Basis for Dosimetric Quantities Used
in Radiological Protection
Task Group of ICRP Committee 2

The U.S. Nuclear Regulatory Commission (NRC) would like to thank the International Commission on Radiological Protection (ICRP) for the opportunity to provide comments on the FD-C-2, Basis for Dosimetric Quantities Used in Radiological Protection. The opportunity to submit and review other stakeholder comments on Commission documents is greatly appreciated. The foundation document recommends several changes, which include adopting new radiation weighting factors for protons and neutrons and new tissue weighting factors used in the calculation of effective dose (formerly referred to dose equivalent).

General Comment:

The NRC staff recommends that the ICRP not attempt to complete a revision of this foundation document in the short time period before the ICRP meeting in Geneva, as implied by the "Summary of the 2005 Paris Meeting" provided on the ICRP web site, and instead recommends that ICRP take sufficient time to thoroughly consider and revise the report.

Specific Comments:

1. Page 4 No rationale was provided for changing the term deterministic effects to "tissue reactions". The original terminology should be retained unless an explanation is provided.

2. Page 6 The LNT is defined twice (in paragraph 2 and 3). LNT is redefined again on page 11. Delete these redundant definitions.

3. Page 6 The last sentences of paragraphs 1 and 2 under the section 2.1 appear redundant. Recommend that these be deleted and the issue of the assumed LNT be addressed in a separate paragraph. The dose range of LNT applicability should be clarified; the term "for radiological protection purposes," is not clear (i.e., occupational, public, and environmental protection?)

4. Page 6 The task group should consider, or at least acknowledge, the information on noncancer effects described by the Radiation Effects Research Foundation at its web site www.rerf.org.jp/top/healthe.htm for a discussion of the dose response relationships between excess relative risk versus dose for cardiovascular disease.

5. Page 8 The sentence starting at the bottom of the page, which refers to the "protection of other biological organisms," seems out of place in this paragraph. The issue should be addressed in a separate paragraph, possibly at the end of the section.

6. Page 9 The text should emphasize that the N used in equation 3.1, and supporting text, is not the same variable as the N use in equation 2.1.

7. Page 13 Section 3.2 should also address extreme cases of non-homogeneous dose distributions from external exposures (i.e., partial body irradiations). The advisability of using the average dose to an organ that is only partially exposed (i.e., bone marrow, when only the upper legs are exposed), should be addressed. Local doses could exceed the threshold for tissue damage without exceeding the dose limit if the average dose is always used.

8. Page 18 Text at the top of the page implies that determining the dose to the lens of the eye in mixed beta, gamma fields, requires two dosimeters (calibrated to Hp(10) and Hp(.07) respectively). A single operational quantity should be specified for the protection of the eye.

9. Page 25 For clarification revise second sentence to read “Radionuclide emitting neutrons are not frequently encountered in operational radiological protection situations and their internal dose contribution to effective dose is generally low.”

10. Page 28 Equation 4.7 is not correctly expressed as a continuous function. The neutron energy variable, E_n, must be adjusted in each of the last two expressions in order for the function as a whole to remain continuous. Also, the inequality in the last expression is reversed. We suggest the following correction;

$$w_R = \begin{cases} 2.5 + 18.2e^{-\left[\ln(E_n)\right]^2/6}, & E_n \le 1MeV \\ 5.0 + 17.0e^{-\left[\ln(2(E_n-1))\right]^2/6}, & 1MeV < E_n \le 50MeV \\ 2.5 + 3.25e^{-\left[\ln(0.04(E_n-50))\right]^2/6}, & E_n > 50MeV \end{cases}$$

11. Page 32 Rephrase line four, paragraph 1 to “lifetime risk for cancer incidence for a composite population. The detriment is modeled as a function ...” There are seven groups of individuals that represent a single composite population.

12. Page 32 Delete kidney from the second to last sentence. The kidney is now considered a remainder tissue.

13. Page 35 The term "airborne activity density" in the 2nd paragraph should be revised to read "airborne activity concentration."

14. Page 35 The forth paragraph should also point out that since much of the activity inhaled is cleared through the digestive track, it is sometimes difficult to resolve the intake into $I_{j,inh}$, and $I_{j,ing}$.

15. Page 36 Equations (5.5) and (5.6) appear incomplete. Equation (5.5) has no term e(τ).

16. Page 37 The basis for the dosimetric quantity "annual effective dose" should be more clearly defined in section 5.3 and added to the glossary. The terms $E(T_X)$, $e_{j,k}(T_X)$, $e_{j,ing}(T_X)$, and $e_{j,inh}(T_X)$ in equation 5.8 do not contain the variable τ, which connotes committed effective dose, but the definition of the variables $e_{j,ing}(T_X)$, and $e_{j,inh}(Tx)$ eight lines below equation 5.8 do include τ. As a result, it is not clear how ICRP intends to define the dose quantity "annual effective dose." It could mean the effective dose, e, delivered during one year of exposure, or it could mean the committed effective dose, e(τ), for 50 or 70 years following the year of exposure.