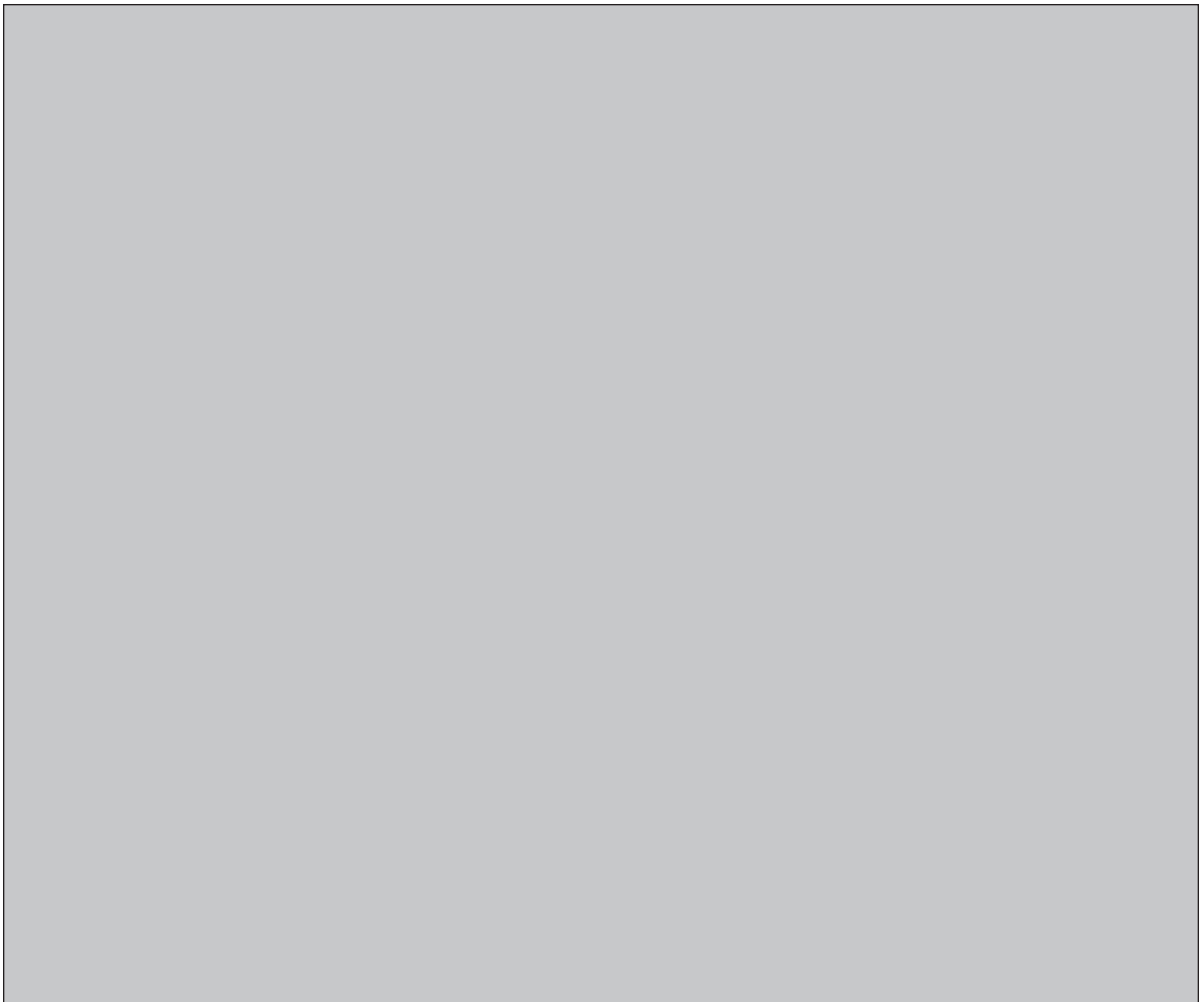


NWMO BACKGROUND PAPERS

1. GUIDING CONCEPTS

1-1 SUSTAINABLE DEVELOPMENT AND NUCLEAR WASTE

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NWMO Background Papers

NWMO has commissioned a series of background papers which present concepts and contextual information about the state of our knowledge on important topics related to the management of radioactive waste. The intent of these background papers is to provide input to defining possible approaches for the long-term management of used nuclear fuel and to contribute to an informed dialogue with the public and other stakeholders. The papers currently available are posted on NWMO's web site. Additional papers may be commissioned.

