NUCLEAR WASTE MANAGEMENT AND DECOMMISSIONING – BACKGROUND INFORMATION

1.0 PURPOSE

The purpose of this evidence is to provide background information pertaining to OPG's nuclear waste management and decommissioning activities. The following specific aspects of nuclear waste management and decommissioning are discussed:

- The process by which nuclear waste is generated at OPG's generating stations, the different nuclear waste types, OPG's general approach to nuclear waste management as well as OPG's decommissioning responsibilities and role in the management of nuclear wastes at Pickering A and B Generating Station ("Pickering"), Darlington Generating Station ("Darlington") and the Bruce Generating Station ("Bruce"), operated by Bruce Power L.P. (section 2.0).
- The regulatory framework that applies to the financial management of nuclear waste management and decommissioning (section 3.0).
- A description of OPG's financial reference plan for nuclear waste management and decommissioning activities which provides the basis for determining OPG's nuclear liabilities and the current estimated values of these liabilities (section 4.0).

These items provide the necessary context for the subsequent explanation of the recovery of costs associated with the OPG's liabilities for decommissioning its nuclear stations (including the Bruce Generation Station) and nuclear used fuel and low and intermediate level waste management (collectively, the "nuclear liabilities") through the revenue requirement as described in Ex. H1-T1-S2.

2.0 NUCLEAR WASTE GENERATION AND DECOMMISSIONING

2.1 Nuclear Waste Types

In Canadian Deuterium Uranium ("CANDU") reactors, such as those used in OPG's nuclear generating stations, nuclear fuel consists of uranium dioxide processed into ceramic pellets, which are then sealed in tubes. Several tubes are joined together to form fuel bundles. Heat

generated by the splitting of uranium atoms (i.e., fission) is used to turn water into steam, which runs the turbines that generate electricity. When a fuel bundle no longer contains enough fissionable uranium to heat water efficiently, it becomes used fuel and must be replaced.

Used fuel removed from OPG owned reactors is radioactive and considered to be high level radioactive waste. Materials that have come into close contact with the reactors but which are less radioactive than used fuel, such as used reactor components, ion exchange resins, filters used to keep reactor water systems clean and other structural material and reactor equipment, including pressure tubes, are considered to be intermediate level radioactive waste. A third category, low level radioactive waste, consists of materials that are used in connection with station operations such as tools, mop heads, and protective clothing. These items are less radioactive than intermediate level radioactive waste and can generally be handled without radiation shielding.

OPG is responsible for the ongoing, long-term management of all levels of radioactive wastes, including those from Bruce. As such, references in this evidence to the nuclear generating stations, includes all OPG owned nuclear stations (Pickering, Darlington, and Bruce).

2.2 Management of High Level Radioactive Wastes

Used fuel bundles are temporarily stored in water-filled pools known as used fuel wet bays at the nuclear generating stations for a “cooling-off” period of at least ten years, during which time their radioactivity and heat is substantially reduced. Each nuclear generating station has sufficient capacity in its wet bays to store quantities of used fuel corresponding to approximately 15 to 20 years of operation. After a sufficient “cooling off” period, used fuel can be transferred from the wet bays to above-ground concrete canisters that are stored at each nuclear station site. This is referred to as dry storage. Dry storage capacity at individual sites can be expanded as needed to meet station life needs and will be integrated with eventual long-term waste management plans for all Canadian used fuel in accordance with the federal *Nuclear Fuel Waste Act* (“NFWA”).

In June 2007, Natural Resources Canada announced that the Government of Canada has accepted a recommendation by the Nuclear Waste Management Organization in response to the NFWA for the safe, long-term management of used nuclear fuel. Additional details on the requirements of the NFWA and the work of the Nuclear Waste Management Organization are discussed in section 3.2 of this exhibit.

2.3 Management of Low and Intermediate Level Radioactive Wastes

OPG's low level radioactive waste and intermediate level radioactive waste, collectively "L&ILW", is stored primarily at OPG's Western Waste Management Facility. This facility is situated at the Bruce nuclear site in the Municipality of Kincardine. This facility, which is owned and operated by OPG, operates under licenses issued by the Canadian Nuclear Safety Commission ("CNSC") that are distinct from OPG's nuclear generator licenses that are issued by the CNSC.

