To: Krystyn Tully, Lake Ontario Waterkeeper

From: Dr R Seaby and P Henderson

CC:

Date: November 14, 2008

Re: Guidelines for the preparation of the Environmental Impact Statement for Ontario Power Generation's Darlington 'B' new nuclear power plant project

Notes on the guidelines for the EIS for Darlington 'B' nuclear power plant

Lake Ontario Waterkeeper has asked Pisces Conservation to comment on the document;

> *Guidelines for the Preparation of the Environmental Impact Statement for Ontario Power Generation's Darlington 'B' New Nuclear Power Plant Project.*

This document is to ensure that the environmental impact statement to be prepared by Ontario Power Generation (OPG) addresses all the issues raised by this project, for all the stages of the development.

This memo addresses a series of questions presented in a letter from Krystyn Tully at Lake Ontario Waterkeeper, dated 3 November 2008.

- **In your opinion, is the scope of the project sufficiently broad to capture all environmental effects relating to your area of expertise? (Section 4.1)?**

  In Section 4.1 OPG describes the major operations that will occur during the preparation, construction, operation and decommissioning phases of the development of the Darlington 'B' site. They propose to cover all the likely operations that will have an effect on aquatic life.

  The scope is sufficiently broad to cover all the main impacts of a power plant on the aquatic environment. During the preparation phase, the main aquatic issues are likely to be building a wharf, stabilising the shore, land reclamation and stream realignment.

  During construction the building of new intakes and outfalls and the use of the wharf are potentially the most significant.

  Operational impacts are mainly related to the use of cooling water and comprise entrainment, impingement, thermal plume and any biocide system used.

  Decommissioning is unlikely to raise any important new aquatic issues provided that decontamination and demolition do not pollute surface waters. At some old nuclear facilities now decommissioned, it has been found essential to consider the impacts of the loss of the heated water discharge plume on the local flora and fauna which had become adapted to the warm water over the 30 - 40 year existence of the plant.

During the construction phase, no explicit mention is made of good environmental site practices that need to be followed with regard to stopping the release of silt into surface waters, fuelling of vehicles etc, wheel washing and other construction activities.

- **Looking at the list of alternative means in Section 7.3, are there any alternatives that should be added to this list or modified on this list, relating to cooling water?**

In Section 7.3 the document describes the alternative means to carry out the project that are considered technically and economically feasible. Aquatic impacts mainly relate to cooling water design. OPG intends to assess alternative condenser cooling water systems, although the types of cooling system that will be considered are far from clear. The reference to discharge through underground tunnels to the lake suggests the possibility of a once-through system, and cooling towers are also mentioned. The closed-cycle cooling water option must also be considered. However, we were unclear exactly what systems would be assessed. In particular, did closed-cycle include a dry-cooling option? We assume so, but this needs to be checked.

To aid in the discussion of the various cooling water system options and their environmental impacts and advantages, we summarise below the various options that are commonly used. We consider this topic in detail because it is the key issue in terms of aquatic environmental impacts.

At present no information has been supplied on the design of cooling water systems proposed for the power stations. Cooling water systems vary greatly in their impacts upon the aquatic environment, and the choice of system will define to a great extent the level of environmental impact. The present nuclear power stations use once-through cooling, which is the most environmentally damaging option.

A Review of Cooling Methods

The classification of cooling systems can be confusing. The following binary distinctions are in general use:

- **Dry air-cooled compared with evaporative wet-cooled**. In evaporative cooling, water is lost to the atmosphere and heat is removed by latent and sensible heat transfer. With dry cooling, water is not lost to the atmosphere and only sensible heat is transferred.
- **Open compared with closed systems**. In an open system the coolant (water) is in contact with the environment; in a closed system the coolant circulates through the plant without contact with the environment.