The topics of the background papers can be classified under the following broad headings:

1. **Guiding Concepts** – describe key concepts which can help guide an informed dialogue with the public and other stakeholders on the topic of radioactive waste management. They include perspectives on risk, security, the precautionary approach, adaptive management, traditional knowledge and sustainable development.
2. **Social and Ethical Dimensions** - provide perspectives on the social and ethical dimensions of radioactive waste management. They include background papers prepared for roundtable discussions.
3. **Health and Safety** – provide information on the status of relevant research, technologies, standards and procedures to reduce radiation and security risk associated with radioactive waste management.
4. **Science and Environment** – provide information on the current status of relevant research on ecosystem processes and environmental management issues. They include descriptions of the current efforts, as well as the status of research into our understanding of the biosphere and geosphere.
5. **Economic Factors** - provide insight into the economic factors and financial requirements for the long-term management of used nuclear fuel.
6. **Technical Methods** - provide general descriptions of the three methods for the long-term management of used nuclear fuel as defined in the NFWA, as well as other possible methods and related system requirements.
7. **Institutions and Governance** - outline the current relevant legal, administrative and institutional requirements that may be applicable to the long-term management of spent nuclear fuel in Canada, including legislation, regulations, guidelines, protocols, directives, policies and procedures of various jurisdictions.

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Sustainable Development and Nuclear Waste

David Runnalls*

Sustainable development was defined by the Brundtland Commission as development “which meets the needs and aspirations of the present generation without compromising the ability of future generations to meet their own needs”.

The Commission, named after its Chair, the Prime Minister of Norway, was established by the United Nations in 1984 to take stock of the deterioration of the earth’s resource base and to recommend viable paths for the future. Its report, issued in 1987, is still timely more than 15 years later. The Commission pointed out that all of the critical ecological indicators were headed in the wrong direction, a situation which has worsened in the decade and a half since it issued its report. Loss of biodiversity, deforestation, the decline and collapse of many ocean fisheries, (such as the North Atlantic Cod) the spread of deserts and the looming threat of climate change, are all still in the daily news of the 21st century.

Rather than be discouraged by this wearying litany of potential catastrophes and throwing in the towel, the Commissioners developed the new concept of sustainable development. Sustainable development is a widely quoted, although much misunderstood, concept. At its heart is the idea that progress should be measured by much more than just the traditional economist’s tool kit of GNP (the total of goods and services produced in a national economy in one year) or the growth in the value of the stock market, or the quantity of material goods which people can amass. Sustainable development is a concept which can guide decision makers toward choices which are economically, environmentally and socially sustainable. Under sustainable development, each of these considerations must be fully taken into account before major decisions are made. This must lead to a decision making process in which these three concepts are integrated so that both human and ecosystem well being are better off than they are now.

At first, we hoped for a happy world of “win-win” decisions and there are many of those out there. But the real world is a world of tough choices. Sustainable development demands that these trade offs take all three aspects of the equation into account and that decisions not be made exclusively on economic grounds with a wink and a nod to social and environmental constraints (or vice versa).

The phrase “sustainable development” has been subject to a good many interpretations. That is both its strength and its weakness. As we shall see, it has proven attractive to a number of the world’s largest and most profitable companies. And every Canadian politician has learned how to say the words, if not to appreciate the full extent of their meaning. I sometimes think that there is a secret school somewhere in the Gatineau Hills north of Ottawa, where bureaucrats and politicians go to learn how to pronounce the words “sustainable development”.

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Many in the environmental community have been uncomfortable with the phrase, partly because the use of the term “development” makes them uneasy. They feel that it ducks the real issue of limits to economic activity by holding up the promise of a kind of nirvana- a world where people can continue to consume without limits while at the same time enjoying high levels of environmental and social quality. Many feel that society has already breached a number of critical natural thresholds and that economic growth itself must be curtailed, or at least drastically restructured. And many in the academic community have heaped scorn on the concept because it is subject to so many definitions, many of which are so fuzzy as to be meaningless at best and at worst to amount to greenwash.

At the same time, it is important to remember that sustainable development has popular appeal simply because it sounds so, well, sensible. And perhaps it helps a little to conceive of sustainable development as something other than a fixed, definable goal. The Brundtland Commission itself described it as more of a journey than a destination. “. . . *sustainable development is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs*”.

Sustainable development is by no means an easy way out of our current dilemmas. It involves a series of very difficult choices and trade offs for the well off countries like Canada. It is not having your cake and eating it. For poorer countries with their low levels of raw material and energy consumption and with their already serious environmental conditions, it is an even more daunting prospect.

