SAFE, RESPONSIBLE MANAGEMENT OF NUCLEAR WASTE

ONTARIO POWER GENERATION

INTRODUCTION

Electricity powers our homes, industries and ultimately, the economy of Ontario. Nuclear power accounts for over 50% of the electricity generated in the province, but it also produces nuclear waste, which must be responsibly managed.

OPG's Nuclear Waste Management Division is accountable for the safe management of this waste, and every employee of our Division is dedicated to protecting their fellow employees, the surrounding environment, and the communities in which we operate. We, and our predecessors, have been safely managing nuclear waste for nearly 40 years. And although we are very proud of our record, we work closely with leading-edge scientists in countries around the world in order to improve our own waste management techniques.

Our industry is one of the most closely regulated in Canada, and part of our mission is to conform to the very strict rules of the agencies that oversee our activities. Our facilities and transportation programs are licenced and monitored by the Canadian Nuclear Safety Commission. We also comply in full with the conditions, directives and regulations issued by Natural Resources Canada, Transport Canada, the Canadian Environmental Assessment Agency, the Provincial Ministry of the Environment and the International Atomic Energy Agency.

OPG categorizes nuclear waste into three levels – low, intermediate and used nuclear fuel. We operate three facilities in Ontario for the interim storage of waste generated by our 20 nuclear reactors, including those leased to Bruce Power. And we have made significant progress towards solutions for waste management in the long term. Our partnership with the Municipality of Kincardine to develop a Deep Geologic Repository (DGR) for the long-term management of low and intermediate-level waste is now entering the rigorous environmental assessment stage.

In addition, we have made a significant contribution to the Nuclear Waste Management Organization's recommendation to the Federal Government on long-term management of used nuclear fuel. This plan, called 'Adaptive Phased Management', ultimately recommends deep geologic isolation, but is flexible enough to accommodate future technical innovation and community input.

The long-term costs of today's nuclear power plants include both waste management and decommissioning – the dismantling of nuclear plants when they have outlived their useful lives. At OPG we believe that future generations should not have to bear the costs of today's operations, so we make annual contributions to funds dedicated to meeting these long-term obligations. As of 2006, these funds contain more than $7 billion.

Although we are very proud of our record, there is nothing we value more than our relationship with the people of Ontario. The safe storage of nuclear waste is important to every Ontarian, so every Ontarian has the right to know how we manage our business. This booklet is just one of our many efforts to achieve transparency, encourage dialogue, and earn your confidence.

OVERVIEW OF NUCLEAR WASTE

In CANDU reactors, nuclear fuel consists of uranium dioxide processed into ceramic pellets, which are then sealed in tubes. Several of these tubes are welded together to form 'fuel bundles'. The heat generated by the 'fissioning' or splitting of the uranium atoms is used to turn water into steam, which runs the turbines that create electricity.

WHAT IS NUCLEAR WASTE?

In a nuclear plant, there are three types of nuclear waste: used fuel, intermediate-level waste, and low-level waste. Used fuel contains more than 99% of the radioactive by-products of nuclear reactors.

Used Fuel:
When a fuel bundle no longer contains enough fissionable uranium to heat water efficiently, it is replaced by a new fuel bundle. OPG-owned reactors produce about 75,000 used fuel bundles each year (at the end of 2005, the total number of used fuel bundles from our nuclear operations was approximately 1.6 million – enough to fill 4 hockey rinks to the top of the boards).

Intermediate-Level Waste
This consists mostly of used reactor components, as well as the resins and filters used to keep reactor water systems clean. These items, which cannot be handled without shielding, make up about 5% of the non-fuel waste.

Low-Level Waste:
This category consists of minimally radioactive materials such as mop-heads, rags, paper towels, floor sweepings and protective clothing used in the nuclear stations during routine operation and maintenance. These items do not require shielding and make up about 95% of the volume of non-fuel waste.

WASTE MANAGEMENT FACILITIES

OPG has three waste management facilities in Ontario:

Western Waste Management Facility (WWMF)
The WWMF stores all the low and intermediate-level nuclear waste from the operation of OPG's 20 nuclear reactors, including those leased to Bruce Power. In addition, the facility provides dry fuel storage for the Bruce reactors.

Pickering Waste Management Facility (PWMF)
The PWMF provides dry fuel storage for the Pickering reactors.

Darlington Waste Management Facility (DWMF)
The DWMF, new in 2007, is a dry fuel storage facility for the Darlington reactors.

All waste management facilities are licensed and regulated by the Canadian Nuclear Safety Commission (CNSC). The CNSC regulates the use of nuclear energy and materials to safeguard health and the environment, to insure safety and security, and to respect Canada's international commitments on the peaceful use of nuclear energy.

