NON-ENERGY REVENUES - NUCLEAR

1.0 PURPOSE
The purpose of this section of evidence is to discuss OPG nuclear operations that generate non-energy revenue and explain OPG’s proposed regulatory treatment for the test period.

2.0 NUCLEAR NON-ENERGY REVENUES
In the test period, in addition to Bruce Lease revenues and costs (including Bruce waste management revenues) which are discussed at Ex. G2-T2-S1, and OPG nuclear ancillary service revenues which are discussed at Ex. G2-T1-S1, OPG nuclear operations expects to earn revenues from the following non-energy related businesses:

• Heavy water sales and services – nuclear markets.
• Heavy water sales and services – non-nuclear markets.
• Isotope sales (cobalt 60; tritium).
• Inspection and Maintenance Services (“IMS”).

These revenues (less operating costs) are applied as an offset to the nuclear revenue requirement.

2.1 Heavy Water
2.1.1 Heavy Water Inventory
Heavy water is a manufactured product required for CANDU (Canadian Deuterium Uranium) reactor operations. As discussed in Ex. F2-T2-S1, heavy water is required as a moderator for sustaining a nuclear reaction and as a heat transport in a CANDU nuclear reactor. OPG has a heavy water maintenance program designed to manage its inventory of heavy water, whether in storage or in use within its reactors. In addition, OPG has opportunities to sell heavy water and processing services to third parties as discussed below.
OPG owns 14,440 tonnes of heavy water, of which 13,440 tonnes is radioactive, and 1,000 tonnes is non-radioactive heavy water. Of the 13,440 tonnes of radioactive heavy water, 12,300 tonnes are in-service located within OPG’s operating CANDU nuclear units (6,300 tonnes) and within the reactors at the leased Bruce site (6,000 tonnes). The remaining 1,140 tonnes of radioactive heavy water are in out of service Units 2 and 3 at Pickering A, pending a move to a long-term storage facility, on loan/lease to other nuclear facilities (Atomic Energy of Canada, New Brunswick Power), and in OPG-owned storage facilities (about 40 tonnes).

Non-radioactive heavy water is stored in two OPG-owned storage facilities, one on the Bruce Power site and managed by Atomic Energy of Canada Limited under contract to OPG, and the other at Darlington.

As discussed at Ex. F2-T2-S1, OPG earmarks part of its radioactive inventory (slightly over 500 tonnes) to replenish at a rate of three tonnes per year per reactor the heavy water at the existing OPG and Bruce Power facilities (the Bruce Lease Agreement requires OPG to provide this support, as well as detritiation services). The balance of the heavy water inventory, i.e., both the radioactive and non-radioactive heavy water either not in-service or earmarked for replenishment, amounts to 1,640 tonnes (i.e., 2140 tonnes less 500 tonnes). This quantity is available to meet future OPG/Bruce Power needs arising out of plant life extensions, restart (at Bruce Power), new build decisions, and for sale, loan or lease to qualified third parties, subject to regulatory constraints. There is no current commercial production of heavy water in North America. International suppliers include Argentina, Romania, and India.

2.1.2 Sales of Heavy Water and Services
The heavy water sales and service business includes both the sale of heavy water to nuclear and industrial/medical clients, as well as the provision of tritium removal (detritiation) services by processing through the Darlington Tritium Removal Facility (“TRF”).

OPG is a world leader in heavy water sales and services. Total heavy water salesleases and services to third parties amounted to $18.9M in 2006 and $30.3M in 2007 and are forecast to reach $27.0M in 2008. Revenues for 2007 consisted of $19.5M to nuclear markets and $10.8M to non-nuclear markets (e.g., non-radioactive heavy water sales). Sales to nuclear markets include a one-time heavy water sale to a nuclear energy company based in China.

OPG provides additional quantities of heavy water to Bruce Power as well as detritiation services. The Bruce Lease Agreement includes an obligation for OPG to provide 18 tonnes per year of heavy water to Bruce Power for loss make-up over the term of the lease. The potential for sales beyond that amount is limited. The restart of the Bruce A units may provide an opportunity for additional heavy water sales in the future.

OPG sells detritiation services to Bruce Power. Indeed, the bulk of the heavy water sales and service revenues from the nuclear markets are from the provision of detritiation services to Bruce Power. Opportunities for providing detritiation services to other third parties is limited, because of market demand and because there are storage and capacity restrictions at the TRF processing facility.