An agreement has been reached with the Municipality of Kincardine and four surrounding municipalities for OPG to develop a deep geologic repository facility for the long-term placement of L&ILW adjacent to the Western Waste Management Facility. OPG has initiated a federal environmental assessment process in respect of this proposed facility. OPG's plan is for L&ILW to continue to be stored at the current facility while the deep geologic repository facility is planned and developed. The in-service date of the deep geologic repository facility is estimated to be year end 2017.

As part of its radioactive nuclear waste management program, OPG typically transports close to 500 truck shipments of L&ILW each year. Many of these are waste shipments from the Pickering and Darlington sites to the Western Waste Management Facility. OPG has an exceptional safety record in the transportation of radioactive materials. There has not been any release of radioactive material to the environment from OPG's nuclear waste transportation operations.

2.4 Decommissioning Overview

OPG will also manage radioactive wastes associated with the decommissioning of its nuclear generating stations, including Bruce A and Bruce B Generating Stations, after the end of their useful lives. When a nuclear facility is shut down permanently, the facility is initially placed in safe-store condition to protect the health and safety of workers, the public and the environment. Decommissioning involves activities undertaken to safely eliminate the radiological, chemical, and industrial hazards from the facility in order to release the site for other uses based on approved site release criteria.

OPG's current plans for decommissioning the nuclear generating stations are to remove fuel and heavy water from the reactors and place the station into a safe-store state. Safe store activities have begun at Pickering A Units 2 and 3. The facility is then stored and monitored for 30 years to allow the residual radioactivity to decay. This will be followed by station dismantling and site restoration over a ten-year period. Used fuel will continue to be stored on site until the long-term management strategy for used fuel is implemented as documented in section 3.1.

As noted earlier, OPG also owns and operates radioactive waste management facilities on the Bruce site and used fuel storage facilities at the Pickering and Bruce sites. A used fuel storage facility at the Darlington site was placed in-service in October 2007. OPG will decommission these waste facilities when they are permanently shut down. Decommissioning of OPG's radioactive waste management facilities will entail the removal, re-packaging (if required) and transporting of the waste to a long-term facility, dismantling of the facilities and site restoration.

Station decommissioning estimates are prepared by a U.S.-based consultant, TLG Services, who prepare a large number of station decommissioning estimates for U.S. utilities and has developed a database on decommissioning costs based on actual experience. TLG have done estimates for 91 of 104 operating U.S. power reactors at 61 sites and for 19 of the 23 permanently shut down U.S. power reactors at 17 sites. They worked with Pickering station staff to update decommissioning estimates for Pickering A with the latest available data

based on the work to place Pickering A Units 2 and 3 in safe-store following the decision to not return these units to service.

3.0 REGULATORY FRAMEWORK

3.1 Ontario Nuclear Funds Agreement ("ONFA")

On April 1, 1999, the obligation for nuclear waste management and decommissioning was transferred from the former Ontario Hydro to OPG. The responsibility for funding these liabilities is described in the ONFA agreement between the Province of Ontario and OPG. ONFA provides for the establishment of a reference plan for nuclear waste management and for decommissioning of stations and other facilities. The reference plan, approved by the province, includes cost estimates at a reasonable level of detail as well as assumptions on economics, waste program timing and planned operating lives for stations.

The key provisions of the ONFA are:

1. For OPG to establish two segregated funds, including the used fuel fund (to fund future costs of nuclear used fuel waste management) and the decommissioning fund (to fund the future cost of nuclear fixed asset removal and low and intermediate level waste management). The used fuel fund includes the trust fund required by the NFWA.
2. For the Ontario Electricity Financial Corporation ("OEFC") to be responsible for funding approximately $2,378M (present value as at April 1, 1999). This amount was included in the decommissioning fund at the time that the agreement became effective.
3. For the Province to limit OPG's financial exposure in relation to the cost of used fuel management.
4. For the Province to support financial guarantees to the CNSC for OPG's nuclear waste management and decommissioning liabilities by providing a provincial guarantee as a supplement to accumulated ONFA funds in return for an annual guarantee fee equal to 0.5 percent of the amount guaranteed.

