

**Some Thoughts on “Sustainable Development and Nuclear Waste”
by David Runnalls**

Robert Morrison
School of Public Policy and Administration, and
Technology, Society, Environment Programme at Carleton University

November 16, 2003

Introduction

What ideas about sustainable development are most useful to the NWMO in assessing different options for the long term management of nuclear fuel wastes in Canada?

David Runnalls' essay on Sustainable Development and Nuclear Waste addresses this question. He begins with a section on the concept of sustainable development, stressing the difficult tradeoffs required between economic, social and environmental goals, and between the present and the future. He also underlines the need to go beyond tradeoffs to achieve better wellbeing for both humans and ecosystems, although it's not clear how this should be done. He then moves on from concept to practice in business and government. Neither of these first two sections refer specifically to nuclear fuel waste. A third section deals with views on nuclear power. A final section suggests ten fairly general questions that the NWMO should address in its process and criteria for decision-making.

The Concept. My overall reaction is that the paper addresses sustainable development at a fairly high level of generality. The suggested criteria are useful, but don't provide much guidance on the practical problems the NWMO will face in presenting nuclear fuel waste management options to specific communities. Sustainable development has to be very specific and local, as well as general and global.

The paper also could use more context and perspective. It does not suggest how to assess the relative importance of the various risks and benefits of nuclear waste options or nuclear power, nor how they compare with other risks that modern society faces. It would be helpful to situate nuclear fuel wastes in a broader sustainable development context in at least three areas: the need for equity, the challenges of energy and environmental policy, and the management of other wastes.

The Brundtland Report explicitly stated that concern for equity between generations must logically be extended to equity within each generation, and that the needs of the world's poor should be an overriding priority. Equity concerns apply to energy. Two billion people in the world still lack access to electricity and other modern forms of energy. The potential for the growth of electricity demand is huge, and justified on equity grounds.

This leads to fundamental questions of sustainable development in terms of energy use and environmental impact. Fossil fuels supply 90% of the world's commercial energy. Most new electricity capacity will be fossil-fired, intensifying the problems of air quality

and climate change. Nuclear power and its wastes must be seen in this light, along with efficiency, renewables and carbon sequestration.

Runnalls notes that many in the environmental community don't like the idea of development, fearing that it may be inherently incompatible with environmental sustainability. This approach seems insensitive to the need for equity, and to the ineluctable interdependence of development and sustainability. People are less likely to support protection of the environment if they see it as a threat to their welfare.

Another important context for the NWMO, and one that is has already looked at, is the range of wastes that we produce as a society. It seems essential not to treat nuclear fuel waste in isolation, but to assess it along with other wastes like municipal garbage, hazardous wastes, or industrial and agricultural wastes. How does nuclear fuel waste compare with them in volume, toxicity, duration, exposure to people, environmental impact, and in the way we treat them and regulate them? While the NWMO mandate is limited to nuclear fuel waste, it's helpful to have the broader waste context.

There is an apparent choice between trying to solve the problem of nuclear fuel waste so that future generations won't have to worry about it (permanent passive disposal), and leaving them the ability to make decisions on a stepwise basis as technology evolves (storage). Since current storage methods cannot continue indefinitely, we owe it to future generations to develop options for the longer term, and this is precisely the NWMO's mandate. Fortunately, as recent NWMO workshops have indicated, these two approaches are not necessarily orthogonal. Disposal will need many decades of storage before a repository is sealed, and storage is likely to move eventually toward more permanent disposal. Each approach can incorporate elements of the other, and each approach, carried out with due diligence, can be consistent with sustainable development. Since protection of people in the long term in all options means keeping the wastes out of the biosphere, Runnalls' goals for human and ecosystem wellbeing should be achievable simultaneously.

Concept to Practice. Runnalls notes that while governments have not done much for sustainable development recently, business has embraced it, because it's good for the bottom line. This is encouraging, but it doesn't seem to be happening on a broad enough scale. There are clearly conflicts between sustainable development and many business goals and products. Government action will be needed to resolve those conflicts.

