S. Mundigl*

Radiological protection of the environment

Recent debates on radiological protection have begun to raise the question of establishing a system for protecting the environment. Until now, the system of radiological protection has focused on the protection of humans, implicitly assuming that this would also appropriately protect the environment. However, an evolving civil society is increasingly unsatisfied with such an approach, and it is becoming imperative to demonstrate that the environment is protected.

Since the early part of the 20th century, the primary aim of radiological protection has been to provide an appropriate standard of protection for humans, without unduly limiting the beneficial use of radiation exposure, for example for medical treatment. Over time, as new studies on the effects of ionising radiation have been carried out, the system of radiological protection has evolved. The current system based on the Recommendations of the International Commission on Radiological Protection (ICRP) is presently under review in order to see where improvements can be made.

One of the goals of the review is to make the system of radiological protection more coherent and concise. Consideration is also being given to the protection of the environment. In various international groups, work is under way to develop a rationale for radiological protection of the environment that is comprehensive and can be implemented in an efficient manner. The NEA proposed to contribute to this work by promoting and establishing a process for the development of a policy that is as broadly informed as possible. This approach was also designed to foster information exchange among the various initiatives.

** Dr. Stefan Mundigl (e-mail: mundigl@nea.fr) is a member of the NEA Radiation Protection and Radioactive Waste Management Division.*

A new system for protecting the environment

Based on discussions held at an NEA-ICRP forum[1] early in 2002, the system for protecting the environment will have to be built on solid scientific foundations, and lead to the formulation of clearly defined regulations so that situations can be properly assessed and monitored. This will help ensure successful implementation. While predicated on scientific considerations, it will have to include social, philosophical, ethical, political and economic considerations as well. It will also draw upon those aspects of the precaution principle that are relevant to this application. In the end, the systems for protecting humans and protecting the environment should clearly take mutually coherent approaches. This will be important for societal acceptance, but it does not necessarily mean adopting strictly identical systems, which could be difficult to achieve.

The current notions of justification and optimisation will have to be redefined in order to integrate the environmental component into the broader system. Trends that go beyond the current anthropogenic definition of optimisation are already emerging. Indeed, there is currently a notable shift in the ALARA (as low as reasonably achievable) principle as it applies to the management of discharges into the environment. With increasing pressure from society, regulators are beginning to consider ALARA in parallel with the notion of BAT (best available techniques). This clearly corresponds to the public's demands to discharge as little waste into the environment as possible – as a precaution, but also in response to a new notion of maintaining a "clean environment".

Defining the environment to be protected

If the environment is confined to the human habitat, the existing system of radiological protection, if applied correctly, is sufficient. By protecting people on an individual basis the environment is respected. Under the current anthropocentric approach, for example, the environment is monitored to ensure that the public is not overexposed. To this end, regulatory limits are imposed on what can be discharged into water or the atmosphere, and regulators already take these factors into account when licensing nuclear facilities. Such aspects are also considered when contaminated sites are rehabilitated and subsequently reoccupied by the public. The drawbacks of such a system are most evident in the cases of sparsely populated or uninhabited areas of the planet. In addition, the co-factors classically studied for humans, namely chemical, physical or bacteriological toxins, are more extensive in the case of the environment.

If the definition of the environment is broader than just humans and their immediate surroundings, and extends to uninhabited areas, the tenet of "protection through protection of man" remains to be proven, and would, in fact, seem not to hold true under all circumstances. It would notably fail to addresses the issue of sites from which humans are absent, such as the Kara Sea, but which is nonetheless the subject of deep concern. Nor does it address the issue of environmental protection in connection with the management of deep geological disposal sites, even though as much as possible is being done to ensure that the current and future impacts on humans and their environment are either negligible or acceptable. Other "hybrid" cases can also be imagined, such as releases which cause little exposure to humans or to parts of the human food chain, but which significantly expose other components of the environment.

Radiological monitoring of the environment
at the McArthur River uranium mining site in Canada.

A biocentric approach in which certain species would be designated for protection runs the risk of being both subjective and incomplete. An ecocentric approach, based on the preservation of ecosystems, seems best suited to protecting the environment as a whole. This is supported by the growing ability of scientists to demonstrate that an action at one level, however trivial, can have a delayed impact in both time and space.[2] Actions leading to climate change and problems of the ozone layer are examples. However, once the target of protection has been identified, the problems of assessing effects and estimating risks remain to be resolved.