Under ONFA, the limit to OPG's financial exposure with respect to the cost of long-term management of used fuel was capped at $5.94B (January 1, 1999 present value) for the first 2.23M fuel bundles. OPG is responsible for funding the incremental costs associated with the

long-term management of fuel bundles in excess of 2.23M. It is currently estimated that the 2.23M bundle threshold will be reached in 2011.

Under ONFA, the Province of Ontario guarantees the rate of return earned in the used fuel fund for 2.23M bundles at a specified rate of 3.25 percent over the change in the Ontario consumer price index. The Province is obligated to make additional contributions to the used fuel fund if this fund earns a rate of return that is less than the rate of return guaranteed by the Province. If the return on the assets in the used fuel fund exceeds the Province's guaranteed rate, the Province is entitled to the excess. For the decommissioning fund, the rate of return is targeted to be 3.25 percent over the Ontario consumer price index. Should this rate in the decommissioning fund not be achieved over the lifetime of the funds, OPG is required to fund the shortfall.

The provincial guarantee provided to the CNSC is intended to supplement accumulated funds in the ONFA nuclear funds to meet the requirements of the CNSC financial guarantee. OPG pays a guarantee fee to the Province for providing this guarantee (see Ex. F3-T1-S1). The value of the required provincial guarantee was re-evaluated as part of the updated 2008 - 2012 financial guarantee submitted to the CNSC in 2007. This submission proposed a provincial guarantee level of $760M for the years 2008 - 2010. This level was confirmed as adequate based on accumulated nuclear fund levels at year-end 2007. Beyond 2010 it is projected that accumulated funds within the ONFA nuclear funds will be sufficient to meet the CNSC financial guarantee requirement, thereby eliminating the need for the provincial guarantee.

OPG's contributions to the used fuel fund and the decommissioning fund are determined based on the ONFA reference plan cost estimates. These estimates are prepared with the assistance of external consultants and are based on external practices and benchmarks. The ONFA agreement specifies the timing, circumstances, contents, and approvals required for changes to the reference plan. ONFA reference plans must be updated every five years or whenever there is a "material change" which includes significant changes in estimates of station life or liability costs. The most recent update to the reference plan was submitted by

OPG to the Province in November 2006. The reference plan was approved by the Province in December 2006 after a detailed review of the submission with the aid of external consultants. The new reference plan resulted in an increase in OPG's nuclear liabilities by $1.386B on December 31, 2006 and correspondingly increased OPG's nuclear (Pickering, Darlington and Bruce) fixed asset balance (see Ex. B3-T3-S1 Table 1, Ex. F3-T2-S1 and Ex. G2-T2-S1 Table 2). OPG's nuclear liabilities are discussed in greater detail in section 4.0 of this exhibit. Exhibit J1-T1-S1 highlights the implications of this reference plan update to the nuclear liabilities deferral account.

As part of the ONFA reference plan update, updated nuclear funds contribution profiles were submitted to the Province. Contributions are made at the end of each quarter to the used fuel fund, while the decommissioning fund is already fully funded based on the approved reference plan. The Province approved this updated profile in March 2007. A further update to the nuclear funds contribution profile is being pursued with the Province in 2008 as a result of a $334M payment into the funds made December 2007 to satisfy a requirement related to the Bruce Lease transaction. This payment is called the Bruce Extraordinary Payment (as discussed in Ex. G2-T2-S1) and constitutes a triggering event within ONFA which leads to an update of the contribution profile. This update was submitted to the Province in February 2008 with approval targeted in the second quarter of 2008. Contributions continue until the end of individual station lives as assumed within the reference plan. The current approved contribution profile continues until 2036 which is the planned end of life for Bruce A. Contributions to the nuclear funds, and consequently changes to the nuclear funds contribution profile, impact the nuclear revenue requirement solely through their deduction for income tax purposes (Ex. F3-T2-S1).

