenhouse gas emissions targets. Emission reductions targets for air pollutants will specify the maximum level of pollutant that can be emitted from a given sector in a given year. Fixed emission caps will be placed on the following air pollutants: nitrogen oxides, sulphur oxides, volatile organic compounds, and particulate matter. The framework also identifies the government's intent to set limits on mercury from coal-fired power plants.

Environment Canada Environnement Canada

Regulations are not yet fully developed. Updates will be available at http://www.ec.gc.ca/cleanair-airpur/.

In respect of water, the continued groundwater monitoring and addition of more monitoring wells is commendable; however, the frequency of sampling of the ash lagoon outflow should be increased as it sits on a recharge zone. In addition the report in several places refers to a "fully mixed zone in the river"; it is worth noting that the Fisheries Act does not allow for a mixing zone.

Thank you for the opportunity to review the project proposal.

Yours sincerely,

Reg. B. Ejeckam, P. Geo.
Environmental Assessment Coordinator
Environment Protection Branch. MB. Div
Phone: (204) 984-3522; Fax: (204) 983-0960
e-mail reg.ejeckam@ec.gc.ca

Cc:
Peter Boothroyd:	CEAA;
Mike Norton	EPOD
Cheryl Baraniecki	EPOD
Lorie Cummings	NCR
Frank Letchford	EPOD

EC ENVIRONMENT CANADA

This section contains the responses to comments from R. Ejeckam (EC) to T. Braun (MC), dated April 30, 2007.

COMMENT: *"Given that Brandon Unit #5 is approaching the end of life of a typical coal-fired power plant (40 years in 2010), Environment Canada believes that there is a need to improve environmental performance, enhance the operation and maintenance of the unit and more effectively use the existing site, in order to justify its continued use. Environment Canada advocates that the project review should consider appropriate modifications to the unit within a holistic approach that addresses all environmental impacts including, but not limited, to greenhouse gases, criteria air contaminants, toxics such as mercury to all media, water issues, etc."*

RESPONSE: The useful life of a coal-fired generating station is not based on chronological age, but on generating unit operating hours. Unit 5 has historically only been operated on an intermittent basis and, for this reason, the generating equipment has very low operating hours relative to its chronological age. While Unit 5 has been in service for 38 years, it has a lifetime capacity factor of only 24%. Manitoba Hydro diligently maintains its thermal fleet and optimizes the operational performance of all units using a reliability-centered maintenance program to ensure reliable, efficient, and safe operation. In fact, Unit 5 is currently the most thermally efficient unit in Manitoba Hydro's thermal fleet and, due to its combination of low operating hours and diligent maintenance practices; Unit 5 is in excellent condition and is capable of many more years of service.

From 1995 to 1997, extensive rehabilitation work was undertaken to upgrade the environmental performance of the Brandon Generating Station. Emission reduction equipment (an electrostatic precipitator) was installed on Unit 5 to remove virtually all the suspended fly ash from flu gases. A cooling tower was also built to cool the circulated water that condenses used steam, thus allowing the same water to be recirculated as well as substantially reducing the amount of water taken from the Assiniboine River and, in turn, reducing any impacts on the aquatic ecosystem. In addition to these environmental upgrades, extensive rehabilitation and modernization of the generating equipment was also conducted to upgrade the operating performance of the unit. This work included the installation of a modern digital control system, steam supply system upgrades, and coal handling system upgrades.

In 2002, as part of the installation of the Units 6&7 at Brandon Generating Station, the raw water, water treatment, and auxiliary fuel systems were also upgraded as these systems are shared with the new gas turbines.

In addition to maintenance and rehabilitation activities, Manitoba Hydro has implemented voluntary programs to control emissions of greenhouse gases and mercury from its fleet of thermal generating resources, in the absence of regulatory limits. Furthermore, Manitoba Hydro has also implemented an environmental management system for all of its facilities and an environmentally preferable coal procurement program for Unit 5:

- In 1997, Manitoba Hydro implemented a voluntary greenhouse gas emissions management program to control corporate GHG emissions to 6% below 1990 levels and has been recognized as a national leader in this area. At the end of 2005, Manitoba Hydro's average net emissions were 15% below 1990 levels, surpassing its 6% reduction target. On the basis of GHG intensity, Manitoba Hydro produced 38% fewer GHG emissions in 2005 than it did in 1990.

- In 2000, Manitoba Hydro implemented an ISO 14001 registered Environmental Management System (EMS) that provides a framework for the continual development and integration of environmentally responsible practices into the operation of all of Manitoba Hydro's facilities, including Brandon G.S.

- In 2006, Manitoba Hydro began voluntarily limiting mercury air emissions to 20 kg per year, as communicated to Manitoba Conservation in September of that year.

- In 2006, Manitoba Hydro implemented an environmentally preferable coal procurement program to further mitigate air contaminants associated with Unit 5 operations

Through this combination of diligent operational and maintenance practices and voluntary management programs, Manitoba Hydro manages the environmental effects of its thermal generating fleet to ensure compliance with current and anticipated regulatory limits while providing reliable power and protecting Manitobans against the consequences of drought. Environmental assessments conducted for the Unit 5 EIS, and their conclusion that Unit operation will not produce significant environmental effects, attest to the effectiveness of Manitoba Hydro's holistic approach to managing environmental effects through a combination of controls and best operation and maintenance practices.