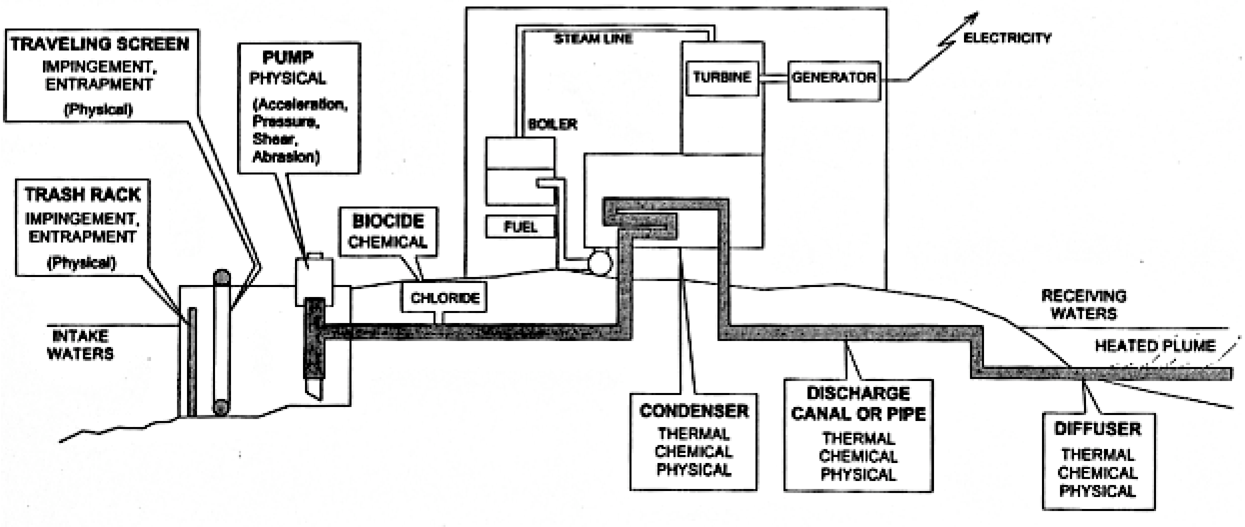
- **Direct compared with indirect systems**. In a direct system, there is one heat exchanger where the coolant and the medium to be cooled exchange heat. In an indirect system, there are at least two heat exchangers and a closed secondary cooling circle between the process or product to be cooled, and the primary coolant.

Once-through cooling systems

Direct once-through cooling systems

In direct once-through systems, water is pumped from a source (e.g. a river, lake, sea or estuary) via large water inlet channels directly to the plant. After passing via heat exchangers or condensers, the heated water is discharged directly back into the surface water. The heat is transferred from the turbine steam water to the coolant through the wall of the condenser tubes.

Figure 1: Schematic representation of a direct once-through cooling system



Potential environmental issues

For once-through systems, the major environmental issues are as follows:

1. Those associated with the use of large amounts of water. These include impingement and entrainment of fish and other aquatic life.
2. The discharge of heated water
3. Sensitivity to biofouling and the need to add antifouling agents
4. Corrosion and scaling problems.
5. The release of heavy metals.
6. The use of additives and the resulting emissions to water.
7. Construction of intake structures, intake canals etc.
8. Changes in water flow and bed scour

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Once-through cooling systems with cooling tower