Sustainable Development and Nuclear Power. Noting that nuclear power has always posed a problem for the sustainable development community, he briefly points out some of its advantages: no air pollution, no contribution to climate change, a potential source of hydrogen, and a domestic energy source for developing countries with limited fossil fuels like China. He also notes its good safety record and, in Canada, its good management of transportation and storage.

Without wanting to be unduly polemical, some other aspects of nuclear power that might be discussed in a sustainable development context could include:

Significant expansion and diversification of the energy resource base
 possibilities for further expansion through advanced fuel cycles
 Huge amounts of energy supplied per unit mass or unit volume of fuel,
 helping to reduce material flows in the economy: a tonne of nuclear fuel
 produces as much electricity as 10 000 tonnes of coal,
 Small volume of wastes (proportional to fuel volumes)
 High standards for safety standards and quality assurance (pace Homer
 Simpson),
 Lower health and environmental impacts than fossil fuels, as shown by the
 ExternE project of the European Community
 Radioactivity in a nuclear fuel waste disposal vault will decay in a few thousand
 years to the level of the original ore body from which it came, a long time
 in human history, but not on geological timescales.
 Many underground uranium ore bodies billions of years old have no surface
 expression, suggesting the decay products do not enter the biosphere.

Runnalls goes on in more detail to outline four strikes against nuclear power. A few points may be in order.

1) Longevity of the waste products. There is certainly a challenge in this regard, but it should be placed in context. Heavy metals and many chemicals live forever. More important, activities do not need long lives in order to have long-term impacts. Many things we do exert a profound influence on the future. A reversal of the ocean currents due to climate change would change the history of the planet for all future time, long after the greenhouse gas molecules that caused it have cycled on. The issue is whether the nuclear fuel waste can be managed safely and cost-effectively over their active period. The indications are that this is the case. The high value of the electricity supplied by the small volumes of fuel means that adequate funds can be made available by consumers for their management, as is the case with the NWMO.

The argument about nuclear wastes requiring institutional stability for 10 000 years strikes me as equally misplaced. Of course we want to plan as best we can for the future, but there are no guarantees of what may happen in human society even on timescales of decades. The world has changed enormously in the last century, since we first learned about the nucleus, and will continue to change. Nuclear fuel wastes are one small element of our interaction with the natural world and with each other, and a small element of the heritage we leave. Our genes, behaviours, cultures and institutions are much more important. We will have to manage all aspects of our relation with the natural world in perpetuity – habitat, land use, climate change, as well as maintaining and enhancing the basic functions of human civilization. If we lose the institutional ability to deal with nuclear wastes, it will presumably be because we have lost the overall ability to manage human civilization, and that will entail much more serious problems.

2) Security. This is addressed by another paper in this series, so I won't touch it here.

3) Economics and 4) Operating experience. It's certainly true, as Runnalls points out, that nuclear reactors, like other major projects, including those in the hydro and renewable sectors, have high capital costs and are thus subject to cost overruns, especially in times of high inflation. Overruns are a challenge to project management and regulation, not something inherent in the technology. AECL's CANDU projects in Korea and China have come in on time and budget, and are operating well.

Runnalls does not mention that nuclear power, along with hydro and renewables, have low fuel and operating costs, making them less sensitive to inflation, once operating. They are complementary to projects with low capital and high fuel costs, such as gas turbines, which are very exposed to fuel cost increases, as we have seen recently.

Sustainable development is based on a long-term approach that values the future. This implies a low discount rate. High discount rates, like those assigned in the capital markets, value quick returns and assign effectively zero value to anything that happens more than a few decades in the future. Runnalls cites an ethical principle that no moral basis exists for discounting future health and environmental risks, implying a discount rate of zero. Projects with high capital costs similarly require a low-discount rate approach, since their payoffs are longer term. The value of nuclear power in offsetting the long-term impacts of climate change and relieving the pressure on fossil fuel supply is given zero credit in today's market.

