Sustainable Development and High Level Waste

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Background

Sustainable development, defined by the Brundtland Commission as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" [1], relates to a number of issues such as population, health, food, species and ecosystems, energy, industrial development, urbanization, societal issues and economy, and how these global challenges could be met within a long term strategy.

It is not obvious how the principle may be applied to final disposal of radioactive waste, but the global scope of the principle suggests that no sector in society should be exempted from scrutinizing its practices in the light of the challenge presented by sustainable development.

Goals for management of radioactive waste

Waste management, as pointed out by the International Commission on Radiological Protection, ICRP [2], cannot be seen as a free standing practice in need of its own justification. The produced waste cannot be seen separately from the other components of nuclear production. However, the existence of very long-lived radioactive nuclei in the spent fuel warrants a careful examination of this sub-practice.

International consensus on general principles

International consensus concerning important ethical principles for waste management is expressed in the "Collective Opinion" concerning the environmental and ethical principles of geological final disposal prepared by the Radioactive Waste Management Commission [3], and in the International Atomic Energy Agency's (IAEA) publication on basic principles for waste management [4].

The most important criteria or principles for the post-closure phase of a repository are

> Principle 1: Protection of human health.
> Radioactive waste shall be managed in such a way as to secure an acceptable level of protection for human health.
>
> Principle 2: Protection of the environment. Radioactive waste shall be managed in such a way as to provide an acceptable level of protection of the environment.
>
> Principle 4: Protection of future generations. Radioactive waste shall be managed in such a way that predicted impacts on the health of future generations will not be greater than relevant levels of impact that are acceptable today.

The first two concern two important principles relevant to sustainable development and the third principle, No. 4 in ref. [4], contains an important commitment to protect humans in the future as we do today. This principle implies a clear commitment for regulators.

Referencing the future

Assumptions about the future

If human health as the endpoint in a performance assessment, PA, how may we describe man and the biosphere in a distant future? The answer of this problem relates to the very purpose of the repository and the purpose of the goal and criteria in force. It can therefore never be given a complete scientific answer separated from its philosophical-political context. It must fit in with the view of the future in other areas of jurisprudence.

It may safely be deduced that humans in the future are not much different from humans today in terms of need of water and foodstuff. They would otherwise simply not qualify as "humans". Apart from that, however, all assumptions seem easy to challenge. No one knows the future.

The main problem in this domain is related to the biosphere's changes in the future, both natural and anthropogenic, and the different possible lifestyles. The possible developments include both changes near the repository site, and global changes of the biosphere.

The need of regulatory decisions in this area has been seen and addressed in several national nuclear waste programs. In these programs it is recognized that the existing society is a valid test case for performance assessment, as in the following examples of regulations:

From the US - EPA

> *Performance assessments /.../ shall assume that characteristics of the future remains what they are at the time the compliance application is prepared, provided that such characteristics are not related to hydrogeologic, geologic or climatic conditions* [5].

From Sweden – the Swedish Radiation Protection Institute

> *The description shall include a case, which is based on the assumption that the biospheric conditions which exist at the time that an application for a license to operate the repository is submitted will not change* [6].

Both cases point to today's biosphere as a reference biosphere. In the Swedish example, the comments to the regulations explain that changes such as land uplift, which stems from geological conditions, should be included in the assumptions on the biosphere.

The decisions from the regulators in the examples above does not eliminate questions about man and the biosphere, but they both cautiously avoid the mistake of forcing the implementer into unlimited speculation about society's development during thousands of years.

The total burden in the future

The second problem is to allow for resources for future generations, so that in Brundtland's words *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* [1].

This is an area where there is no consensus internationally, not even an awareness of the problem. The issue, is demonstrated by the following line of reasoning, formulated bluntly:

> We have in Sweden a limit on 0.1 mSv/year for releases to individuals of the public. This limit has been set to prevent a total yearly dose in excess of 1 mSv. Assume now that there will be no nuclear production after 2010 in Sweden (ever). In that case, we might allow higher releases, since there is no combination of the releases today with those of the future.

The argument can be generalized to any waste producing activity and could be presented as follows:

> Since we don't know the future it is inappropriate to make assumptions about how it might develop. For this reason, it is better to assume the future does not exist. From this, in turn, follows that we can pollute relatively freely. We must think of the consequences of *our* activities tomorrow, but we don't have to take into consideration the fact the society tomorrow has its own pollutants on the top of what remains from ours.

Sustainable development and existing criteria

As mentioned above, health based post-closure criteria or standards for long-lived waste, usually make use of the concept of partitioning dose limit. ICRP recommends that individuals in the public do not receive a yearly dose in excess of 1 mSv as a result of releases in connection with activities involving the use of ionising radiation, and that any single facility does not generate a dose burden to individuals in excess of a fraction of this value. For an operating facility, this fraction is normally at least a factor of three.

By definition, operational changes are not possible for a closed repository. It follows from this that the partitioning has another function. One interpretation is that it can allow for the simultaneous use and burdens of future generation's activities. Both the Swedish and the proposed US criteria and from EPA and NRC, as well as standards from Canada, UK and others make use of partitioning or have sufficient margins to incorporate the proposed aspect of sustainable development.

Conclusion

International guidance is sufficiently protective to allow for sustainable development in the context presented here. Taking sustainable development into account does not necessarily imply that the partitioning value should be the same for all, or that differences in national legislative systems should not be recognized. Instead, it is an aspect to be taken into account as protective systems develop along with other parts of resource and risk management for the future.

6 References

1. United Nations, 1987
2. ICRP publication No. 77, Radiological protection policy for the disposal of radioactive waste, 1997.
3. OECD/NEA, The Environmental and Ethical Basis of Geological Disposal, Radioactive Waste Management Committee, 95.
4. The Principles of Radioactive Waste Management, IAEA 1995.
5. EPA 40 CFR part 194.25, Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR part 191 disposal regulations
6. The Swedish Radiation Protection Institute's Regulations concerning the Protection of Human Health and the Environment in connection with the Final Management of Spent Nuclear Fuel or Nuclear Waste; 10 §, translated from Swedish.