The application of a two-dosimeter system with its algorithm, as well as a test of its use in an inhomogeneous high-radiation field, is described in this paper. The goal was to improve the method for estimating the effective dose equivalent (EDE) or effective dose (E) during maintenance periods at Korean Nuclear Power Plants (NPPs). The use of this method in Korean and international NPPs, including those NPPs in the USA and Canada, was also investigated. The algorithms used by the American National Standards Institute, Lakshmanan, the National Council on Radiation Protection and Measurements (NCRP), the Electric Power Research Institute and Kim were extensively analyzed as two-dosimeter algorithms (TDAs). Their possible application to NPPs was evaluated using data for each algorithm from two-dosimeter results that were obtained from an inhomogeneous high radiation field during maintenance periods at Korean NPPs. The NCRP (55:50) algorithm was selected as an optimal TDA for Korean NPPs by taking into account the field test results and the convenience of wearing two dosimeters.

In Korea, the ICRP 60 recommendations have been fully implemented to the Korean atomic energy law for nation-wide radiation safety regulations since 2003. As a protection quantity, the E based on the ICRP 60 recommendation has been used for dose assessment of radiation workers. The selected TDA in this paper, the NCRP (55:50) algorithm, was reflected in standard procedures of Korean NPPs at the end of 2005. As a result, this TDA has been implemented extensively to all Korean NPPs since 2006. In 2007, the ICRP published the ICRP 103, which provides the revised weighting factors for both radiation and tissues and the new reference phantom. In this paper, the applicability of current NCRP (55:50) algorithm at Korean NPPs for ICRP 103 was also analyzed. As a result, it was found that the NCRP (55:50) algorithm is still effective to estimate the E of workers under ICRP 103. It is, thus, considered that the NCRP (55:50) algorithm can be well enough to estimate the E as well as EDE with the same coefficients taking into account the results of this paper.

Workers who maintain the water chambers of steam generators during maintenance periods in NPPs have a higher likelihood of high radiation exposure, even if they are exposed for a short period of time. In particular, it is expected that the hands of workers would receive the highest radiation exposure as a consequence of hand contact with radioactive materials. In this paper, the current status of extremity dosimetry at Korean NPPs was investigated. Although individual NPPs maintain some extremity dosimeters (EDs) for workers who handle radioactive materials, their use was not common and extremity monitoring requirements were not standardized. In this paper, field tests using thermoluminescent dosimeters (TLDs) and EDs were also performed during outages at both a pressurized water reactor (PWR) and a pressurized heavy water reactor (PHWR) to evaluate the equivalent dose to the extremities (particularly the hands).

To provide information about the extremity dose during an outage at both PWRs and PHWRs in Korea, several field tests were conducted using an ED, whole-body TLDs and an ED. In the field tests, radiation workers were required to wear an ED on the finger, a whole-body TLD on the wrist, two whole-body TLDs on the chest and the back and electronic dosimeters on the chest and the back. As a result of the tests, the extremity dose at the finger was 50 % higher than the E based on the TLD readouts for the chest and the back. In the case of the equivalent dose at wrist, it was 20 % higher than the E. Furthermore, it was found that most extremity doses were low compared with their annual dose limits. Thus, it is expected that the use of EDs at Korean NPP will not be demanded as much as the use of whole-body dosimeters. In this paper, it was also

observed that inhomogeneous radiation fields for contact operations at NPPs were dominated by high-energy photons. The previous provisional conditions of EDs were not standardized and differed depending on the individual NPP in Korea. In this paper, it was suggested new provisional conditions of EDs where the extremity dose was expected to exceed 10 % of the annual dose limit on the basis of the guidelines of the Institute of Nuclear Power Operations and World Association of Nuclear Operators. Finally, the Korea Institute of Nuclear Safety, the Korean nuclear regulatory body, determined the requirement for provisional conditions of EDs to radiation workers for tasks in which the dose to extremities is expected to be 25 mSv in a single access to the radiation controlled area or 50 mSv in a single task taking into account the proposal of Korean NPPs