After Brundtland reported, attention shifted to action, or at least the appearance of action. The Earth Summit in Rio de Janeiro in 1992 brought together more than 110 Heads of State to discuss the way forward for sustainable development. The Conference produced two treaties, one on climate change and the other on the preservation of biodiversity, adopted a lengthy action plan and adopted a set of principles for sustainable development.

A year after Rio, Maurice Strong, the Secretary-General of the Conference, was appointed to head Ontario Hydro. He set up a Task Force to review the state of the utility’s rapidly deteriorating finances, and to recommend ways out of the mess. Following the report of that group, he asked the Secretary-General of the Brundtland Commission, Jim MacNeill and I, to head another internal Task Force to develop a strategy for sustainable energy development for the company. We and our 12 colleagues from Hydro defined the challenge thus:

“Sustainable development involves re-harnessing market forces so that they can work for both the environment and economy simultaneously, and not one at the expense of the other. It means living off the interest from our natural capital of forests, water and soils, without encroaching on that capital itself. It requires that society invest massively to build up declining stocks of this natural capital to increase future dividends. It requires forms of development that use progressively less energy, water and other materials, cause less

pollution and produce less waste per unit of output. It means changes in the way society measures economic activity. Most importantly, it means changes in the way we make decisions.”¹

So, here we have the building blocks for sustainable development decision making: intergenerational equity, integrated decision making, living off income and not capital and most important of all, a process which gives more or less equal weight to social and environmental factors, along with economic feasibility, leading to a result which makes both people and ecosystems better off. When we apply the concepts to practical decision making, the concept becomes somewhat more complicated, but these basics remain simple.

From Concept to Practice

Sustainable development has been around for more than 15 years and it is fair to ask what has happened as a result, Has it changed decision making dramatically? Is the world a better place as a result? The answer is yes and no.

Heads of State and the “Great Leaders of Modern Thought” gathered again in Johannesburg last year to assess progress since Rio. Marred by tensions between the rich and poor countries and between the United States and almost everyone else, the official conference achieved little. Despite the fact that many of the basic indicators which worried the Brundtland Commission more than 15 years ago are even more alarming today, the assembled leaders confined themselves largely to platitudes and produced an action plan which contains little action.

But the unofficial conference was a revelation. Thousands of people turned up at the “side events” from around the world to showcase what they had learned and done about sustainable development. Municipalities, scientists, ngo’s, local village organizations and policy wonks all demonstrated breakthrough thinking and examples of sustainable development at the grass roots level. The concept had clearly caught on.

The Canadian record is mixed, at best. We now have a Commissioner of Environment and Sustainable Development who is appointed by the Auditor General. Her job is to report directly to Parliament on the implementation by federal departments of the sustainable development strategies which most of them are required to prepare every three years. The current Commissioner and her predecessor have done an excellent job of analyzing these strategies and the implementation of other government policies on sustainable development. There has been a good deal of progress made. But they have found that most departments are still paying only lip service to the concept. Despite the fact that a number of departments now have sustainable development as part of their statutory mandates, the concept has still not fully rooted itself in the bureaucratic culture.

¹ A Strategy for Sustainable Energy Development and Use for Ontario Hydro, Jim MacNeill and David Runnalls, Ontario Hydro, Toronto 1993, p. x

At the local level, the situation is much different. Canadian cities and towns are replete with sustainable development strategies, climate change policies, new green infrastructure funds and the like. And they have proven these strategies to be good administrative, as well as political, practice. They joined with their colleagues from other countries in Johannesburg to demonstrate these experiences.

Perhaps the most interesting events at the Summit were organized by elements of the business community. A day was devoted to the CEO's of many of the world's largest companies to report on their experiences with building sustainable development into their business plans and practices.

The World Business Council for Sustainable Development (WBCSD) comprises some 160 international companies and 35 partner organizations involving some 1,000 business leaders globally. Some Canadian companies have been vigorous members of the WBCSD. Ontario Power Generation and BC Hydro are active members and Hydro Quebec was previously a member. These companies are not building sustainability into their business plans out of the goodness of their collective hearts. According to their submission to the Summit, the members believe that:

“Pursuing a mission of sustainable development can make our firms more competitive, more resilient to shocks, nimbler in a fast-changing world, more unified in purpose, more likely to attract and hold customers and the best employees, and more at ease with regulators, banks, insurers, and financial markets. We define sustainable development as forms of progress that meet the needs of the present without compromising the ability of future generations to meet their needs. Given the scale of poverty today, the challenge of meeting present needs is urgent. Given the damage our past and present actions may visit upon our descendants, concern for future needs for environmental, human, social, and other resources is also compelling.

