MANAGEMENT OF RADIOACTIVE WASTE		
Consumption and Production Patterns	**Waste Generation and Management**	

1. INDICATOR

(a) Name: Management of Radioactive Waste.

(b) Brief Definition: Radioactive waste arises from various sources, such as nuclear power generation and other nuclear fuel cycle related activities, radioisotope production and use for applications in medicine, agriculture, industry and research. The indicator provides a measure of both the current status of radioactive waste management at any point in time and the progress made over time towards the overall sustainability of radioactive waste management.

(c) Unit of Measurement: a dimensionless indicator ranging from 0 (least sustainable condition) to 100 (most sustainable condition) in increments dependent on the progress towards safe storage or disposal. The factor may be calculated for each waste class used by a country or it may be presented as an average for all waste classes.

(d) Placement in the CSD Indicator Set: Consumption and production patterns/Waste generation and management.

2. POLICY RELEVANCE

(a) Purpose: The purpose is to represent the progress in managing the various radioactive wastes that arise from the nuclear fuel cycle and/or from nuclear applications. Quantitative information is required to indicate this progress by way of a baseline for full sustainability coupled with a knowledge of the key steps towards full sustainability.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Radioactive waste, if not properly managed, can have a direct impact on health and the environment through exposure to ionizing radiation. In order to protect human health and the environment, appropriate waste management strategies and technologies must be employed. Fundamental principles of radioactive waste management, as well as activities such as minimization of waste arisings, involve systematically considering the various steps in treatment, conditioning, storage and disposal. Effective management of waste (control of inventory) has a positive impact regarding sustainability as it reduces the pressure on the environment and the commitment of resources. Waste management strategies seek ultimately to confine and contain the radionuclides within a system of engineered and natural barriers so that any releases to the environment are small compared to natural background.

(c) International Conventions and Agreements: The Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management

[Ref 1] entered into force June 2001. This convention binds Contracting Parties to manage spent nuclear fuel and radioactive wastes using sustainable waste management practices.

(d) International Targets/Recommended Standards: The International Atomic Energy Agency (IAEA) has established Safety Standards, Fundamentals, Requirements and Guides [Ref 2 - 4] applicable to the management of radioactive wastes. It has also established Basic Safety Standards for the Protection of Humans against Ionizing Radiation [Ref 5], that are consistent with recommendations of the International Commission on Radiological Protection (Ref 6,7).

(e) Linkages to Other Indicators: A large portion of radioactive waste arises from practices within the nuclear fuel cycle, therefore major current arisings are related to a significant generation of electricity by nuclear means with an equivalent reduction of environmental impacts by other energy sources (Chapter 4 of Agenda 21). This implies a reduction in the release of atmospheric pollutants; notably greenhouse gases, contributing to the protection of the atmosphere (Chapter 9 of Agenda 21). Since some radioactive waste arises from medical applications, such as treatment with radioisotopes or sealed radiation sources and nuclear medicine research, a link exists with the extent of these applications and with the protection and promotion of human health (Chapter 6 of Agenda 21). Additional links are with the transfer of environmentally sound technology (Chapter 34 of Agenda 21) and with the environmentally sound management of hazardous waste (Chapter 20 of Agenda 21).

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Principles regarding the protection of future generations are formulated in the International Atomic Energy Agency's Safety Fundamentals [Ref. 4]. IAEA definitions and the classification of radioactive waste are given in relevant standards, accessible via [Ref 8].

(b) Measurement Methods:. Management progress is measured against key milestones related to both the processing of waste into forms suitable for either safe storage or for placement into a designated endpoint (the "form factor") and to the placement of waste into an endpoint facility ("endpoint factor"). Each factor has four states with values assigned according to specified milestones. Determination of progress to towards sustainable waste management requires a knowledge of the status of the designated milestones, which is in turn related to (1) the rate of waste generation, (2) the rate that wastes are put into suitable forms and (3) the rate that wastes are placed into an endpoint facility. All rates have units m3/a or tonnes/a (mass is typically used for spent nuclear fuel that is declared to be waste). A five year moving average is recommended for the determination of these rates. Details of the methodology to calculate the indicator can be obtained via the contact point identified in Point 5 below or via the link "GUIDANCE FOR CALCULATING THE INDICATOR OF SUSTAINABLE DEVELOPMENT FOR RADIOACTIVE WASTE MANAGEMENT" before Point 4 below.

