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ACHIVEMENTS AND ISSUES IN RADIATION PROTECTION IN THE REPUBLIC OF KOREA

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Measures taken for the Implementation of ICRP 60 Recommendations

Through the revision of the Atomic Energy Laws and regulations in 1998, Ministry of Science and Technology (MOST) reduced the public effective dose limit to 1 mSv per year and revised the occupational effective dose limit to 100 mSv in a consecutive five-year period, subject to a maximum effective dose of 50 mSv in any single year. However, MOST allowed the relevant industries to prepare for the full implementation of the reduced dose limits by applying the dose limit of 200 mSv in a consecutive five year period from 1998 to 2002, subject to 50 mSv in any single year. Since 2003, the dose limits identical to those of the ICRP 60 recommendations have been implemented. Meanwhile, to apply the effective dose concept, the MOST Notice No.2002-20 "Regulations on the Measurement and Assessment of Internal Doses" was promulgated in December 2002 and has been implemented since 2003. Based on the new dose limits and dose coefficients, derived air concentrations and discharge limits have been derived for each radionuclide and promulgated in the Notice No. 2002-23 of the Minister of Science and Technology (titled "Radiation Protection Standards"). Thus all major ICRP 60 recommendations have been incorporated into the domestic laws and regulations.

Accordingly, Korea Hydro and Nuclear Power Company (KHNP), in preparation for the implementation of ICRP 60 recommendations, conducted a research, jointly with Korea Electric Power Research Institute (KEPRI), to establish measures for the introduction of the new radiation protection concepts. Also, in preparation for the requirement of internal dose assessment, KHNP jointly with Yonsei university conducted a research on assessment of internal dose and improvement of measurement reliability. In 2003, a technical basis report for the establishment of procedures for internal dose assessment was prepared based on the research results and then submitted to MOST. Standard procedures were made and have been applied to all NPPs.

Personnel Dose Management by KHNP

For the year 2003, the total radiation dose of personnel engaged in radiation works related with the operation of 18 NPP units and pre-operation of 1 unit was 10.288 man-Sv and the average collective dose per unit was 0.57 man-Sv. In general, the total collective dose greatly depends on the outage duration for maintenance works. For the year 2003, the total collective dose was slightly greater than that for the year 2002 (9.32 man-Sv) partly because outage maintenance works lasted for 575 days at 15 NPP units. However, this figure is very low compared with the world average collective dose as seen in Figure 1, thus showing superior management capability of radiation safety control at Korean NPPs.