HOW WASTE IS MANAGED

USED FUEL MANAGEMENT

Used fuel is managed in two stages: water storage and then dry storage.

Water Storage: Used Fuel Bays

The used fuel bundle, which is still emitting heat and radioactivity, is removed from the reactor by remote control and discharged into a water-filled 'bay'. It looks like a swimming pool, but is built of reinforced concrete, lined to prevent leaks and designed to withstand earthquakes.

Dry Storage: Used Fuel Containers

After the used fuel bundles become 'cool' enough, they are transferred to CNSC-licensed dry storage containers made of concrete and steel. The containers are then welded closed, and the International Atomic Energy Agency (IAEA) affixes sophisticated seals to the containers to verify that Canada is in compliance with the international Non-proliferation Treaty.

When loaded, these containers weigh about 70 ton and have a design life of 50 years. Studies indicate that, with ongoing maintenance and inspection, they can be safely used for a much longer time.

Intermediate-level Waste Management

Smaller used reactor components, as well as resins and filters used to keep reactor components clean, are loaded into specially reinforced and shielded transportation packages licensed by the CNSC for shipment to the Western Waste Management Facility (WWMF). There, the waste is stored in steel-lined, in-ground storage structures.

Low-level Waste Management

These minimally radioactive materials, used in the operation and maintenance of the nuclear plants, are packed in plastic bags and shipped to the WWMF in CNSC-licensed steel containers for processing and storage. Where possible, these materials are then compacted or incinerated to reduce their volume, so that the concrete warehouses used to store them can be designed with smaller environmental footprints.

35+ YEARS OF SAFE TRANSPORTATION

OPG makes approximately 2000 shipments of radioactive materials per year, and has done so for the past 35 years. After thousands of shipments and millions of kilometers, not a single gram of radioactive material has ever been released to the environment from our transportation operations.

MAKING ABSOLUTELY SURE

OPG complies fully with Canadian regulations regarding 'Transportation of Dangerous Goods' and the transport of 'Nuclear Substances'. Our transportation packages are licensed by the Canadian Nuclear Safety Commission. In addition, our trucks, transportation packages and programs are maintained and tested to the highest standards, and adhere to the International Atomic Energy Agency regulations for the 'Safe Transport of Radioactive Material'.

As well, OPG conducts regular audits and safety assessments of our transportation practices to make absolutely sure they conform to Transport Canada's regulations. In addition to regular inspections and maintenance, we also have an emergency response plan that is audited internally and by Transport Canada.

Several types of packaging are used to transport radioactive materials. They are all built to requirements specified by the CNSC. For example, the intermediate-level waste transportation package used for shipping resins in bulk and tritiated heavy water are built to Type B standards – the most secure level of packaging for radioactive shipments. All Type B packages must be able to withstand a nine-metre drop onto an unyielding surface; a one-metre drop onto a steel pin; 30 minutes in an 800°C fire; and eight hours immersed in 15 metres of water. Only after field-testing and/or computer analysis has demonstrated that the packages can survive these tests will a license to use the container be issued by the CNSC.

ASSURING THE FUTURE

Although the Federal Government is responsible for oversight and regulation, those who are responsible for producing nuclear wastes are also held responsible for their long-term management. Canadians have told us that they don't want to wait another generation to see substantial progress in nuclear waste management, and OPG is working hard to do its part.

Because some nuclear waste continues to be radioactive even after thousands of years, long-term planning is an essential part of the waste management process at OPG. All plans are formally reviewed – and if necessary revised – to make sure that we continue to manage nuclear waste in ways that are environmentally sensitive, socially responsible, and financially sound.

Long-Term Management of Low-Level and Intermediate-Level Waste: The DGR
OPG, with the support of the local community, has proposed the construction and operation of a Deep Geologic Repository (DGR) for the long-term storage of low and intermediate-level nuclear waste on lands adjacent to the Western Waste Management Facility in Kincardine, Ontario.

The DGR would be located 660 metres or 2150 feet below the surface, beneath very thick layers of limestone and shale rock, which have remained unspoiled – in spite of geologic upheaval, major climate change and glacial cycles – for more than 450 million years. These formations will safely isolate nuclear waste for many thousands of years to come.