There are many cases that can be made for sustainable development: moral, ethical, religious and environmental. Many of us as individuals deeply believe in those cases. But being a Business Council, we emphasize the business case.

That case has a financial bottom line. During the five years before August 2001 the Dow Jones Sustainability Index (DJSI) clearly outperformed the Dow Jones Global Index (DJGI). While the DJSI had an annualized return of 15.8 %, the DJGI increased by 12.5% in that period. The DJSI consists of the top 10 per cent of companies in 68 industry groups in 21 countries seen as leaders in sustainable development. However, our rationale is not based solely on short-term, financial returns. Companies comprise, are led by, and serve people with vision and values. Companies that do not reflect their peoples' best vision and values in their actions will wither in the marketplace in the long-term. The business case is also an entrepreneurial position: it looks to the next point on the business curve, the point at which business can be more competitive by being more sustainability driven. WBCSD companies intend to be at that point first and to stake it out as their value opportunity.”²

² The Business Case for Sustainable Development, Geneva, WBCSD, 2002, introduction

At the core of the WBCSD business case is the concept of eco-efficiency which they define as "...the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle to a level at least in line with the earth's carrying capacity. In short, it is concerned with creating more value with less impact."

WBCSD and its members also produced a book entitled, "Walking the Talk"³. Edited by the CEO's of Shell and Dupont, it contains more than 50 case studies of companies putting sustainable development into practice.

Obviously not all, or even most, businesses have adopted these practices. Nevertheless, the experience of the WBCSD members demonstrates clearly that there is a robust business case for sustainable development and that the concept can be operationalized at the project level with benefits both for the bottom line and for society as a whole.

Sustainable Development and Nuclear Power

Nuclear Power has always posed a problem for the sustainable development community. On the one hand, it has obvious advantages. It produces little or no air pollution during its life cycle, a fact that could be particularly important as Southern Ontario struggles with the increasing smog crisis. It does not contribute significantly to climate change, the greatest problem facing sustainable development today. And some feel that it could be an essential component of the shift away from fossil fuels which must come if we are to have an impact on climate change. Many feel that the great transition away from fossil fuels for mobility will be toward a "hydrogen economy". A number of the large energy companies, including Shell, are beginning to think that way as well. But hydrogen requires a good deal of energy to produce and the nuclear industry is already positioning itself as the clean way to produce large amounts of hydrogen. And for developing countries like China with limited fossil fuel reserves of their own, nuclear power offers independence from imported fuels and their consequent destructive drain on foreign exchange.

And the nuclear industry has a good safety record, considering the number of reactors in use today. There are 434 nuclear units in operation throughout the world, producing 17% of the world's electricity. And its record on the storage and transportation of spent fuel has also been good, especially in Canada.

But the industry also has a number of strikes against it, which make the task of building a consensus on dealing with its wastes highly contentious, as the Seaborn panel found out. First, is the obvious problem of the longevity of its waste products. This not only poses a series of environmental and health challenges, their storage or disposal requires institutional arrangements that could last for centuries. Even its most ardent supporters

³ Walking the Talk: The Business Case for Sustainable Development; Charles O. Holliday Jr.; Stephan Schmidheiny; Sir Philip Watts, KCMG; Geneva, WBCSD, 2002

have always been concerned about the need to safeguard decommissioned reactors, as well as their waste fuel. The noted American nuclear scientist, Alvin Weinberg described the need for a “nuclear priesthood” of dedicated scientists to safeguard the industry’s facilities and its wastes.

The second potential strike is the security one. Nuclear reactors are potentially vulnerable to terrorist attacks, or at least to the dangers of terrorist diversion of the wastes, particularly plutonium wastes. With North Korea and Iran’s nuclear weapons ambitions very much in the news these days and with the suspicions that CANDU reactors were used to produce the raw materials for India and Pakistan’s nuclear programs, worry has increased about the handling of existing radioactive wastes, let alone the production of new ones.