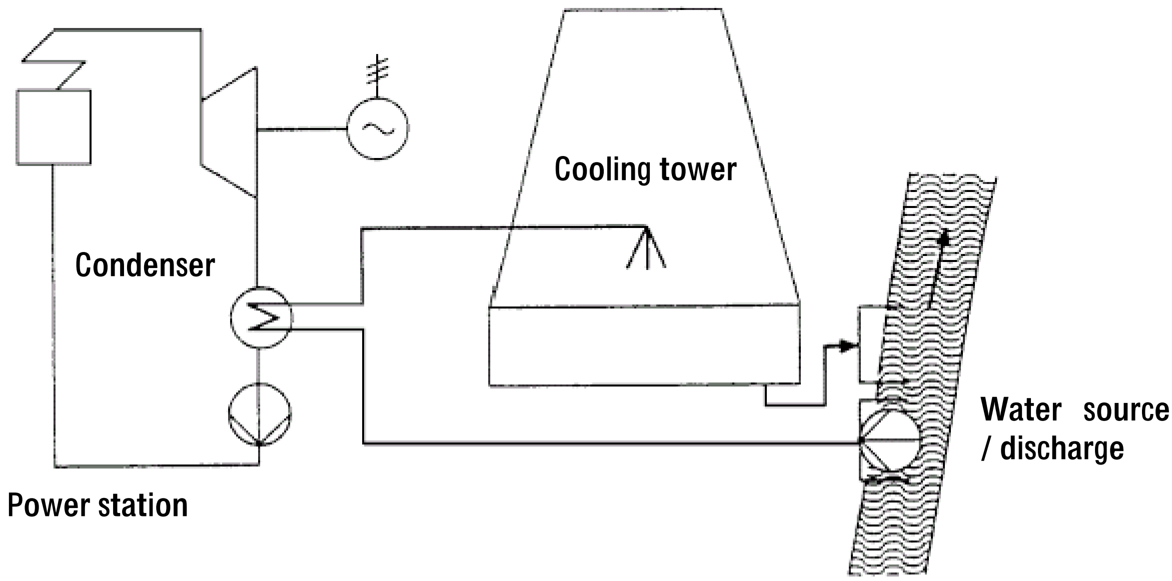
At some localities once-through systems are combined with a cooling tower to cool the discharge before it is released to the receiving surface water. This is done in situations where cooling water may recirculate and raise the temperature of the cooling water intake of the same plant, or where there is a serious risk of the heated effluent, damaging sensitive environments. This configuration has been used at both coastal and inland power stations.

Potential environmental issues

For once-through systems with cooling towers the major environmental issues are as follows:

1. Those associated with the use of large amounts of water. These include impingement and entrainment of fish and other aquatic life. This is lower than for a simple once-through system.
2. The discharge of heated water
3. Sensitivity to biofouling and the need to add antifouling agents
4. Corrosion and scaling problems.
5. The release of heavy metals.
6. The use of additives and the resulting emissions to water.
7. Construction of intake structures, intake canals etc.
8. Changes in water flow and bed scour.
9. Cooling towers in saline water systems can cause salt spray drift.
10. Possible build-up of pathogens in the cooling towers. Controlled by the use of biocides.