(c) Limitations of the Indicator: The management of radioactive waste is only a first approximation of its hazard. It is assumed that only improperly managed waste can have an impact on human health and the environment. The actual impact requires a site specific analysis taking into account the isotopic and chemical composition of the waste. This indicator gives a measure of progress towards reduction in the volume of waste that could impact upon health and the environment. As configured, this indicator does not seek to establish progress with historic waste management.

(d) Status of the Methodology: Safety assessment of the radiological hazard of radioactive waste disposal is considerably advanced and is used as the basis for regulatory decisions in many countries (the milestones of factors are related to specified regulatory decisions, such as the approval of a disposal facility for operation).

(e) Alternative Definitions/Indicators: None.

GUIDANCE FOR CALCULATING THE INDICATOR OF SUSTAINABLE DEVELOPMENT FOR RADIOACTIVE WASTE MANAGEMENT

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: the volumes or masses of the various classes of radioactive waste (1) arising annually, (2) processed to suitable forms and (3) consigned to an endpoint facility expressed in cubic metres per annum (m3/a) or tonnes per annum (tonnes/a) plus a knowledge of the status of specified milestones for the form and endpoint factors

(b) National and International Data Availability and Sources: At the national level, the volume or masses of radioactive waste arisings can be obtained from the waste accountancy records maintained by the various waste generators or, in consolidated form, from either national waste management organizations or regulatory bodies. Almost one third of the IAEA member states keep some type of national radioactive waste registry. The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management requires Contracting Parties to report an inventory of radioactive waste that is subject to the Convention. Through this mechanism, both the availability and the quality of data is likely to increase over time.

(c) Data References: The primary source for data includes national or provincial/state level governmental organizations. A secondary source may be databases managed by international organizations such as the IAEA or the Nuclear Energy Agency of the Organization of Economic Cooperation and Development (OECD/NEA).

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The International Atomic Energy Agency. The contact point is:
Indicator of Sustainable Development for Radioactive Waste Contact Point
International Atomic Energy Agency
Department of Nuclear Energy

Division of Nuclear Fuel Cycle and Waste Technology
Waste Technology Section
Wagramer Strasse 5, P.O. Box 100
A-1400, Vienna, Austria
E-mail: ISD-RW@iaea.org

(b) Other Contributing Organizations: Governments and inter-governmental organizations, possibly the European Commission (EC), the OECD/NEA, the United Nations Environment Programme (UNEP), non-governmental and other organizations, such as the International Union of Producers and Distributors of Electrical Energy (UNIPEDE) and the Electric Power Research Institute (EPRI).

6. REFERENCES:

[1] *The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management,* as adopted in September 1997 (IAEA Press Release PR 2001/05, 20 March 2001, http://www.iaea.org/worldatom/Press/P_release/2001/prn0105.shtml).

[2] IAEA's Safety Guides (Safety Series No. 111-G-1.1), 1994, *Classification of Radioactive Waste.*

[3] IAEA's Safety Standards (Safety Series No. GS-R-1), 2000, *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety.*

[4] IAEA's Safety Fundamentals (Safety Series No. 111-F), 1995. *The Principles of Radioactive Waste Management.*

[5] IAEA's Safety Standards (Safety Series No. 115), 1996. *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources.*

[6] ICRP Publication 46, 1996. *Radiation Protection Principles for the Disposal of Solid Radioactive Waste,* Pergamon Press, Oxford.

[7] ICRP Publication 60, 1991. 1990 *Recommendations of the International Commission on Radiological Protection.* Annals of the ICRP 21 (1- 3), Pergamon Press, Oxford.

[8] World Atom Internet site: http:/ww.iaea.org/worldatom/