Cost estimates for long-term programs have been prepared by external subject matter experts, reviewed and accepted by OPG, and then subjected to independent review by the Province and the CNSC. Withdrawals by OPG for ONFA eligible expenditures require the approval of the Province. Ontario Nuclear Funds Agreement funds management is the responsibility of OPG's Treasury Department which uses external fund managers to manage

the funds. The Province has significant oversight of funds management and as such provides approval of contributions to segregated funds and fund investment decisions.

3.2 Nuclear Fuel Waste Act

The handling and disposal of radioactive material in Canada is subject to federal legislation. The NFWA, administered by Natural Resources Canada, addresses the long-term management of used nuclear fuel. The NFWA, which came into force in November 2002, requires the owners of nuclear fuel waste in Canada to establish a waste management organization, incorporated as a separate legal entity, with a mandate to manage and coordinate the full range of activities relating to the long-term management of nuclear fuel waste.

In response to the NFWA, in 2002, OPG and other Canadian nuclear fuel waste owners incorporated the Nuclear Waste Management Organization. The Nuclear Waste Management Organization completed an extensive study of the options available for the safe long-term management of used fuel which was submitted to Natural Resources Canada in November 2005 along with a recommended approach. In June 2007, Natural Resources Canada announced that the Government of Canada had accepted the recommendation proposed by the Nuclear Waste Management Organization. The selected approach described as adaptive phased management includes the isolation and containment of used nuclear fuel in a deep geologic repository with an option for initial temporary shallow underground storage. The earliest in-service date for the central facility to support this approach is estimated to be 2035.

Funding for the long-term management of used fuel is shared amongst the Canadian owners of used nuclear fuel, based on the respective quantities of used fuel they generate and the timing for delivery of this fuel to the central repository. Based on current plans, OPG's share of this fuel is approximately 91 percent. The NFWA requires the nuclear fuel waste owners to establish and make payments into trust funds for the purpose of funding the implementation of the long term management plan. For OPG, the NFWA trust fund is part of the ONFA used fuel fund which is described in section 3.1 of this exhibit.

3.3 Nuclear Safety and Control Act ("NSCA")

The NSCA provides the CNSC with authority over nuclear waste from a health, safety, and environmental protection perspective. The CNSC licenses all of OPG's waste management facilities. On a regular basis, OPG must demonstrate to the CNSC that its nuclear waste management facilities are safe and operating within regulatory limits.

On a five year cycle, OPG submits updates to decommissioning plans for all stations and waste management facilities to the CNSC, along with updated plans for long-term management of all nuclear waste generated from the operation of its nuclear stations. The submission includes estimates for the liability associated with these plans and indicates how the liability is to be satisfied through a combination of ONFA funds (used fuel fund and decommissioning fund), supplemented by the provincial guarantee for the balance. This satisfies the financial guarantee requirement stated in the NSCA. On an annual basis, OPG submits a report to the CNSC on the status of the financial guarantee, detailing amounts accumulated in the ONFA funds and any material changes in decommissioning or waste management plans, waste quantities or cost estimates which may impact the CNSC financial guarantee requirement.

In 2002/2003, OPG submitted a set of reference assumptions to the CNSC that was accepted by the CNSC as the basis for the initial financial guarantee established in July 2003 and covering the period to year-end 2007.

The set of reference assumptions has been updated for the financial guarantee period from January 2008 to year end 2012 and was submitted to the CNSC in 2007 culminating in a documentary information summary submitted in May 2007 and updated in August 2007. The hearing on this submission was held on November 1, 2007. CNSC agreement with this submission was documented in a Record of Proceedings, including Reasons for Decision dated November 29, 2007.

3.4 Other Legislation

The development and operation of radioactive waste management sites is also subject to federal environment assessment requirements under the *Canadian Environmental Assessment Act*, as well as provincial and federal environmental protection legislation. Of particular note, the transportation of radioactive materials is regulated by both the CNSC and Transport Canada.