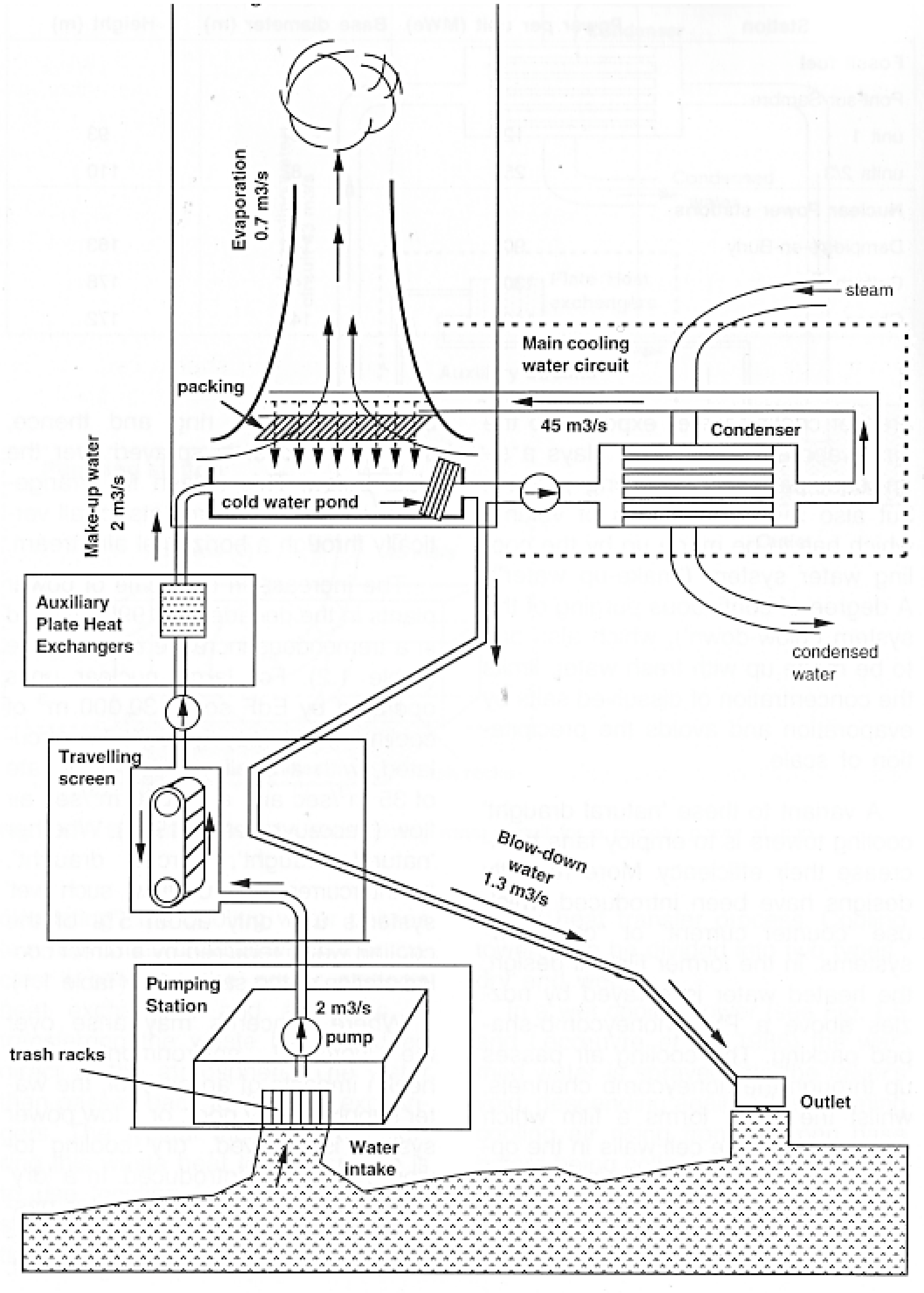
Figure 2: Schematic representation of a direct once-through cooling system with a cooling tower as applied in the power industry.



Open recirculating cooling systems

Open recirculating cooling systems are also referred to as open evaporative cooling systems. In these systems, cooling water that is led through the heat exchanger(s) system is cooled down in a cooling tower, where the majority of the heat is discharged to the environment. In the cooling tower the heated water is distributed over the cooling tower fill, and is cooled by contact with air and collected in a reservoir, after which it is pumped back to the reservoir to be reused as a coolant. The air movement is created naturally or by means of fans that push or pull the air through the tower. Cooling of the water is a result of evaporation of a small part of the cooling water and of sensible heat loss by the direct cooling of water by air, also called convection. The main causes of water loss are evaporation, blowdown (windage, drift, purge (intentional blowdown) and leaks). Intentional blowdown is the draining of water from the circuit necessary to avoid concentration of dissolved solids. To compensate for the blowdown and evaporation, make-up water is added. Generally, the make-up water flow used by an open recirculating system is about 1-10% of the flow of a once-through system with the same cooling capacity. Blowdown generally ranges from 0.15-0.80 m^3/s per 1000 MWth cooled.