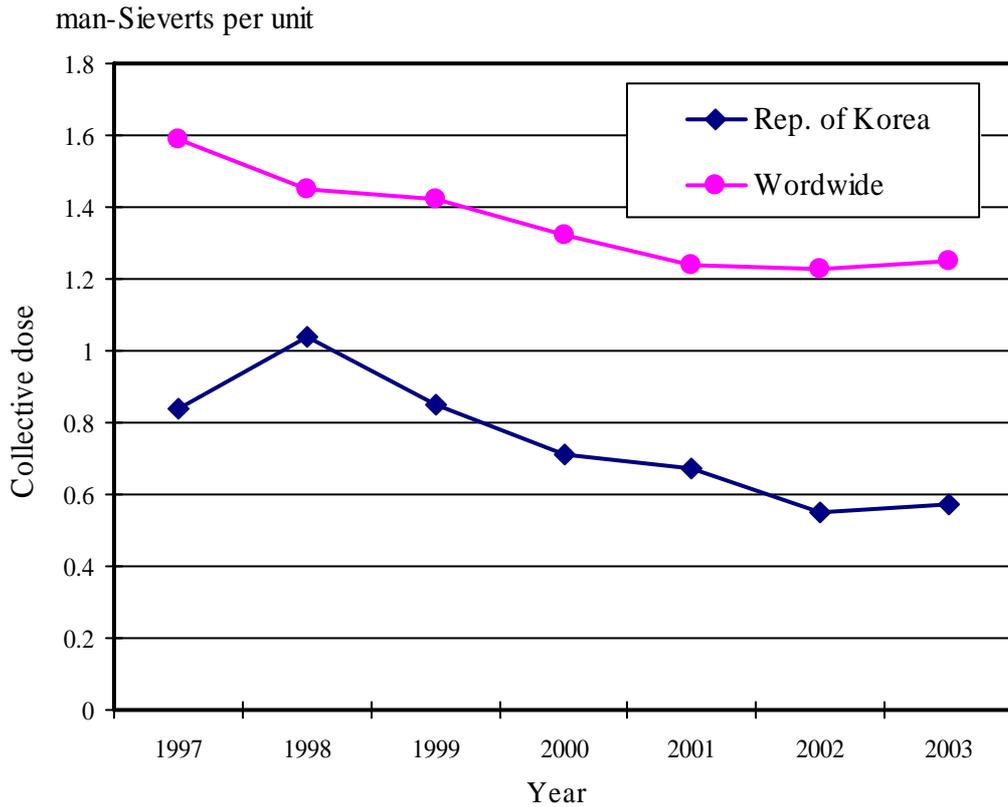


Figure 1. Trend of the average annual collective dose per unit

Meanwhile, the average annual individual dose was 1.18 mSv/y. There was no personnel that had radiation dose exceeding the annual dose of 20 mSv during the period between 1999 and 2003. Most of radiation workers (77%) received radiation dose below 1 mSv. Thus, Korean NPP industry has been well adapted to the new ICRP recommendations and domestic Atomic Energy Laws.

The following table shows the average collective dose per unit for Korean NPPs and world NPPs.

Table 1. Comparison of average collective dose per unit

Year	(unit : man-Sv/y)						
	1997	1998	1999	2000	2001	2002	2003
Korean NPPs	0.84	1.04	0.85	0.71	0.67	0.55	0.57
World NPPs	1.59	1.45	1.42	1.32	1.24	1.23	1.25

* World NPPs : WANO Performance Indicator Report [Mean of all reactor types (Mean)]

To achieve these results, KHNP established an implementation plan for overall improvement of reduction of radiation doses at NPPs and has continuously made efforts in ALARA activities for areas of reactor operation and improvement of facility/equipment, securing new automatic maintenance equipment, improvement of management.

However, the importance of ALARA activities is more emphasized since the radiation levels inside the NPP systems are increasing as the reactors are becoming aged and also the scope of maintenance work is increasing. Especially, although personnel doses are well managed below the legal dose limits, the need to reduce worker dose further is raised for worker health and safety. Accordingly, KHNP has been making efforts for the reduction of personnel doses based on the second mid-and long-term dose reduction program, which was made in 2001 and is to be applied up to the year 2010. The second mid-and long-term dose reduction program includes improvement and of facilities /equipment such as modification of RTD, installation of permanent seal ring of reactor pool, improvement of shaft of reactor coolant pump, installation of integrated reactor head assembly as well as improvement of operational systems such as improvement of internal dose assessment program, development of computerized system for the management of radiation measurement devices, establishment of an award for radiation safety control, establishment of ALARA review system in the NPP design and construction stages.

Protection of Workers from Radiation Exposure

KHNP established radiation health research institute (RHRI), an affiliated specialized medical research institute. This institute conducts management on personnel health and carries out researches on the effects of ionizing radiation on humans. Also, it has made a great effort for personnel health by tracing personnel health status by establishing an integrated health management system since 2002. This system has a database of medical examination and historical record of disease for entire KHNP employees

In 2003, KHNP/RHRI introduced the PET/CT system and carried out examinations on 1,287 employees. For those who were diagnosed to have cancer, early treatment such as surgical operations was prescribed. In addition, RHRI conducts researches on the effects of radiation exposure on human health, e.g. development of specific genetic indicator derived by radiation. In 2004, RHRI will conduct research on radiation hormesis using a low level irradiation facility.

Establishment of a recording level for national dose records for radiation workers

MOST intends to establish and operate a recording level for standardized national dose recording system for radiation workers. Currently the dose recording system includes various cases such as case of recording of all measured doses, recording of all measured doses excluding doses below lower limit of detection or minimum detectable amount, excluding doses below a certain level, and assigning an arbitrary dose below a preset value. Each case may have acceptable reasons for application, however, this nonstandard recording system causes distortion in dose data for national statistics and comparative analysis.

Korea Institute of Nuclear Safety (KINS) has studied on the analysis of dose assessment method of various dosimetry systems, analysis of the impact of implementing a dose recording level, and processing method for doses below the recording level, with the aim of applying the recording level in 2006. The research results will be legislated in 2005 through report to and advice from the specialized committee of radiation protection under Nuclear Safety Commission.