AN OVERVIEW OF THE WORLD STATUS OF RADIOACTIVE WASTE MANAGEMENT

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Determining the status of radioactive waste management worldwide is not straightforward. International databases are not yet comprehensive enough and the existing national databases do not usually transform the quantities of waste into risks to humans and the environment or detail costs of disposal and remediation. All calculated risks and costs have large uncertainties, so global numbers are not particularly useful at this time. The only certainty is the existence of large quantities of waste that must be taken care of.

The IAEA's proposed waste classes include Exempt Waste, Low and Intermediate Level Waste (a. short lived, b. long lived), and High Level Waste. Most countries with extensive radioactive waste programmes usually classify waste by its origin and include mining and milling waste and decontamination and decommissioning waste. Also, they are concerned about radioactive sources used in industry and medicine, naturally occurring radioactive materials and radioactively contaminated soils and waters.

The amount of radioactive waste in each country is a function of the amount of nuclear power generated, whether it is a nuclear-weapon State, the level of technology in the country (which determines the medical and industrial uses of isotopes), whether uranium is mined for energy generation, and the date weapons and commercial power development was started.

In the 1940s, with the emphasis on weapons production and wartime and cold war rivalries, the competition to produce plutonium and the lack of scientific and technical knowledge resulted in gross processing inefficiencies and, in some cases, overrode human and environmental safety concerns. Not only was the level of technical sophistication different at that time; the level of protection for humans and the environment thought appropriate was also different. Further complicating the problem of extrapolating from the past is the fact that the measurement techniques and requirements were not what they are today and much of the information needed for accurate analysis did not exist. Also, as the technology has changed, the volume of waste has decreased greatly. However, the laws of physics have not changed and the radioactivity generated from a 3000 MW(th) fission plant remains the same. Moreover, the largest volume of new waste will come from decommissioning and dismantlement. Depending upon the degree of advancement in technology and increases in recycling, this waste could overwhelm present facilities. What this means is that a simple extrapolation of volumes from the past is not likely to be correct. Nor is the extrapolation of risks from the past likely to be correct, particularly considering the long periods covered by safety assessments - with some countries requiring "assurance" of safety beyond a million years into the future. It is recognized that it is not possible to reliably predict the fate of waste nor the changes in the human condition over those times.

We should, however, keep the problem in perspective. This paper is about radioactive waste management and not radiation risks to humans, though that is what is of most concern to people. Risks from radiation from fallout from atmospheric testing of nuclear weapons will not be considered even though its impact to date is more than ten times greater than that of all other anthropogenic sources other than medical exposures. Natural sources of exposure, such as radon in homes, will not be considered either even though their impact is 20 times greater than that of all anthropogenic sources other than medical exposures. Nor do we consider the effects of nuclear warfare, such as the deaths and radioactively contaminated soils and water that they have produced.

There have been a number of recent successes in disposing of waste such as the opening of the first deep geological repository for transuranic waste, the Waste Isolation Pilot Plant in the USA; the opening of low level waste facilities in Spain and Finland, and the opening of the Tailings Management Facility in Canada; and the steady progression towards development of high level waste repositories in Sweden and Finland. However, there have been a number of setbacks with delays in establishing deep geological repositories in Canada, France, Germany, Switzerland, the United Kingdom and the United States and the failure to open new low level waste facilities, even already licensed ones such as Ward Valley, in the USA. Remediation of contaminated soils and waters is progressing in most western countries though such remediation continues to lag elsewhere.

Beyond that, what will occur in the future is mere speculation since the choices are more influenced by policy, (e.g. recent policy changes in Germany, energy crises such as in 1973, global warming concerns, sustainability concerns, risk preferences) than by scientific and engineering principles. On a global basis, it seems that efforts will continue in pollution prevention and waste minimization so that the urgency for new low level waste disposal facilities will decrease, provided that recycling plays a large role during decontamination and decommissioning and remediation. Decontamination and decommissioning and remediation will continue until the public and the scientific communities perceive greater risks elsewhere or until the cost no longer justifies the risk reduction. For high level waste, the delays currently being experienced in many countries will negatively affect those countries moving towards establishing repositories unless the high level waste can be placed at or near presently existing waste disposal sites and nuclear energy facilities. Consensus is being reached that retrievability is essential for public acceptance though it violates the principle of this generation taking responsibility for its waste. Alternative methods (e.g. separation and transmutation) will be sought with limited success.