The third strike is the economics of nuclear power. Nuclear power in Canada has long required a subsidy to make it economic. AECL still receives substantial sums from the federal government and governments everywhere guarantee nuclear accident liabilities above a certain level. Nuclear power is highly capital intensive and Canada’s record in controlling the costs of nuclear development has been unfortunate. Perhaps the most glaring example is the Darlington nuclear plant which came in at up to 500% over budget, depending upon which figures are used for the calculation. More recently, the refurbishment of the Pickering “A” reactors was supposed to take 3 years and is now 6 and counting. It was supposed to cost \$800 millions or so and it seems to be at 300% of that and it is still unfinished. Most of the old Ontario Hydro’s \$30 billion plus debt was incurred in the construction of the three major nuclear stations. It looks as if most of this debt will need to be paid off with a surcharge against electricity bills.

The cost overruns are responsible for a good bit of that debt. But the cost of debt service is another. There has been controversy over the optimistic assumptions which Ontario Hydro’s economists made about future interest rates. Because the capital costs of reactors are so high, their economics are dependent upon the costs of borrowed capital. The lower the costs of borrowing money, the more profitable the project. If the assumptions are too low, then the reactor may always operate at a loss, leaving the taxpayer to pick up the difference.

Finally, the fourth strike has been the operating experience. The Ontario CANDUs were built to operate for 30 years (or forty years, according to the people who calculate their economics within the company). But after a dozen years or so of operation, their reliability seems to become patchy. The four reactors at Bruce “A” have been closed since 1997 and it is doubtful if the first two will ever operate again. And I have already mentioned the experience with the Pickering reactors. Although there have been no serious accidents at any of the Ontario generating stations, the operations at Pickering were severely criticized for sloppiness, poor operating procedures and inadequate operator training, before they were closed six years ago. And although the industry’s safety record has been good, those incidents which have occurred do not instill a high degree of trust. Chernobyl is still seared in the minds of many in the former Soviet Union and it is clear that the Three Mile Island incident could easily have been much more

serious not to mention the fire which disabled the emergency systems at the Brown's Ferry reactor in the United States when a technician used a candle to locate a problem.

This record tends to make many in the sustainable development community suspicious about nuclear power, not to mention most people in the financial services industry. It has been many years since a nuclear reactor was started in the United States and most Wall Street analysts feel that any new starts would simply be unfundable.

This nervousness about nuclear power has recently been quantified in Europe, one of the most nuclear dependent regions of the world. According to a 2001 survey of over 16,000 Europeans conducted by the EU's Eurobarometer group, only 10% believe the nuclear industry and 11% the European Commission itself. On the other hand, independent scientists (32%) and ngos (31%) enjoy a much broader level of public trust. These figures are consistent with data about public trust on environmental issues collected in Canada over the years by the Environmental Monitor.

This will make the job of the NWMO very difficult over the coming years. The Seaborn panel experienced this public opposition for the eight years of its existence even though it was not focusing on any site specific proposals. Experience in Europe and the United States has shown that opposition becomes even more intense (if more localized) when the discussion concerns the selection of a specific location or locations for storage or disposal.

Finally, before proceeding to a methodology that I hope could guide the work of the NWMO over the coming years; I need to explore a final issue. Many feel that any examination of the alternatives for waste handling or disposal should be accompanied by a review of Canadian energy policy overall, or at least Canada's (or Ontario's) electricity policies. This argument is at least partially based on an assumption that if NWMO successfully resolves the waste issue, it would provide a fillip to the nuclear power industry and would provide another argument in favour of the construction of additional nuclear stations. They would like to use the waste issue as a "wedge" issue to force governments to be more thoughtful about nuclear energy policy generally.

The case for a review of electricity policy has merit. Indeed, the Seaborn panel, reports that "When it announced the Panel, ministers committed the government to conducting a parallel review in a different forum that would put the nuclear fuel waste question in a broader context. A task force on electricity and environment was to look at the environmental effects of nuclear and other methods of generating electricity. Despite repeated written reminders from the Chairman, the ministers have not held this parallel review."⁴

The arguments for such a task force have been strengthened by the recent blackout and the need to make the electricity distribution and generation systems much more robust to

⁴ Report of the Nuclear Waste Management and Disposal Concept Environmental Assessment Panel, CEAA website: www.ceaa.gc.ca/0009/0001/0001/0012/001/7_e.htm

prevent further incidents and by the need for the electricity sector to take action to meet its commitments under the Kyoto Protocol.

But the fact still remains that we have created all of this waste. Do we not have an obligation to future generations to deal with it in a more systematic fashion now, regardless of the overall fate of the nuclear power industry? And can we do this in a way that contributes to sustainable development?