Figure 3: Schematic representation of an open recirculating system. (Jenner et al 1998)



Potential environmental issues

Recirculating system impacts depend on the type of cooling tower and the way it is operated. Impingement and entrainment deaths are reduced to only about 20% or less of that caused by a once-through system. The main impacts are:

1. Cooling water additives and their emission through the blowdown to surface water
2. Emissions into air
3. Plume formation, condensation and ice formation
4. Noise
5. Waste due to replacement of cooling tower fill
6. Human health aspects
7. Effects related to the extraction of water including impingement and entrainment

Closed (dry) circuit cooling systems

In air-cooled cooling systems (normally termed dry cooling systems) the turbine water is circulated through coils, tubes or conduits, which are cooled by a passing air stream.

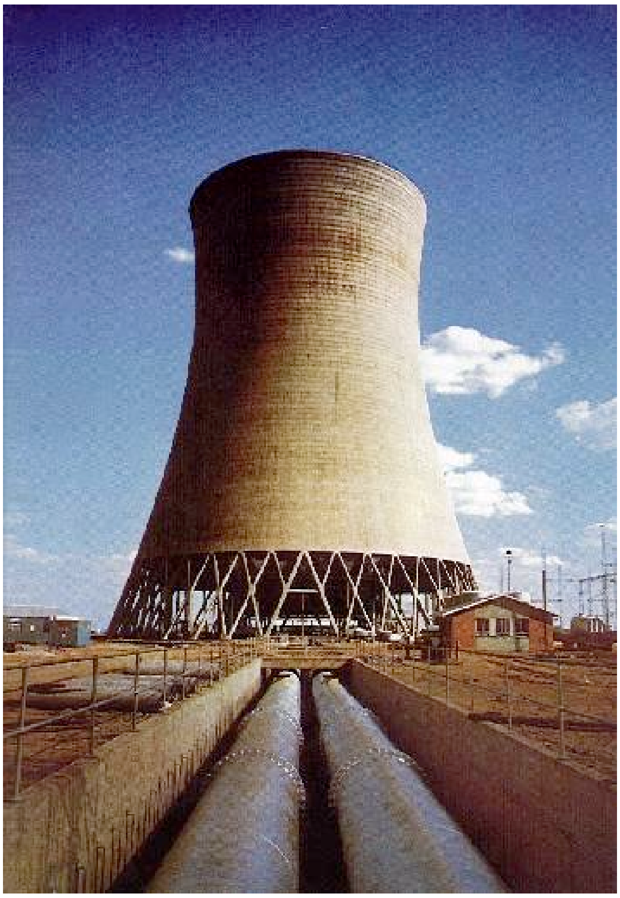
Closed circuit dry air-cooled systems consist of finned tube elements, coils or conduits of a condenser, fans with drives and a carrying steel construction or a tower. The process medium itself or a coolant (indirect system) is circulated through the tubes. An air stream is created, naturally or by fans, that flows past the tubes thus cooling the medium by conduction and convection. If the process medium is a fluid, the cooling system is called an air-cooled fluid cooler. If it is a vapour that is condensed to liquid, the cooling system is called an air-cooled condenser.

Potential environmental issues

Impingement and entrainment deaths are reduced to negligible levels. The main impacts are:

1. Noise
2. Impingement of aerial plankton – health issues

Figure 4: Example of natural draught dry cooling tower for a power plant application



Combined wet/dry cooling systems

The open wet/dry cooling tower or hybrid cooling tower is a special design that has been developed as a solution to the problem of cooling water use and of plume formation.

It combines both 'wet' and 'dry' cooling tower features: evaporative and non-evaporative cooling. A hybrid cooling tower can be operated either as a pure wet cooling tower or as a combined wet/dry cooling tower, depending on the ambient temperature. The heated cooling water first passes through a dry section of the cooling tower, where part of the heat load is removed by an air current, which is often induced by a fan. After passing the dry section, water is further cooled in the wet section of the tower, which functions similarly to an open recirculating tower. The heated air from the dry section is mixed with the vapour from the wet section in the upper part of the tower, thus lowering the relative humidity before the air current leaves the cooling tower, which reduces plume formation above the tower.

