Session 4.2

Thyroid Dose Estimation for Epidemiological Studies

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Health effects among general populations of nuclear radiation accidents resulting in releases of radioactive materials into the environment, such as that at Chernobyl in 1986, have been evaluated in analytical radiation epidemiologic studies, in which individual dose estimates are required for most, if not all, subjects. Unlike dosimetry for establishing compliance with regulations that relies on doses estimated for representative, maximally exposed, or highest-risk persons, dosimetry for epidemiologic studies of radiation accidents almost always requires developing new dosimetric models or tailoring existing ones to reach a higher level of individualization and to obtain unbiased dose estimates. Additional requirements are to estimate thyroid doses for large numbers of exposed individuals and to do so with a moderate to high degree of certainty in order to ensure the validity of the results of the epidemiologic analysis. For these reasons, Individual dose reconstruction for analytical epidemiologic studies is very difficult and time consuming. Guidance on how to perform individual dose reconstruction in the framework of epidemiologic studies is available in the literature, but does not include a detailed discussion on the practical problems encountered when performing dose reconstruction.

The purpose of this presentation is to describe the dosimetry activities that were undertaken in the aftermath of reactor accidents or of large releases of radioactive materials in the environment, and to indicate what should have been done, with the benefit of hindsight, to facilitate epidemiologic assessments of thyroid cancer. It is shown that even though all dose reconstructions are different, there is an ideal approach and six general principles that are applicable to most studies related to radiation accidents: (1) strive to have as many radiation measurements as possible for all subjects, (2) collect for each subject information that can be used for the estimation of the dose, (3) collect information on the spatial and temporal variations of the radiation field, (4) calculate realistic doses, keeping in mind that all sources of bias should be eliminated, (5) validate the dose estimates, (6) evaluate the uncertainties. The extent to which the ideal approach and the general principles have been applied to specific studies of thyroid cancer, especially those conducted by the National Cancer Institute in Ukraine and in Belarus, are discussed.