Criteria for Building Sustainable Development into the Work of the NWMO

The Seaborn Panel provided the basis for a framework to analyze the sustainability of the three options when it wrote:

“To assess broad public acceptability, the NFWMA must measure options for managing nuclear fuel wastes against not only the technical criteria, but also the predominant values held by Canadian society. To delineate these values, the NFWMA should either hire or contract a group of social scientists and ethicists, who would establish an assessment framework with input from the public. Based on what we heard, the framework would address ethical issues such as those discussed in Chapter 4 and those listed below, in the contexts of managing nuclear fuel wastes and of linking these issues to policy decisions:

- the rights and responsibilities of current and future generations;
- responsibilities to the environment and ecological integrity;
- societal versus individual rights;
- the needs of significant minorities who may incur risks involuntarily;
- the degree to which the public should be able to hear different schools of thought in discussions preceding decisions;
- risks that are worth taking, given the probability of harm;
- procedures for arriving at collective consent; and
- retrievability versus irretrievability of the wastes, and which option is morally preferable. [The last three points are rephrased versions of information from Hardy Stevens and Associates, Moral and Ethical Issues, cited in Anna Cathrall et al, A Report to the FEARO Panel, Volume 2, pp. 26-27.]

The framework would also address social and environmental issues and priorities such as the following:

- socially oriented siting criteria, such as valued cultural and ecosystem components;
- the consistency of the options with Canadian policies on hazardous waste management, environmental protection and sustainable development;
- effects on communities' self-image, economic vitality, social development and cohesion, and relationship with the land;
- trade-offs in terms of potential siting territories, affected natural resources, economic advantages and disadvantages, and social controversies;

- the degree to which a demonstration project should be part of a waste management approach;
- liabilities in case of accidents; and
- cost effectiveness.⁵

How do we incorporate these and other considerations into a useable framework for the NWMO? There are a number of frameworks for incorporating sustainable development into project planning. The Guide to Green Government provides guidance to the work of the Commissioner on Environment and Sustainable Development. And many companies have developed their own individual frameworks which they apply to projects before they are approved internally.

The International Institute for Sustainable Development developed a practical framework for assessing the relationship between mining projects and sustainable development as part of a world wide project examining this industry.⁶ Although this framework was developed specifically for the mining industry, it has much in common with the nuclear business. It is an industry which has been the subject of much criticism from its stakeholders for its siting decisions. It operates on a large scale and its operations are physically very intrusive. And one of the nuclear waste options to be studied (geological disposal) is essentially a mining operation.

At the heart of this framework is the assumption that both ecosystem and human well being must be improved for sustainable development to be achieved. “Though values vary greatly in detail within and between cultures, at the heart of the concept of sustainability there is a fundamental, immutable value set that is best stated as ‘parallel care and respect for the ecosystem and for the people within.’ From this value set emerges the goal of sustainability: to achieve human and ecosystem well-being together.

It follows that the ‘result’ against which the success of ... any human activity should be judged is the achievement of, or the contribution to, human and ecosystem well-being together. Seen in this way, the concept of sustainability is much more than environmental protection in another guise. It is a positive concept that has as much to do with achieving wellbeing for people and ecosystems as it has to do with reducing stress or impacts.

In short, it implies the need to achieve a net environmental and human benefit (or in other words, to maintain or improve human and ecosystem well-being)Conversely, if a project or operation leads to a net degradation of human and ecosystem well-being, it must be described as reducing the potential for sustainability. In such cases, if the decision to proceed is made, decision-makers, other interests and the public should understand the implications from a sustainability perspective.

Taken together, these ideas veer sharply away from thinking in terms of a ‘trade-off,’ human vs. ecosystem well-being. There are obviously hundreds of small trade-offs in any practical application: between interests, between components of the ecosystem, across

⁵ Ibid.

⁶ Seven Questions to Sustainability, IISD, Winnipeg, 2002

time and across space. However, in a macro sense, the idea of sustainability calls for human and ecosystem well-being to both be maintained or improved over the long term. Maintaining or improving one at the expense of the other is not acceptable from a sustainability perspective because either way, the foundation for life is undermined. The above ‘positive contribution to sustainability’ criterion is different from, though built upon, the ‘mitigation of adverse effects’ criterion that is the focus of traditional environmental and social impact assessments. The implications of the shift are twofold. On one hand, the positive orientation opens the door to a much fuller treatment of the benefits ... than has traditionally been the case with impact assessment approaches. On the other, the same positive orientation sets the assessment bar higher.”⁷

I list below ten questions which need to be answered in the process of assessing the suitability of the three nuclear waste management questions. The ordering is not intended to signify any ranking by importance of these questions. Each is much more complex than a single question and spawns a number of sub questions. The space constraints of this current paper do not allow for an exploration of these sub questions.