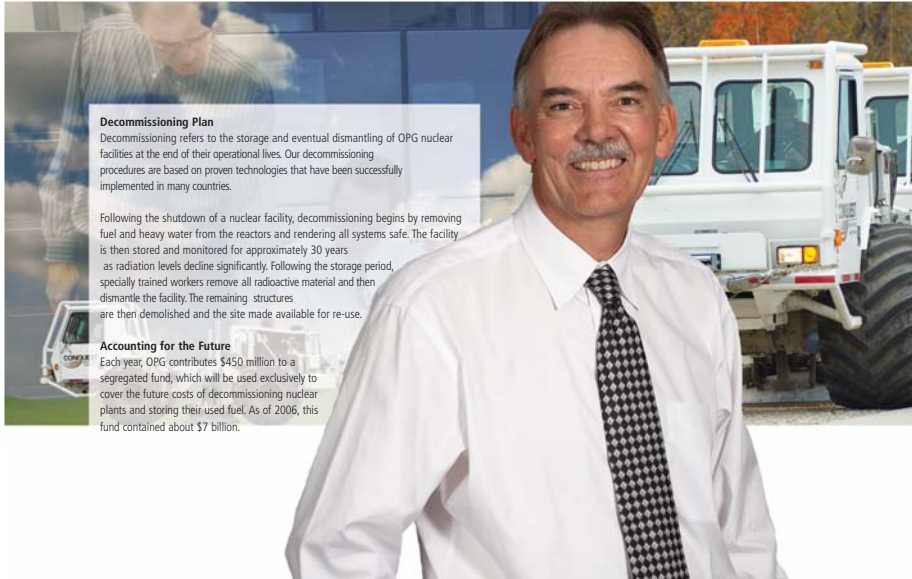
In 2005, the Municipality of Kincardine conducted a poll among its citizens to gauge the level of support for the DGR. The majority agreed with Council's recommendation and the project has now entered the long and careful regulatory process. Pending approvals and licensing by regulatory agencies, the DGR will commence construction in 2012 and operation in 2017.

Long-Term Management of Used Fuel
The Nuclear Waste Management Organization, which consists of representatives of Canada's nuclear utilities, has been mandated by the Canadian Government's Nuclear Fuel Waste Act to submit a proposal for the long-term management of used nuclear fuel.

To find out how Canadians felt about various options for long-term management, the NMWO conducted a study in which more than 18,000 people (including 2500 Aboriginal people) participated. Their opinions, as well as input from more than 500 specialists, helped shape the NMWO proposal, which was submitted to the Minister of Natural Resources in November 2005.

This proposal recommended that used fuel from Canadian nuclear facilities would be isolated in a repository deep underground. The used fuel would be contained by engineered barriers and the surrounding geology. It would be constantly monitored and would remain retrievable indefinitely, if necessary.

The proposal calls for a voluntary, transparent process in which people in communities would be able to make their views known at key decision points, and have genuine opportunities to influence progress and outcomes.



Decommissioning Plan
Decommissioning refers to the storage and eventual dismantling of OPG nuclear facilities at the end of their operational lives. Our decommissioning procedures are based on proven technologies that have been successfully implemented in many countries.

Following the shutdown of a nuclear facility, decommissioning begins by removing fuel and heavy water from the reactors and rendering all systems safe. The facility is then stored and monitored for approximately 30 years as radiation levels decline significantly. Following the storage period, specially trained workers remove all radioactive material and then dismantle the facility. The remaining structures are then demolished and the site made available for re-use.

Accounting for the Future
Each year, OPG contributes $450 million to a segregated fund, which will be used exclusively to cover the future costs of decommissioning nuclear plants and storing their used fuel. As of 2006, this fund contained about $7 billion.

HEALTH, SAFETY AND THE ENVIRONMENT

Our Pledge on Nuclear Waste: Safety First, Foremost and For Always

Safe operation means safe for employees, for the community and for the environment – today, tomorrow and into the far distant future. At OPG's Nuclear Waste Management Division, we work passionately to fulfill this responsibility in everything we do. 'Safety first' is not just a corporate edict; it is a way of working that is embraced by every person who works in our company.

Around the world, research on the long-term management of nuclear waste has engaged thousands of scientists and involved billions of dollars in research. OPG belongs to several international organizations concerned with nuclear waste and has cooperative agreements with many countries that are in the forefront of nuclear waste research and development. These links facilitate the exchange of technical information, joint research and development activities, and in some instances the exchange of technical staff.

At OPG, we understand the importance of working together with Ontario communities to help assure Ontario's energy future, and we realize that transparency, dialogue, and easy access to information are vital to the success of our mission. We invite you to read more about the Deep Geologic Repository, as well as our other waste management operations and initiatives, by contacting us at any of the sources listed at the end of this publication.

COMMUNICATING WITH YOU

Because OPG shares the concerns of Ontarians for health, safety and the environment, we actively seek opportunities for dialogue. We want to share information about our waste management processes, make sure you are informed of any OPG initiatives near your community, and make it easy for you to respond.

We welcome your comments or any questions you may have about this publication. E-mail us at: nwmd@opg.com or visit our website at www.opg.com.