4.0 NUCLEAR LIABILITIES

The financial reference plan is reflected in OPG's nuclear liabilities. In accordance with Generally Accepted Accounting Principles, the amount of nuclear liabilities recorded on OPG's balance sheet at any point in time represents the present value of the committed portion of the lifecycle cost estimate in the financial reference plan. The committed portion includes the fixed cost components of each program as well as the lifetime variable costs for wastes already generated. As new waste is created, the nuclear liabilities increase by the additional variable cost of such waste. These increases in the liabilities are booked as fuel and depreciation expenses for used fuel and L&ILW, respectively (see Ex. F2-T1-S1 Table 1 and Ex. F3-T2-S1 Table 4). Exhibit H1-T1-S2 explains how costs associated with the nuclear liabilities are recovered through the revenue requirement.

NUCLEAR WASTE MANAGEMENT AND DECOMMISSIONING - REVENUE REQUIREMENT TREATMENT OF NUCLEAR LIABILITIES

1.0 PURPOSE

The purpose of this evidence is to describe the revenue requirement treatment of OPG's liabilities for decommissioning its nuclear stations (including the Bruce Generating Stations) and nuclear used fuel and low and intermediate level waste management (collectively, the "Nuclear Liabilities").

2.0 REVENUE REQUIREMENT TREATMENT

Ontario Regulation 53/05 specifically requires that the OEB "ensure that Ontario Power Generation Inc. recovers the revenue requirement impact of its nuclear decommissioning liability arising from the current approved reference plan." In the context of O. Reg. 53/05, "nuclear decommissioning liability" is defined as "the liability of Ontario Power Generation Inc. for decommissioning its nuclear generating facilities and the management of its nuclear waste and nuclear fuel." An "approved reference plan" is defined as a "reference plan, as defined in the Ontario Nuclear Funds Agreement, which has been approved by Her Majesty the Queen in the right of Ontario in accordance with that agreement."

Ontario Regulation 53/05 also requires that OPG establish a deferral account allowing for recovery of the revenue requirement impact of any change in its nuclear decommissioning liability arising from an approved reference plan approved after April 1, 2005. Evidence on this deferral account is presented in Ex. J1-T1-S1.

As described in Ex. H1-T1-S1, OPG's financial statements recognize Nuclear Liabilities, which represent the present value of committed costs based on the lifecycle cost of decommissioning and nuclear waste management programs. Committed costs include the fixed cost components of each program as well as the lifetime variable costs for waste already generated. Under Generally Accepted Accounting Principles, upon the initial recognition of the liabilities, the present value of the committed costs is recorded in the related nuclear fixed assets. The fixed assets costs are depreciated over the useful lives.

The recovery of costs associated with the Nuclear Liabilities is achieved through the following inclusions in the revenue requirement based on OPG's financial statements.

1. Depreciation Expense: OPG includes nuclear depreciation expense (presented in Ex. F3-T2-S1) in the revenue requirement, and the expense related to the committed costs is included therein.

2. Return on Rate Base: OPG includes its total nuclear fixed asset balance (presented in Ex. B1-T1-S1) in the rate base. As described above, the fixed asset balance includes a component related to the Nuclear Liabilities. Therefore, the return on rate base computed as part of the revenue requirement includes an amount related to the Nuclear Liabilities.

3. Fuel Expense: The present value of the variable costs related to incremental quantities of used fuel generated in each period is recovered as a portion of OPG's nuclear fuel expense, as presented in Ex. F2-T5-S1 Table 1. The difference between the lifecycle estimate and the amount of committed costs relating to used fuel included in the Nuclear Liabilities balance represents the variable costs of future fuel waste. Using a present value basis, these variable costs are divided by the number of future fuel bundles to calculate the $/bundle rate. Used fuel expenses are then calculated by applying the $/bundle rate to the actual (or forecast, as appropriate) used fuel generated. Each bundle is charged an equal amount in present value terms.