COMMENT: *"In respect of air, within the proposed modifications to the site, there are currently no planned alterations to the boilerlgenerator, nor any plans to address emissions of air pollutants and greenhouse gases which will continue to be emitted, uncontrolled for the most part, for the next several years. There is potential for these emissions to have significant impacts on the environment and human health."*

RESPONSE: The environmental assessments of Unit 5 determined that there will be no significant impacts on the environment or human health associated with continued operation of Unit 5. Section 5.4.5 – Conclusion, of the EIS states: "In summary, the results of the human health and ecological risk analysis determined that there will be no incremental, measurable adverse effects on humans or the environment from the operation of Unit 5 at the Brandon G.S."

Manitoba Hydro manages the environmental effects of its thermal generating fleet to ensure compliance with current and anticipated regulatory limits through a combination of diligent operational and maintenance practices and voluntary emissions management programs.

As discussed above, extensive rehabilitation work was undertaken to upgrade the environmental performance of the Brandon Generating Station. In addition, as discussed in detail in Chapter 5 of the EIS, a high-efficiency electrostatic precipitator is used to minimize emissions of particulate matter, as well as of associated organic and inorganic compounds. Emissions from Unit 5 are mitigated through the use of the burner management system and operation and maintenance activities to maximize the efficiency of the Unit 5 boiler, and minimize the emissions of CO and NO_x. Manitoba Hydro has consistently used a low sulphur coal in its operation s in order to minimize SO_2 emissions. Manitoba Hydro also diligently maintains the unit and optimizes its operational performance. Manitoba Hydro has conducted a detailed review of the coal quality characteristics of available coal suppliers with a view to minimizing, to the extent possible, emissions of particulate matter, SO_2 and trace heavy metals in future operations. Manitoba Hydro actively manages fugitive dust emissions from its coal pile and coal unloading operations. Consequently, Unit 5 operation meets current standards, regulations and guidelines as defined by the terms and conditions of its current Environment Act Licence assuming 100% capacity factor operation of the Unit. For more information on the air quality assessments, refer to the Air Quality Assessment Report, Appendix K of the EIS and the complete Human Health and Risk Assessment Report, Appendix N.

Where regulations for particular pollutants do not already exist, such as with GHG and mercury emissions, Manitoba Hydro voluntarily limits emissions. For more information on the effectiveness of Manitoba Hydro's GHG management program, refer to Appendix M of the EIS. For more information on Manitoba Hydro's voluntary commitment to limit mercury emissions prior to the implementation of Canada-Wide-Standards in 2010, refer to Section 5.3.2.5 of the EIS.

COMMENT: *"During this Environmental Act Licence Review, if it is intended that Brandon, Unit #5 is expected to continue its operation to at least 2019, it is suggested that Manitoba Hydro consider future expectations of coal-fired power plants for all pollutants. On April 26, 2007 the Government of Canada*

announced its intent to impose mandatory emission targets on industry related to greenhouse gases and air pollution. In 2010, facilities existing in 2006 will be required to reduce to meet challenging greenhouse gas emissions targets. Emission reductions targets for air pollutants will specify the maximum level of pollutant that can be emitted from a given sector in a given year. Fixed emission caps will be placed on the following air pollutants: nitrogen oxides, sulphur oxides, volatile organic compounds, and particulate matter. The framework also identifies the government's intent to set limits on mercury from coal-fired power plants.

Regulations are not yet fully developed. Updates will be available at http://www.ec.gc.ca/cleanair-airpurl"

RESPONSE: Manitoba Hydro is fully engaged with Environment Canada led, industry and public consultations regarding the "ecoAction Regulatory Framework for Industrial Air Emissions" initiative held in May and June 2007 and intends to comply with all regulations and limits resulting from this process that apply to Unit 5 in the future. In addition, Manitoba Hydro along with industry representatives, provincial and federal regulators continues to investigate the various compliance mechanisms being considered as part of this Environment Canada initiative.

COMMENT: *"In respect of water, the continued groundwater monitoring and addition of more monitoring wells is commendable; however, the frequency of sampling of the ash lagoon outflow should be increased as it sits on a recharge zone."*

RESPONSE: Since 1993 and during periods of ash lagoon outflow, Manitoba Hydro samples the decanted, ash lagoon discharge for general chemistry parameters on a weekly basis and report to Manitoba Conservation on a monthly basis. In addition, samples are also collected and tested on a biweekly basis for a suite of selected heavy metals from the ash lagoon outflow. This sampling frequency is sufficient to detect any significant change in ash lagoon outflow chemistry that would denote a change in the process or the fuel characteristics.

COMMENT: *"In addition the report in several places refers to a "fully mixed zone in the river"; it is worth noting that the Fisheries Act does not allow for a mixing zone."*

RESPONSE: Manitoba Hydro is aware that the Fisheries Act does not allow for a mixing zone as Section 36 prohibits the discharge of deleterious substances. This issue was addressed in the EIS through comparison of the effluent itself to conditions in the river and the MWQSOGs, as well as an assessment of the potential for toxicity considering the results of laboratory toxicity tests (Refer to Section 4.2.1.1.3 for additional details).

REF

REFERENCES

REF REFERENCES

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