Sustainable development will require appropriate price signals, including the longer term health and environmental costs of our activities. Runnalls does not mention the degree to which nuclear power internalizes its costs, through waste management and strict safety regulation, unlike many other energy and industrial activities. Nuclear power essentially contains its wastes throughout their active lifetimes, where other activities disperse their emissions routinely and in huge volumes into the environment, with little or no cost to themselves, but with very high external costs for health and environmental impact to a society at large. The NWMO's activities are financed by consumers of nuclear electricity, but the government's activities on climate change are financed by taxpayers, not by users of fossil fuels. It's true that governments can interfere in this process with price caps and the shifting of debt to other budgets, but in general there's a good case that nuclear internalizes its costs to a higher degree than fossil sources and many other industries.

A strike against nuclear power that Runnalls does not address is the dread factor that colours many people's perception of nuclear issues. In the face of this fear, it will take time and effort, and a well-designed process, to build trust.

Runnalls suggests that in parallel with the NWMO activities, there should be a review of Canadian energy policy overall, or at least Canada's or Ontario's electricity policies. He notes that the argument for a broader review is based partly on the view that a solution to the fuel waste problem would be bad... in that it would encourage nuclear power. While I agree with looking at things in the broader context, it seems odd from a sustainable development perspective to suggest that solving serious long-term problems is not a good

thing in itself. In any case, the NWMO has a mandate to put forward real solutions to real issues.

It is true that when the nuclear fuel waste disposal concept was referred for environmental assessment review in the late 1980s, the ministers involved agreed on a broader review. A comparative study of electricity sources was proposed, but electricity is provincial, and the provinces were very resistant to a federal review in their area of jurisdiction.

That said, there are certainly some essential decisions to be made on Ontario's electricity system in the near future: the need for new generation and transmission capacity; the cost-effectiveness and reliability of the system; interties with neighbouring jurisdictions; the possibilities for distributed generation, efficiency and renewables; the refurbishment of the five nuclear units still out of service; and the health and environmental impacts of fossil fuels, including the Kyoto commitments. With new governments in Ontario and Ottawa, and new technologies to consider, a review could indeed be timely.

Criteria for Building Sustainable Development into Work of NWMO. Here Runnalls puts forward eight ethical issues, seven major social and environmental issues, and ten fundamental questions to be answered, along with some subquestions, in the following areas: engagement, people, environment, economy, traditional and non-market activities, institutional arrangements and governance, overall integrated assessment and continuous learning, security, ethics, and risk and precaution. In one of these, ethics, he cites eight further excellent principles from the Nuclear Energy Agency of the OECD. All these are laudable, and they certainly establish a good checklist for the criteria and process that the NWMO should follow, but the list is daunting in its complexity. If I had to make a shorter list for criteria to assess options, I would suggest: protection of people and the environment, fairness, flexibility, cost and overall acceptability to a host community.

There is no question that excellent processes and criteria for decisions are necessary in a controversial area like nuclear fuel waste. Processes seen as legitimate, like democratic elections, provide legitimacy for the outcome. They must be comprehensive, fair, transparent, and fully participatory. But it is important to recognize that even with the best processes and criteria, basic conflicts may well remain, choices will still be difficult, and trust essential to success. In the end, there is no escape from the need for judgement and good management. Sustainable development has to be embodied in real projects for managing nuclear fuel wastes in real communities with all their particularities.

About the Author

Dr. Morrison has a degree in engineering physics from McGill and a Doctorat du Troisieme Cycle from the University of Paris in experimental physics. He is affiliated

with the School of Public Policy and Administration and the Technology, Society, Environment Programme at Carleton University. From 1980 to 1997, Dr. Morrison was Director General of Uranium and Nuclear Energy at Natural Resources Canada. Since 1997 he has consulted for Natural Resources Canada (NRCan), Ontario Power Generation, the NWMO, Foreign Affairs and International Trade Canada, the Belgian government, and the OECD Nuclear Energy Agency (NEA). He worked with the NEA on a study of sustainable development and nuclear energy released in December 2000, and on a study of the role of governments in nuclear energy, to be published in 2004. He is the co-editor of a book on Canadian Nuclear Energy Policy (U. of T Press, 2001), and has written recent papers on energy and sustainable development and on technology development for climate change. Dr. Morrison is a member of the Nuclear Working Group of the Joint Canada-US Joint Task Force on the Power Outage.