4. Low Level and Intermediate Level Waste Expense (recorded in depreciation expense for financial reporting purposes): The present value of the variable costs related to incremental volumes of low level and intermediate level nuclear waste produced in each period is recovered as a portion of OPG's depreciation expense, as per Ex. F3-T2-S1. The difference between the lifecycle estimate and the amount of committed costs included in the Nuclear Liabilities balance represents the variable costs of future waste. Using a present value basis, these variable costs are divided by the low level and intermediate level radioactive waste volume estimates to calculate the $/$m^3$ rate. Low

level and intermediate level radioactive waste expenses are then calculated by applying the $/m^3 rate to the waste volumes generated.

The recovery of costs associated with the Nuclear Liabilities for Bruce Generating Stations through the revenue requirement occurs in an equivalent manner. Depreciation expense, return on equity and deemed interest, used fuel storage and management expense, and low level and intermediate level waste expense (recorded in depreciation) related to the Bruce Generating Stations are presented in Ex. G2-T2-S1.

Impact of Nuclear Liabilities on the Revenue Requirement

In order to provide clarity to the question of the impact of the nuclear liabilities on revenue requirement, Attachment 1 provides a table which presents the impact of nuclear liabilities on all affected components of the revenue requirement in OPG's application. These impacts are shown separately for the prescribed nuclear facilities and the Bruce facilities.

Also shown in this attachment is the annual cash outflow to satisfy the nuclear liability obligations of OPG. These consist of the contributions to the ONFA segregated funds plus the cash flow to pay for that part of the liability that is internally funded from cash flow from operations. The ONFA funds are established to satisfy the long-term nuclear liability obligations for each of the nuclear generating facilities. The cost of interim storage and management of used fuel and low and intermediate waste prior to station shut down is paid for from internal cash flows.

Nuclear Waste Management & Decommissioning Costs included in Revenue Requirement and Cash Requirements

$ millions	Table Number	Exhibit Component of	ACTUAL 2005	2006	2007	2008 Q1	2008 Q2-4	2009	Total for 21 Month Test Period
Description									
NBV of ARC, average balance in fixed assets - Bruce	G2-2-1 Table 2	part of net fixed assets	428	350	1159	1123	1099	1057	
NBV of ARC, average balance in fixed assets - Pickering / Darlington	IR L-2-55	attachment 1	1064	970	1369	1287	1227	1121	
NBV of ARC, average balance in fixed assets			1491	1320	2528	2409	2325	2178	
Capital structure:									
Debt			0.55	0.55	0.55	0.55	0.425	0.425	
Equity			0.45	0.45	0.45	0.45	0.575	0.575	
Nuclear Revenue Requirement:									
Deemed interest									
Pickering / Darlington	K1-1-1 Tables 1,2	part of interest	33	29	42	10	23	28	51
Bruce	G2-2-1 Table 3	part of interest	13	11	35	9	20	27	47
Return on Equity @ 5% until March 2008 / 10.5% April 2008 - December 2009									
Pickering / Darlington	K1-1-1 Tables 1,2	part of return on equity	24	22	31	7	56	68	123
Bruce	G2-2-1 Table 3	part of return on equity	10	8	26	6	50	64	114
Cost of capital			80	69	134	33	148	186	334
Depreciation of asset retirement costs (ARC)									
Pickering / Darlington	F2-1-1 Table 1	part of depreciation	101	86	134	30	90	120	211
Bruce	G2-2-1 Table 3	part of depreciation	78	78	60	12	36	48	84
Used fuel storage & disposal provisions									
Pickering / Darlington	F2-5-1 Table 1	full amount, line 5	14	15	16	5	15	21	36
Bruce	G2-2-1 Table 3	full amount, line 6	14	16	13	4	11	15	25
Low level & intermediate level waste provisions									
Pickering / Darlington	F2-1-1 Table 1	part of depreciation	4	4	2	0	1	2	3
Bruce	G2-2-1 Table 3	part of depreciation	1	1	45	3	8	2	10
Total revenue requirement			293	270	404 *	87	310	394	704
Cash Requirements									
ONFA Funds Contribution			454	454	788	113	341	350	
Internal Funding			55	83	110	30	88	100	
Total			509	537	898	143	429	450	

Notes:
* includes the revenue requirement impact in 2007 deferred under the nuclear liability deferral account