1. Engagement. Are there commitments to processes of community engagement, designed and implemented that ensure all affected communities of interest (including vulnerable or disadvantaged groups) have the opportunity to participate in the decisions that influence their own future, and are understood and agreed by the communities of interest? This also includes the collaborative identification of the desired objectives, the development of a mechanism satisfactory to all for resolving disputes that may arise and some transparent and trustworthy systems of measuring and reporting on progress.

Finally, there must be adequate resources to make sure that all communities of interest can participate in the process. This would not only entail some form of intervener funding, which is common in cases like this, but also special efforts to identify all the potential communities of interest.

2. People. Will the project/operation lead directly or indirectly to maintenance of people’s well-being (preferably an improvement)? If the eventual siting decision results in one or more communities acting as hosts for new facilities, this implies assistance to develop effective and representative community organizations. It includes the development of appropriate standards for worker health and safety, as well as the health and safety of the community in which the site is located.

This is also the place where questions of equity must be raised. There would need to be a mechanism to identify and to report on the equity of the distribution of costs and benefits from NWMO’s point of view as the operator of a facility or facilities and from the point of view of the local communities. Much of the controversy over nuclear waste depositories has centered on whether particular, often isolated communities, are asked to bear a disproportionate share of the costs. These costs need to be set out in a transparent way so that they can be debated within these communities.

⁷ Ibid, page 7

It is here that the cultural costs and benefits to receiving communities must be calculated. This will be particularly important in the case of any aboriginal communities where sites may be located. Canada has a good deal of experience, both good and bad, of this kind of analysis

3. *Environment.* Will the project or operation lead directly or indirectly to the maintenance or strengthening of the integrity of biophysical systems so that they can continue to provide the needed support for the well-being of people and other life forms?

This must involve a reasonable degree of confidence on the part of all communities of interest that ecosystem function, resilience and self organizing capacity will be maintained or improved over the long term. It must involve an acceptable identification that the full costs, benefits and risks to the ecosystem have been identified and factored into the project.

It must also instill a reasonable degree of confidence that the capacity of project affected renewable resources will be maintained or enhanced so that the needs of future generations are met.

Finally, there must be steps taken to ensure the continuing integrity of the environmental systems. And these steps must also be understood by and acceptable to, all communities of interest.

4. *Economy.* Is the financial health of the project assured? This will entail the preparation of proper cost/benefit analyses of the project itself. NWMO's funding is prejudiced on a set of assumptions about the eventual costs of waste disposal. Given that there has been no experience of long term disposal and little of the option of regional concentration, it is important that these figures be subjected to independent analysis by the relevant communities of interest. It is also important to bear in mind the history of major cost overruns with previous nuclear investments.

The proponents will also need to demonstrate that the project and its operation contribute to the long-term viability of the local, regional and national economy in ways that will help ensure employment for local people and provide specific opportunities for the less advantaged?

Should a decision be taken for geological disposal, there is a good deal of experience in Canada with involving remote and aboriginal communities in this regard.

5. *Traditional and Non-market Activities.* Will the project or operation contribute to the long-term viability of traditional and non-market activities in the implicated community and region? "This question addresses the success of non market human activities that are omitted from typical economic studies. For projects affecting indigenous people, a variety of traditional cultural activities come into play including

hunting, gathering and fishing. In addition, the internal cultural and social structure of indigenous people is vulnerable to pressures that arise.”⁸

6. Institutional Arrangements and Governance. This is perhaps the toughest question of all. **Is it conceivable that one could develop social and governance structures necessary to keep these wastes safe over literally thousands of years?** The impossibility of such a guarantee is one of the key arguments used by the proponents of geological disposal.

“The need to keep communications structures active over time-spans of hundreds, thousands, even tens of thousands of years and the unusual technical and economic challenges and burdens of such plans, make it illusory to guarantee the required levels of societal, technical and financial continuity needed for these purposes.”⁹

Nevertheless, the approvals process will need to give reasonable assurances that institutional arrangements and systems of governance are in place that can provide certainty and confidence that: the capacity of government, companies, communities and residents to address project or operation consequences is in place or will be built; and that this capacity will continue to evolve and exist for the foreseeable future.

Also, communities of interest will need assurances that the present system of governance and management can carry out this whole rather complex process and make the kinds of trade-offs necessary in a fair and transparent fashion.