The market for heavy water sales to nuclear facilities remains very small. Sales are primarily for loss make-up, and very occasionally for inventory build-up or topping-up. The non-nuclear markets include research institutions, pharmaceutical companies, laser manufacturers, and chemical companies. The market is relatively stable and limited ($8M to $10M/year). In some instances, OPG takes back depleted or degraded (but non-radioactive) heavy water. After cleaning and upgrading (a process which makes it radioactive and only suitable for reactor use), this water is returned to OPG inventory. All sales, loans or leases are subject to Canadian Nuclear Safety Commission (“CNSC”) regulatory approval, as heavy water is a
controlled nuclear substance, as defined in the regulations to the *Nuclear Safety and Control Act*.

OPG has also agreed to receive about 280 tonnes of radioactive heavy water from the Japan Atomic Energy Authority from a decommissioned Japan Atomic Energy Authority research reactor over the period 2004 - 2010. This heavy water is processed as capability permits (OPG is paid by Japan Atomic Energy Authority to process, clean-up and assume title of their excess radioactive heavy water), and is then added to OPG inventory. Adding to the inventory of radioactive heavy water provides an opportunity for future sales of non-radioactive heavy water should opportunities emerge, without jeopardizing reserves required to serve life extension needs or new build. Some of the tritium that is removed during the detritiation process is sold for industrial use (see isotopes sales below).

Total revenues for heavy water sales and services are summarized in Ex. G2-T1-S1 Table 1. Cost of goods sold and related indirect costs are described in section 3 below.

### 2.2 Isotope Sales

#### 2.2.1 Cobalt-60

Cobalt-60 produced by OPG is used mainly in the health industry for diagnostic and therapeutic purposes treatment and to sterilize surgical and medical supplies. A second, potentially large market developing in North America is the food Industry (i.e., food irradiation).

All cobalt-60 sales are subject to CNSC regulatory approval, as cobalt-60 is a controlled nuclear substance.

Cobalt-60 is produced at Pickering B (Units 6, 7, and 8) by inserting adjuster rods containing cobalt-59 in the reactor core (rods are used to adjust power levels). Over time the cobalt-59 absorbs a neutron and becomes cobalt-60. About every 24 months, in line with a planned outage, the adjuster rods containing cobalt-60 are removed, replaced, cut up, and safely...
stored before shipping to a licensed end-user. OPG sells the cobalt-60 under an exclusive long-term agreement to a third party.

Total revenues from cobalt-60 sales over the period 2006 - 2009 are shown in Ex. G2-T1-S1 Table 1. Yearly revenue variations are generally driven by timing of the cobalt harvest (tied to outage schedule of the Pickering units). The potential for revenue growth is limited, as sale volumes are constrained by the ability to produce cobalt-60. The cost of goods sold for this activity is discussed in section 3.0 below.

2.2.2 Tritium Sales

Tritium is a by-product of electricity generation using CANDU technology. It is produced by irradiation of heavy water. Concentration limits of tritium in reactor heavy water inventories have been established by the CNSC for each nuclear station. In order to remain within these limits, tritium is removed from the heavy water via the TRF (see Ex. F2-T2-S1).

All tritium sales are subject to CNSC regulatory approval, as tritium is a controlled nuclear substance.

OPG has entered into short-term contracts to sell the tritium to government-approved organizations for authorized commercial and health industry uses. Commercial use of tritium includes luminescent signs for use in areas with no power source (e.g., airport runway lights, emergency exit signs) and as a tracer for diagnostic pharmaceuticals and medical research.

While tritium sales have been relatively small and stable over time, OPG is increasingly facing price competition from international suppliers, primarily Russia. The increase in the value of Canadian dollar (relative to the U.S. dollar) has also affected OPG's competitiveness in this market. The joint International Fusion Research project in France may present an opportunity for future tritium sales. The revenue forecast includes some minor tritium sales to International Fusion Research, related to preparatory research work.
Total revenue from tritium sales over the period 2006 - 2009 is shown in Ex. G2-T1-S1 Table 1. The cost of goods sold and related indirect costs are described in section 3 below.

