

**U.S. Nuclear Regulatory Commission  
Comments to ICRP on  
Draft Task Group Report on  
Protection of Non-Human Species from Ionizing Radiation**

General Comments

1. The Nuclear Regulatory Commission has fundamental concerns about the thrust of this draft ICRP publication. The scientific underpinning is lacking for a costly set of new regulatory requirements to protect non-human species. NRC has seen no reason to discard ICRP Publication 60's presumption that by protecting individual humans to current standards, adequate protection is provided to non-human species. Under NRC's current regulatory process, it would be extremely difficult to justify additional regulatory requirements to protect non-human species without considerable additional information beyond the record compiled in this draft ICRP publication.
2. The Task Group report does not appear to make the safety case that the current system of regulations (i.e., if humans are protected, then so is the environment) is an unacceptable method or has any substantial weaknesses. Rather than developing a detailed framework as suggested by the Task Group report, it would seem that the appropriate first step would be to evaluate more explicitly to what extent the current recommendations to protect humans provide for adequate protection of the environment. If the concern is one of transparency of how the current system to protect humans provides protection of the environment, then this could be resolved by making such an evaluation. The report should be augmented with a discussion of how the current system protects the environment, so that ICRP policy-makers can make a fully informed decision.
3. The recommendations of the Task Group report in Chapter 7 are written at a very high level. As such there is not a clear tie between the discussions throughout the report and the recommendations. The recommendations of the report are very general in nature and lack specificity. This made commenting on implications of the recommendations problematic. For example, the report recommends developing a system of radiological protection that includes protection of the living environment with a clear set of objectives and principles; however, the system, objectives, and principles are not described. The report discusses several systems, objectives, and principles in detail, but it is not clear which of these the report is recommending.
4. A lot of additional research and model development will be required to bolster the scientific basis. The Task Group report should make it clear that a great deal more work is needed before the dose criteria and modeling for protection of non-human species can be developed. The scientific community found it difficult to develop a reference man for radiation protection uses. The number of uncertainties associated with the use of a reference flora and fauna, given the wide range of species and exposure pathways, is very great. We would envision groups of flora and fauna that behave similarly and the establishment of exposure protection guidelines for these groups. Such an effort will need strong scientific support. Given that this will take some time to develop, the Task Group report should propose a plan with milestones to be used by ICRP policy makers to develop a stepwise or tiered approach for implementing the recommendations for

protection of non-human species. Also, on a national scale, public involvement in establishing any final exposure guidelines for non-human species would be required. A stepwise or tiered approach would allow for stakeholder involvement throughout the development of the final approach.

5. Consideration must be given to the cost of additional research versus the benefit that would be gained. The draft Task Group report should discuss the regulatory burden associated with implementing additional recommendations and requirements. This regulatory cost needs to be balanced against the change in the level of protection of the environment. Given that the current system does provide some level of protection, it may be more prudent for the ICRP to more explicitly evaluate the level of protection provided by the current system to determine if additional protection is required.
6. The Task Group report discusses the benefit of developing a framework for radionuclides that is similar to that for chemicals. In the US, the environment is protected from chemical contamination through both media concentration limits and discharge limits. In addition, the ecological risk assessment methodology developed for chemicals could be modified to include radionuclides. The framework should not focus solely on dose or dose rate, but should allow flexibility to allow regulation using secondary limits, such as media concentration limits and discharge limits. In addition, the framework should allow for prospective analysis to be useful in preparing environmental impact statements or environmental impact assessments.
7. It is not clear how the optimization process would be applied to environmental dose or harm with respect to the rationale associated with Table 5.1. For humans, one balances risk versus benefit versus available resources. The framework should discuss how one would balance “acceptable” risk in the face of available resources in the optimization of the non-human system. The framework should discuss how far one would go with respect to acceptable risk in the face of available resources. Moreover, in considering justification and optimization, the framework principles should recognize national efforts in the areas of pollution prevention, conservation, and sustainability.
8. In the case of humans, a reference person has been used to establish the lowest common denominator. What is the reference environmental species? The concern is that different fauna and flora species react differently to the same radionuclides in specific chemical configurations. This may drive the reference species concept to the most sensitive to a specific radionuclide (or class of radionuclides) in a specific chemical form. In conjunction with the precautionary principle, this has a very real possibility of driving the acceptable levels of derived concentrations to well below those optimized for human health and safety. This is further supported by the fact that a full understanding of the impact on all flora and fauna, from all radionuclides, in all chemical forms, will be difficult to achieve. So the natural tendency, in cases where a full compendium of knowledge is not available, is to use very conservative assumptions. The full consequences of this inevitability should be carefully considered.
9. Natural background (including cosmogenic and other contributions) must be considered, so that the derived concentration levels do not result in unduly burdensome criteria. Constraints representing small increments above the contribution of natural background

introduce questionable benefits and costly (and often unnecessary) monitoring obligations. So a reasonable start of this process would be to use natural background levels and to classify artificial radionuclides in terms of equivalent hazard. It should also be recognized that natural background may vary between aquatic and terrestrial species.

