Establishment of exposure dose assessment laboratory in National Radiation Emergency Medical Center (NREMC)

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1. Introduction

As unclear industry grown, 432 of the nuclear power plants are operating and 52 of NPPs are under construction currently[1]. Increasing use of radiation or radioisotopes in the field of industry, medical purpose and research such as non-destructive examination, computed tomography and x-ray, etc. constantly[2]. With use of nuclear or radiation has incidence possibility for example the Fukushima NPP incident, the Goiania accident and the Chernobyl Nuclear accident. Also the risk of terror by radioactive material such as Radiological Dispersal Device(RDD) etc.

In Korea, since the 'Law on protection of nuclear facilities and countermeasure for radioactive preparedness was enacted in 2003, the Korean institute of Radiological and Medical Sciences(KIRAMS) was established for the radiation emergency medical response in radiological disaster due to nuclear accident, radioactive terror and so on[3]. Especially National Radiation Emergency Medical Center(NREMC) has the duty that is protect citizens from nuclear, radiological accidents or radiological terrors through the emergency medical preparedness. The NREMC was established by the 39-article law on physical protection of nuclear material & facilities and measures for radiological emergencies.

Dose assessment or contamination survey should be performed which provide the radiological information for medical response. For this reason, the NREMC establish and re-organized dose assessment system based on the existing dose assessment system of the NREMC recently. The exposure dose could be measured by physical and biological method. With these two methods, we can have conservative dose assessment result.

Therefore the NREMC established the exposure dose assessment laboratory which was re-organized laboratory space and introduced specialized equipment for dose assessment.

This paper will report the establishment and operation of exposure dose assessment laboratory for radiological emergency response and discuss how to enhance international level of dose assessment system.

2. Methods and Results

2.1 Present international situation

For radiation dose assessment, there are several methods such as medical dosimetry, physical dosimetry and biodosimetry. The IAEA recommend the exclusive charge dose assessment for effective medical treatment of radiation exposed victims. Especially, the organization has the bioassay team, radiopathology team, biodosimetry team and dosimetry team[4]. In addition, the IAEA manage Response Assistance Network(RANET) which is international support network for radiological incident. The biodosimetry, internal dose assessment, bioassay and dose reconstruction are included 12 special fields expertise of the RANET[5].

In the Japan, department of radiation dosimetry is consist of external dosimetry, internal dosimetry and biodosimetry section which is established in National Institute of Radiological Sciences(NIRS).

In the U.S, Radiation Emergency Assistance Center/Training Site(REAC/TS) was established for response the radiological incidence the dose assessment field. The REAC/TS is qualified to teach medical personnel, health physicists, first responders and occupational health professionals about radiation emergency medical response. Especially, health physicist in dose assessment field consists of external and internal dose assessment. Personal and area dosimeters, biological dosimtery, opportunistic dosimetry(TL/OSL, OSL, Activation Analysis) and dose reconstruction(Physical/Mathematical methods) is in the external dose. And the internal dose assessment is consist of *in-vivo* bioassay(direct measurements) and *in-vitro* bioassay(indirect measurements)[6].

Considering these international institutes, in the NREMC established the exposure dose assessment laboratory which has two part of dose assessment which are biodosimetry laboratory and physical dosimetry laboratory.

2.2 Biodosimetry Laboratory

The biodosimetry laboratory performs cytogenetic examinations which are stable chromosome aberration examination and unstable chromosome aberration examination. The cytogenetic examination methods measure dicentric, translocation, ring, inversion, micronuclei or premature chromosome condensation etc. The method of cytogenctic examination could be applied with the following exposure dose, appropriately. In these methods, it is very important for construct a dose response calibration curve since the curve is standard of radiation dose exposure. In NREMC already

have the own dose response calibration curve of dicentrics [7].

For biodosimetry, the NREMC constructed the laboratory(fig. 1) and introduced specialized cytogenetic analysis equipments such as Metafer system, cell examination equipment, data recording system and fluorescent microscope and so on.

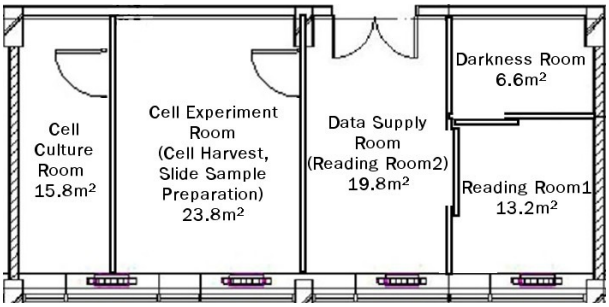

Fig. 1. Biodosimetry laboratory

2.3 Physical Dosimetry Laboratory

The physical dosimetry laboratory performs internal dosimetry, external dosimetry and contamination survey. The internal dosimetry consists of *in-vivo* bioassay and *in-vitro* bioassay. For internal dosimetry, especially *in-vivo* bioassay, we introduced specialized internal doismetry equipment such as whole body counters(standing type, chair type), organ counter(thyroid monitor) and internal dosimetry software endorsed by the ICRP. Furthermore, Gamma spectroscopy system(HPGe, NaI), Alpha spectroscopy system, beta-ray counter(Liquid scintillation counter) and specimen pre-treatment system was introduced for *in-vitro* bioassay. These equipments are recommended by the IAEA. For external dosimetry equipment which Electronic Spin Resonance(ESR) was installed in the branch of KIRAMS(Pusan province) and we have a cooperation for dosimetry. The physical dosimetry laboratory space is separated radiation analysis room, sample preparedness room, internal dosimetry room and radiation monitoring training room(fig. 2).

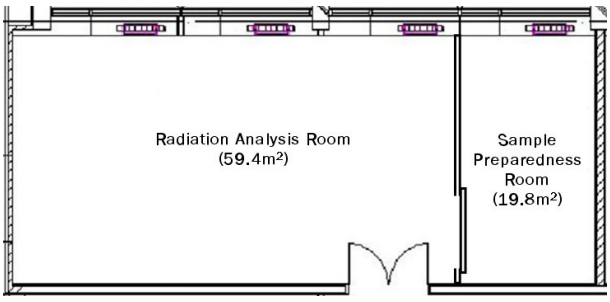

Fig. 2. Physical dosimetry laboratory

For improve dose assessment capability, we preformed cross-tabulation analysis for internal dosimetry (supervised by KAERI) and took part in radioactivity data analysis network system (supervised by KINS) from last year.

3. Conclusions

Nowadays, citizens who suspicious radiation exposure or contamination came to the NREMC for examination since the Fukushima nuclear power plant incident. Our institution already established and operated the exposure dose assessment laboratory so that we could carry out the duty aforesaid. However, at this time we could realize the shortage of manpower compare with international institute/organization such as IAEA, NIRS and REAC/TS etc. It means, for conservative and more accurate dose assessment, it should be considered not only hard-ware factors but also manpower.

For enhance dose assessment capability as international level, we have to reinforce the manpower and get more training for own specialized field. The lastly, we have to make a plan to establish and manage the dose assessment network domestically and internationally.

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