2.3 Inspection and Maintenance Services

OPG’s IMS group is a leading provider of inspection, maintenance and technical services to nuclear and non-nuclear power generation facilities. Through its inspection services, IMS provides detection, characterization and sizing of material flaws in a variety of components and equipment. Through its maintenance services, IMS provides boiler tube plugging and removal, reactor fuel channel spacer relocation, fuel channel replacement and reconfiguration and feeder grayloc maintenance. Inspection and Maintenance Services also offers a project management service for development of new inspection and maintenance equipment. The core activities of IMS are:

- Fuel channel and reactor vault inspection and maintenance.
- Steam generator and heat exchangers inspection and maintenance.
- Balance of plant inspections.
- Development of inspection and maintenance tooling.

Inspection and Maintenance Services is geographically dispersed throughout southern Ontario with regular staff resident at the Bruce Power, Darlington, and Pickering sites, as well as several off-site locations in Pickering and Ajax. To maximize the utilization of staff, IMS deploys staff to all sites during the spring and fall outage seasons. A substantial level of staff augmentation is required to address the seasonal outage work programs. Inspection and Maintenance Services nearly doubles in size using augmented staff (i.e., temporary additions to staff complements for peak periods) during outage campaigns from 534 regular staff to approximately 900 staff during outages to facilitate execution of the work program.

A key 2008 initiative is to increase regular (full time) staffing levels and reduce the reliance on augmented staff. Optimal regular staffing levels were re-assessed in 2007 and it was determined that an increased component, particularly in engineering and maintenance, is required bringing the total regular staff headcount up to 650 in order to:
a) Reduce dependency on contractors: The ratio of IMS staff to contractors is considered a risk to IMS’ ability to meet and deliver its high standards for safe, quality production on schedule during outage execution.

b) Maintain staffing consistency in work programs: IMS’ experience has been that its reactor and delivery equipment maintenance programs are more successful in terms of minimizing critical path downtime when conducted by work crews who have benefited from experience gained through consistent involvement with the same type of work.

Inspection and Maintenance Services provides services to both internal and external customers and was established as a commercial business unit within OPG in 2002. Inspection and Maintenance Services supports OPG’s work program needs for fuel channel, steam generator, and balance of plant inspections and specialized maintenance at Pickering A, Pickering B, and Darlington. Inspection and Maintenance Services also provides limited inspection services for OPG Fossil and Nuclear Waste Management.

Inspection and Maintenance Services main external customer is Bruce Power. Currently IMS has two service level agreements with Bruce Power to provide fuel channel and balance of plant inspection services. Inspection and Maintenance Services, from time to time, may enter into short-term agreements directly or indirectly with other non-OPG clients to provide inspection and maintenance services.

Inspection and Maintenance Services recovers its costs by charging its internal customers (e.g., OPG generation stations) for services at commercial rates that is consistent with how it charges for negotiated services to third parties such as Bruce Power. All net margin earned by IMS on the provision of inspection and maintenance services to internal and external customers is credited back to the nuclear cost of service.

Total revenues from IMS third party sales, primarily to Bruce Power, over the period 2005 - 2009 are shown in Ex. G2-T1-S1 Table 1 and cost of goods sold are discussed in section 3 below. In 2005, Bruce Power transferred steam generator inspection services from IMS to an
original equipment manufacturer. As a result, the steam generator inspection services agreement with Bruce Power was amended in 2005. The revenue lost from steam generator work was offset in 2006 by the commencement of the multi-year fuel channel repositioning and single fuel channel replacement work programs for Bruce Power, both of which were not included in the 2006 business plan. These programs do not occur frequently and represent a significant amount of revenue for IMS. Revenue from these programs was included in the 2007 plan.

From the onset of the external commercial work program, planning information for future programs from Bruce Power has been subject to change due to the variability of work programs. This can be seen in the decline in planned revenues in 2008 and 2009 relative to 2007. Historically, Bruce Power outage programs have frequently changed in scope and are subject to being rescheduled from year-to-year making it difficult to forecast future work programs and revenue with reasonable certainty during the five-year business planning process. Bruce Power is only obliged to show us a two year work forecast. Generally, the work program and revenue for the first year of the five year business plan will have the greatest reliability reflecting most current and up-to date planning information from Bruce Power, while the outer years have less certainty. The Bruce Power work programs and revenues for 2008 and 2009 provided in this application are based on the 2008 business plan forecast, and reflect current and up-to date planning information from Bruce Power.

3.0 OPERATING COSTS OF NUCLEAR NON-ENERGY BUSINESSES

The operating cost of the nuclear non-energy business are made up of direct costs (cost of goods sold) and indirect support costs. The direct costs are shown in Ex. G2-T1-S1 Table 1 on an aggregated basis. Indirect costs are discussed in the base OM&A exhibits.