7. Overall Integrated Assessment and Continuous Learning. Has an overall evaluation been made and is a system in place for periodic re-evaluation based on consideration of all reasonable alternative configurations at the project level (including the no-go option in the initial evaluation)?

Has consideration been given to all reasonable alternatives at the overarching strategic level for supplying the commodity and the services it provides for meeting society’s needs? There will need to be consideration given here to “alternatives” to the alternatives presented by the government to the NWMO. I am thinking particularly of the proposition that the geological option can apparently be carried out in such a way that it does not become “permanent” for at least 50 or 60 years, thus preserving options for other ways of dealing with the wastes should technology develop in the meantime.

8. Security. Does this method of dealing with radioactive waste contribute to North American security? In the post September 11 period, security has moved to the top of the public policy agenda and it would be folly to ignore it.

And will the eventual result enhance or reduce access to nuclear materials to terrorists? The eventual choice of mechanism for dealing with nuclear wastes will have to pass a

⁸ Ibid, page 45

⁹ Ibid, p 23

rigorous security analysis. As Franklyn Griffiths points out in his excellent paper, each of the solutions has its own security attributes and failings. Geological disposal may well have the advantage of easier security, but remote sites pose their own security risks and the transportation process has its own risks. Local site disposal may be more accessible to potential terrorists and a regional site carries its own risks of vulnerability to a single attack.

9. Ethics Is this process itself being carried out in an ethical fashion? Here we need to bear in mind the strictures of the Seaborn panel in their final recommendations (they recommended that the NFWMA should either hire or contract a group of social scientists and ethicists, who would establish an assessment framework with input from the public).

And the process will have to consider the ethics of nuclear waste management and its impacts on future generations. One set of principles was set out by a scientist from the Nuclear Energy Agency of the OECD.

“Ethical Principles Formulated in the Context of the Long Term Management of radioactive waste:

- The generation producing the waste is responsible for its safe management and the associated costs.
- There is an obligation to protect individuals and the environment both now and in the future
- No moral basis exists for discounting future health and risks of environmental damage
- In particular, our descendants should not knowingly be exposed to risks which we would not accept today. Individuals should be protected at least as well as they are today
- The safety and security of repositories should not be based on the presumption of a stable social structure for the indefinite future or on a presumption of technological progress
- Waste should be processed in such a way as not to be a burden for future generations...
- We are responsible for passing on to future generations our knowledge concerning the risks related to waste
- There should be enough flexibility in the disposal procedure to allow alternative choices.”¹⁰

Doubtless there are many alternative formulations of the problem and the ethical framework needed to address its solutions. The point here is that the intergenerational aspects of the waste handling issue must be at the center of any long term solutions to the problem.

¹⁰ Long-term management of radioactive waste: Ethics and the environment: C. Pescatore, NEA newsletter, No.1-1999 pp.13-15

10. Risk and precaution. Do we have an adequate perception of the risks of each of the possible solutions? Has the risk assessment been carried out in a transparent fashion?

There is little to add to the paper prepared on the subject by Kristin Shrader-Frechette. But it is important to remember that risk assessment is not an exact science. Much depends upon the initial assumptions and these assumptions must be transparent if the analysis is to be accepted by the interested communities of interest.

But in the end "... it is necessary to understand the mechanisms that govern the social perception of risk. There are many factors that affect the perception of risk, such as the level of control, familiarity with the technology, the degree of uncertainty, concern for the consequences, the degree of credibility of the institutions, the decision-making process and the ideas and values of the community in which people live."¹¹ This is a decision that must be informed by experts. But it must be made by citizens.

If there is considerable scientific uncertainty in the case of any of the three choices, should the NWMO proceed on the basis of the Precautionary Principle? This principle was adopted at the Earth Summit in 1992. In essence, it says that where there is scientific uncertainty about a result, but that the potential consequences of proceeding could prove grave or even catastrophic, it may be best not to proceed. This principle has been the subject of heated debate within the federal government and is enshrined in a number of Canadian laws and regulations, notably the Canadian Environmental Protection Act.

This decision making framework is much more complex than can be elaborated in a paper of this length. But if all of these steps are followed rigorously and as transparently as possible, the citizens of Canada and the residents of the affected communities should be confident that the final decision has been made in full consideration of the principles of sustainable development.

¹¹ Radioactive Waste management and Sustainable Development, J. Lang-Lenton Leon, NEA News 2001-No. 19.1, p 20