Setting protection levels

If the system is to be practicable, regulators will require clear definitions of the objectives and the methods for attaining them. The same principles of protection should also apply to all environmental pollutants, be they radiological, chemical or biological. The system will have to be pragmatic if it is to be credible, and if it is to be understood by users and by the public. Regulators also need numbers in order to monitor the system's application. Obviously, the simpler these numbers are, and the easier they are to check, the more likely the system will be implemented and understood. A performance-based regulatory system may also be appropriate.

Given the global nature of environmental protection, it would seem necessary to devise a system that is coherent at the international level, and also provides guidance and boundaries that are sufficiently clear and specific to preclude differing local interpretations of environmental protection levels. However, coherency does not necessarily mean uniformity, and the environmental protection system will have to be flexible enough to allow for local initiatives, since public acceptance of an environmental policy requires consensus between stakeholders at different levels.

In the case of "highly mobile pollutants" that are able to cross borders easily, and that can be found anywhere on the planet, an international consensus is clearly desirable. This would cover pollution of the air as well as the seas and oceans. Such pollution could be brought on, for example, by atomic weapons testing and extremely serious accidents such as Chernobyl.

In other situations, in which the impact of discharges is confined to a certain space, a regional consensus would be enough, bringing together a number of affected countries but not going beyond the limits of a given geographical area. This is the case with certain factory discharges that, because of their ecological behaviour or half-life, will affect limited geographical areas only.

For pollutants with limited dispersion, such as radioactive waste that is to be stored deep underground, the consensus will have to be achieved at the national and even local level, because populations living tens of kilometres from a storage site may not perceive the site's hazards in the same way as those living nearby. This geographic definition alone may greatly help in resolving certain potential conflicts. For example, some populations in locally contaminated areas may prefer to run slightly higher risks rather than lose jobs or be forced to relocate.

The figures adopted could convey dose rates (Gy/Unit of time) to which targets (reference species for example) are subjected, and/or concentrations (Bq/Unit of mass or volume) in which targets live. To define an internal dose, as for humans, would seem almost impossible and unnecessary, and could only complicate the system. A simple dose rate or concentration approach would allow better comparisons with other environmental pollutants. For this, studies to define "sentinel species", representative of the "health" of an ecosystem, will be necessary.

With evolving technology, the system will have to be flexible, and designed to allow for advances. With the acceptability of some risks being subjectively judged at the local and/or national level, it is conceivable that the system allow for a given country's level of development, with more being asked of the most technologically advanced countries while not being lax vis-à-vis others. Protecting the environment will clearly be a long-term process, and the speed with which the system is applied will have to take societal context and national priorities into account. Such discussions, for example, are ongoing with regard to the atmospheric pollutants that threaten world climates, and consideration must be given to a similar approach to discussions between countries so as not to unduly penalise the developing world.

Public consultation and societal aspects

Few would question the need for dialogue with all segments of society before such a system is instituted, but this will also be necessary when the system is put in place. Populations face a variety of different social constraints, and foremost among these is the need for employment. Stringent protection that would jeopardise that paramount consideration would be rejected sooner or later, and it could trigger secondary effects in society that would be worse than the hazard being combated. Any international organisation that proposes a new system, such as the ICRP, will have to dialogue with, listen and be responsive to users.

Conclusions

Protection of the environment with the current system of radiological protection is sufficient, as long as humans are part of the ecosystem. In situations where man is absent, the system cannot prove that the environment is adequately protected. The future system for the radiological protection of the environment will need to be pragmatic, and flexible enough to provide for regional solutions. The process for developing the system will need to involve a wide range of stakeholders so as to ensure its acceptance, which can greatly influence future implementation. The series of NEA-ICRP fora, the next of which will be held in April 2003 in Spain, are part of a positive process of dialogue that is being put in place. Co-operation among the scientific community and other interested parties should lead to the development of a widely beneficial and efficient system of protection. ■

Notes

1. The NEA-ICRP forum on "Radiological Protection of the Environment, The Path Forward to a New Policy?", was held on 12-14 February 2002 in Taormina, Italy. A second forum will be held on "The Future Policy for Radiological Protection" on 2-4 April 2003 in Lanzarote, Canary Islands, Spain.
2. Bréchignac, F. "Environment versus man radioprotection: The need for a new conceptual approach?", *Radioprotection*, Vol. 37, C1, pp. 161-166.