SOME CONSIDERATIONS FOR DEVELOPING CRITERIA FOR DECORPORATION THERAPY OF INTAKES OF RADIONUCLIDES

Raymond A. Guilmette, Ph.D.
Team Leader, Internal Dosimetry
Los Alamos National Laboratory

Some recent events at Los Alamos National Laboratory in which two workers were exposed under different circumstances to ^{239}Pu via wounds indicated that there are inconsistencies in the guidance for when decorporation therapy with DTPA should be considered. Although the sources of the discrepancies are not clear, it is worthwhile that the technical basis for selecting trigger criteria for chelation therapy be revisited. In so doing, a consensus basis for these criteria can hopefully be agreed.

The goal of decorporation therapy is to reduce the risk of adverse health effects to a person internally contaminated with radionuclides, whether via inhalation, ingestion, absorption through intact skin or wounds. The working principle is that accelerating the clearance of the radionuclide from the body will reduce the dose to irradiated target tissues and organs, and hence reduce the health risk. There are adequate experimental animal data that indicate that this working principle is valid.

In the best of worlds, treatment criteria would be based on judgments of acceptable risk, which take into account both the radiation risk and the risk from treatment. The latter will vary depending on the treatment modality and patient-specific factors, such as pregnancy and existence of kidney disease. From the radiation risk perspective, ICRP uses the quantity cumulative effective dose (CED, in Sv) as the risk metric, and this quantity has been adopted by most regulators in the United States. However, the value of CED used in the U.S. for worker protection – 50 mSv – is derived from ICRP Publication 26 (1977) rather than the more recent ICRP Publication 60 (1990) for which the standard is 20 mSv. The latter value is used throughout most of the world. The importance of selecting a value for CED will become apparent subsequently when discussing secondary quantities.

When workers are internally contaminated with radionuclides in an incident, early assessment of the intake amount and consequent CED are needed to support early medical management decisions. Unfortunately, under most circumstances, it is difficult to obtain a confident assessment of CED based solely on workplace indicators or early bioassay measurements such as *in vivo* counts or nasal swabs. Thus, early decisions are made based on intake assessments, usually in activity units (Bq or nCi). The CEC/DOE "Guidebook for the Treatment of Accidental Internal Radionuclide Contamination of Workers" (*Radiat. Protect. Dosim.* 41, 1-49, 1992) chose to use the Annual Limit on Intake (ALI) as the metric for decorporation decision making. This quantity can be linked directly to intake estimates, as both are given in activity units.

The use of ALI as a decision metric for medical intervention is a reasonable choice since it can be related to early activity measurements in a relatively straightforward way. The difficulty in using the ALI is that it is a derived quantity, which relies on the selected CED and the dose coefficient for a particular radionuclide, as well as its physicochemical form. So for every intake scenario, and every radionuclide/form combination, an ALI must be derived. Additionally, when the biokinetics models used to calculate dose coefficients are changed, then the ALIs will also change. For example, the ALIs quoted in the Guidebook were taken from ICRP Publication 61, which was current at the time the Guidebook was produced. However, those ALI did not use the ICRP human

respiratory tract model (ICRP 66, 1994), which is now the standard respiratory tract model being used.

So in order to agree on intervention levels for decorporation therapy, several questions must be addressed, and answers agreed:

- What should the risk quantity be?
- What should be its value?
- Should a secondary quantity (e.g., ALI) be used for determining the intervention level?
- What should its value(s) be?
- What biokinetics models should be used to relate activity to dose to risk?

As a suggestion, I would suggest that the models used be the most current ones published by ICRP and NCRP. My dose assessment team would be pleased to assist in calculating whatever intervention levels that are considered appropriate.