3.1 Heavy Water

The cost of goods sold for heavy water sales covers the cost of direct labour involved in handling, testing, loading, unloading, packaging, cost of containers, and transportation costs. The cost of goods sold for detritiation services is an allocation of the TRF’s operating and
maintenance cost. The allocation is approximately proportional to the amount of processing capacity of the TRF facility dedicated to the provision of service to third parties, relative to provision of service to OPG nuclear units. The allocation factor represents a normalized TRF usage over time. TRF costs not allocated to third parties are part of nuclear base OM&A costs recovered in the nuclear revenue requirement. Shipments of heavy water by third parties to the TRF for processing are governed by the plant operations of the third party, plant operations of OPG and the availability of the TRF facility. Hence there are annual variations.

Indirect support costs relate to the Isotopes Sales Group dedicated to servicing this market and an allocation of Isotopes Sales Group management and support staff, all of which is captured in the Commercial Series Group within Nuclear base OM&A.

### 3.2 Cobalt-60

The cost of goods sold for this product includes installation, removal, processing, storage, and packaging. Cost of goods sold also includes a cost item for the long-term storage of the spent (but still radioactive) cobalt, as the third party agreement provides for the return of the spent cobalt to OPG (Nuclear Waste Management Division) for storage as nuclear waste.

There are some indirect support costs including allocation of sales and administration staff costs, which are captured in base OM&A (i.e., Commercial Services Group within Nuclear Generation Development and Services).

### 3.3 Tritium Sales

The cost of goods sold for the tritium sales program are primarily Atomic Energy of Canada Limited laboratory and dispensing fees, packaging, and shipping costs. The product itself is a pure by-product of the detritiation process that is required to reduce employee radiation exposure and no production cost is attached to what is sold. All shipments of tritium must conform to CNSC, and federal and provincial transportation regulations for safe handling and
shipment of radioactive materials to minimize the hazard to those involved in the shipment, the public, and the environment

Indirect costs which are budgeted as Nuclear base OM&A (i.e., Commercial Services Group within Nuclear Generation Development and Services) represent an allocation of Isotopes Sales Group support costs including a portion of labour costs related to Isotopes Sales Group sales and administration.

3.4 Inspection and Maintenance Services
The IMS direct costs are comprised of internal and augmented labor, materials and expenses for executing the external work programs. Indirect costs are budgeted within Nuclear base OM&A (i.e., IMS group within Nuclear Generation Development and Services) and represent an allocation of administrative overheads for provision of IMS services for both internal and external customers.

4.0 NUCLEAR NON-ENERGY REVENUES AND PROPOSED REGULATORY TREATMENT
There are minimal growth opportunities for nuclear non-energy revenues from third party heavy water sales and processing, isotope sales and IMS services with the result that overall revenues and margins have been relatively stable over time. The majority of non-energy revenues and margin come from the provision of services to a single customer, Bruce Power. As discussed above, some opportunities may exist for increasing revenues and margin but also risks are emerging in the form of competitive pressures (e.g., high Canadian dollar impact on tritium and heavy water sales).

The derivation of the interim payment amount for nuclear commencing April 1, 2005 included all revenues (and associated direct costs as well as indirect costs as part of base OM&A) with respect to nuclear non-energy activities. Consistent with this past approach, OPG is proposing that all third party revenues (net of direct costs and indirect costs budgeted within base OM&A) related to heavy water sales, tritium removal services, isotope sales and IMS in
the test period be recorded as an offset to the determination of the regulated payments
amounts.

As shown in Ex. G2-T1-S1 Table 1, the proposed regulatory treatment represents a net
correction (before indirect costs) that reduces the prescribed payment amount by $36.6M in
2008 and $42.0M in 2009. Overall the nuclear non-energy businesses are profitable
enterprises, inclusive of all costs.

While OPG is proposing in its first cost of services application the continuation of the
methodology established for setting the interim payment amount, OPG believes that in a
future proceeding there may be merit in pursuing alternative regulatory treatment for nuclear
non-energy revenues, including consideration of some form of incentive profit sharing
mechanisms.

5.0 PERIOD-OVER-PERIOD CHANGES

2006 Actual - 2009 Plan

Ex. G2-T1-S1 Table 1 sets out non-energy revenues by each business unit over the period
2005 - 2009. Period-over-period variance explanations are provided in Ex. G2-T1-S2.