Potential environmental issues

The major difference between a hybrid cooling tower and a conventional cooling tower is the comparatively lower water use of 20% less than that of a wet cooling tower. There is therefore a proportional reduction in entrainment and impingement.

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- **Section 9.3 lists the VECs (Valued Ecosystem Components). Is this list complete, or are there other components that should be added? Are there any VECs currently on this list that should be removed?**

  Section 9.3 describes the general criteria used to identify VECs that may be affected by the project. OPG lists several species and habitats.

  Two ecological components that are not included within the VECs that merit inclusion are submerged aquatic vegetation and planktonic crustaceans. We do not know if there are any important submerged aquatic vegetation species in this region.

- **In your opinion, should anything be added to Section 10.1?**

  Section 10.1 ensures that the baseline bio-physical environment is described. Section 10.1.2 describes the existing surface water environment and what needs to be described for the characterisation of the baseline. Section 10.1.5 addresses the aquatic environment; we consider OPG has listed all the important habitats, flora and fauna.

- **In your opinion, should anything be added to Section 11.4?**

  Section 11 describes changes in the environment caused by the project, including the effects on the aquatic environment. In Section 11.4 OPG describes the changes and effects that will be investigated in the bio-physical environment.

  In section 11.4.2 surface water, OPG does not mention the possible use and release of any biocide. It is possible that the plant does not use a chemical biocide such as chlorine to control fouling. However, it is equally possible that in the future a once-through or open cooling tower system would find the use of biocides essential. Changes in the biology of the lake, caused by anthropomorphic and biological factors over the possible 60-year life of the plant, may require their use. The dramatic increase in zebra mussel and other related species in recent years demonstrates the potential for great changes and increased fouling.

  Section 11.4.5 (Aquatic environment) lists a range of effects caused by the operation of the power plant. We feel that the assessment of future impacts would be more robust if some account were taken of the potential changes in climate over the next 60 years. These changes could, for example, affect the temperature of lake, the species present, the water height and the sensitivity of the habitat to thermal plumes.

- **In your opinion, should anything be added to the list of follow-up programs on Page 50?**

  In Section 15, follow-up programs that will monitor the effects of the project are outlined in general terms. It is general and does not suggest what data are to be gathered. If once-through cooling were used, we believe that long-term monitoring of

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entrainment and impingent of fish and other species at the station would be appropriate. Further, monitoring of the benthic species and plankton of the lake would also be appropriate.

- **In your opinion, do you have any concerns or advice regarding the instruction that certain financial, commercial, scientific, technical information cooling water should remain confidential? (p. 3)**

  Scientific debate and analysis cannot be undertaken if information is withheld as confidential. In general therefore we would argue strongly that as far as possible a full disclosure of the relevant ecological data should always be sought.

  With nuclear plant there are always areas of concern regarding safety, terrorist threat etc., that must remain confidential, but in our experience these almost never impinge upon the debate of ecological issues.

  Unfortunately we have no knowledge of the Canadian law on confidentiality so do not feel we can comment further.

- **Do you have any suggestions regarding the “description of the relevant organizational and management structure, and staff qualification requirements with emphasis on safety and environmental management programs” as those requirements relate to cooling water? (p. 18)**

  Other than the essential requirement that all senior staff should have relevant professional qualifications and training, we have nothing to add.

Conclusion

In general, this is a well thought-out scoping document for the environmental impacts of the proposed projects. The document includes all the major areas that need to be considered. Three points that may be worth raising are

- More clarity in the cooling water options to be assessed.
- Little regard is given to the potential effects of global warming and ecological change on the impact of the station over the life of the plant.
- We found no mention of biofouling control methods and biocides in particular.

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14 November 2008.

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