10. In light of the uncertainties regarding reference environmental species, perhaps a reference habitat (habitat indicators) may be more useful, where the collection of species in the habitat could be used as an indicator of environmental effect. The difficulty here is whether it is the radioactive or the chemical component or a synergistic combination causing the effect. There are studies of accidents and their environmental harm; [e.g., the fieldwork after the Sverdlovsk-Chelyabinsk accident in the Urals, where comparison studies were done on environmental impacts (e.g., the resistance of deciduous trees versus conifers)]. The record may be more fruitful for compiling the vulnerability of non-human species (both fauna and flora) to radiation exposure -- both direct and systemic.

#### Specific Comments

1. The Task Group report discusses the development of a small number of reference organisms similar to reference man. These reference organisms would have specific external dose conversion factors for various radionuclides. It is implied that the internal dosimetry would be as sophisticated as that for reference man. Given the uncertainties and variability associated with the environmental transfer through various food stuffs, such a sophisticated internal dosimetry system does not appear to be warranted and may not even be possible. The development of complex models for reference fauna and flora may be inconsistent with the ecological models that would be used to transfer the effects on individuals to populations of individuals or even ecosystems.
2. Paragraphs (30) and (74) discuss the fact that effects on higher levels of organization (e.g., populations) occur only if individual organisms are affected. This does not take into account bioaccumulation, where effects may be more pronounced in higher-level organisms. Paragraph (74) discusses radiation effects on higher levels of biological organization and the associated complexity of the interaction between each individual and its surrounding ecosystem. The Task Group report recognizes that these effects can be negatively modified by environmental stressors or by the presence of other pollutants. This discussion needs to include how positive environmental factors may also modify, or mask, the effects of radiation in the environment.
3. It appears that this report is not directed to provide quantitative recommendations on the protection of non-human species. This is understandable, because the database of knowledge of how radioactivity affects other biota is far more incomplete than that relating to humans. A possible approach would be to use an equivalent to work practice standards, for interaction with the environment; these would be actions to be encouraged by national governments, including some of the items in the list of paragraph (58). Some items, such as the precautionary principle, may do more environmental damage than good, because the precautionary principle does not balance

the incremental benefit and detriment of an action. In parallel, the ICRP could commission a long-range study of how radioactivity affects the environment.

4. Paragraph (60) discusses the use of “no expected effects” levels in the context of chemicals. It also discusses using dose rate as a measure of effects in establishing a framework for the protection of the environment from ionizing radiation. These levels for chemicals are often termed “no observed adverse effects levels” and are expressed in terms of media concentrations. If the framework for chemical and radionuclides are to be similar, then using media concentrations, rather than dose rate, would seem to be advantageous.
5. Paragraph (71) discusses that it is premature, at this stage, to try to distinguish between deterministic and stochastic effects. It would seem that, if, stochastic effects are considered then the dose limit for mammals with similar limit spans as humans would be similar. However, the dose rates suggested by IAEA as having effects on the population level and considering reproductive success as the limiting end point are significantly higher than the public dose limit. It would seem that acknowledging that cancer risk in non-human biota is not considered would provide a more reasonable explanation regarding the differences in the dose limits. It is noted that this may conflict with the biocentric ethic.
6. Effects on individuals versus higher levels are discussed in paragraphs (74) to (76), (104), (130), and (131). In setting the limits for individuals or populations, ICRP needs to be cognizant of the regulatory and financial burden when establishing what is deemed as an acceptable risk level.
7. Paragraph (113) discusses what primary reference flora and fauna are. It is not clear how the Task Group selected the reference flora and fauna approach. A more thorough discussion should be included, describing the process used by the Task Group to select this approach. The discussion should include evaluation of the six approaches to environmental protection identified in paragraph (99). Further discussion should be included on what types of biota would not be considered vital to an ecosystem. Additionally, there should be some discussion regarding the potential conflict of selecting a reference species that has public or political resonance, but is not the most radiosensitive.
8. Paragraphs (129) to (131) discuss the advantages of a combined system for the protection of man and the environment. However, further consideration should be given to how conflicts between protection of man and the environment would be resolved in developing the framework. For example, the optimization of the human system for a cleanup may show that access by humans should be limited, but the impacts on non-humans might be above the levels that required some action. For the framework to be useful, it needs to have clear guidance on how to resolve such conflicts.

In addition, the Task Group report should consider where the system for the protection of the environment would apply. That is, would protection of the environment apply within restricted areas or only where public access is allowed.

9. Paragraph (136) indicates there is an urgency in defining relevant quantities and their associated units. The current radiation protection quantities and associated units are not well-understood by general public. Adding more quantities and units would only serve to confuse and, possibly, further alienate the people we are charged with protecting.