

Uncertainties in organ dose reconstruction from Fukushima accident emergency work dose in J-EPISODE cohort study

Hiroshige Furuta, Shin'ichi Kudo and Shin Saigusa

furuta@rea.or.jp

Radiation Effects Association, 1-9-16, Kaji-cho, Chiyoda-ku, Tokyo, 101-0044, Japan

Introduction

Of the 20,000 emergency workers from the 2011 Fukushima nuclear accident, 4,000 were included in the nuclear worker cohort study J-EPISODE, which included 78,000 men; the previous risk analyses with observation period through 2010 used the recorded dose in $H_p(10)$ before the accident, but recently, organ doses during normal work have been reconstructed according to established methods. However, the reconstruction of organ doses during emergency work had to assume many matters due to the lack of available information: 1) the intake of radionuclides took place on the first emergency work day, and 2) the intake of I-131, Cs-134 and Cs-137 was proportional to their air concentration.

Methods

The above assumptions led to uncertainties in the estimates of conversion factors for internal exposure, such as 1) acute and chronic intake scenarios, 2) missing data on actual working days, and 3) missing short-lived radionuclides. These uncertainties were evaluated based on literature review, simulation of intake scenarios using dose calculation software, sensitivity analysis and simulation of the case involving Te-132.

Results

The internal dose in March, the first month of the accident, was dominated by I-131 accumulated in the thyroid gland, and its effect on the colon dose was two orders of magnitude smaller than the effective dose coefficient. Te-132 affected colon dose coefficient ten times larger than I-131. After June 2011, the mean internal dose decreased rapidly and the intake of I-131 became negligible; the internal dose in June—dominated by Cesium—contributed more to the colon conversion coefficient than in March, but the effect on the colon dose was offset by the lower internal dose.

Conclusions

The contribution of emergency work dose to colon absorbed dose was limited even after accounting for uncertainties, and J-EPISODE plans to use organ absorbed dose in future risk analyses. This study was funded by the Nuclear Regulation Authority of Japan.