Development of Internal Dosimetry Laboratory Using Whole Body Counter in Nuklear Malaysia (1/4)

(Suzilawati binti Mohd Sarowi, Azimawati binti Ahmad, Norhayati binti Abdullah, Raymond Yapp, Nur Khairunisa binti Mohd Zahidi)

Introduction

A personnel dealing with ionizing radiations may exposed to the radiation either externally or internally. A part of radiation protection for the workers, an occupational dose limit of 20 mSv/year (for external and internal exposures) is set by the authority as stipulated in the Basic Safety Radiation Protection (BSRP 2010). Currently, Malaysian Nuclear Agency (Nuklear Malaysia) focus on measurement of external radiation which is can be measured using a personal device dosimeter such as thermoluminsence dosimeter (TLD) and optically stimulated luminescence dosimeter (OSLD). Therefore, the development of internal dosimetry laboratory is crucial to strengthen a radiation protection principles in Malaysia as well as for radiological & nuclear emergency preparedness and response.

ORTEC Whole Body Counter

ORTEC Whole Body Counter (WBC) is a complete whole body counting system which was installed and commissioned at Nuclear Malaysia on 19 November 2012. The system is specially constructed with low background steel frame, lead and shadow shield, X-COOLER II compressor, an ORTEC Model GEM-FX8530P4 High Purity Germanium Detector, ORTEC Model DSPEC-jr-2.0 Digital Spectrometer. The system is controlled by the Renaissance-32 WBC Software. Setting up of the detector performance includes energy calibration, efficiency calibration and Minimum Detectable Activity (MDA). All the parameters and calibration set-up were carried out using a standard radionuclide sources which contain of Am-241, Co-57, Ce-139, Hg-203, Sn-113, Cs-137, Y-88, Co-60 and Y-88 with a range of energy between 59.5 keV and 1836.2 keV for qualitative measurement. The system is primarily applicable to detect radioactive materials that emit gamma rays, for example, I-131, Cs-137, Cs-134 and Co-60.

Development of Internal Dosimetry Laboratory Using Whole Body Counter in Nuklear Malaysia (2/4)

External contamination monitoring

The external contamination monitoring using frisking technique will be performed on the person to be monitored prior the body scan using WBC (Fig. 1). The objective of the monitoring is to detect any present on radioactive contamination on the body surface and clothing. The person and clothing are considered contaminated if the contamination level exceeds two times of background radiation level. The contaminated person then will be sent to the decontamination room for external decontamination procedures. The contaminated clothing including shoes, watches and scarfs need to be removed and treated as radioactive waste.

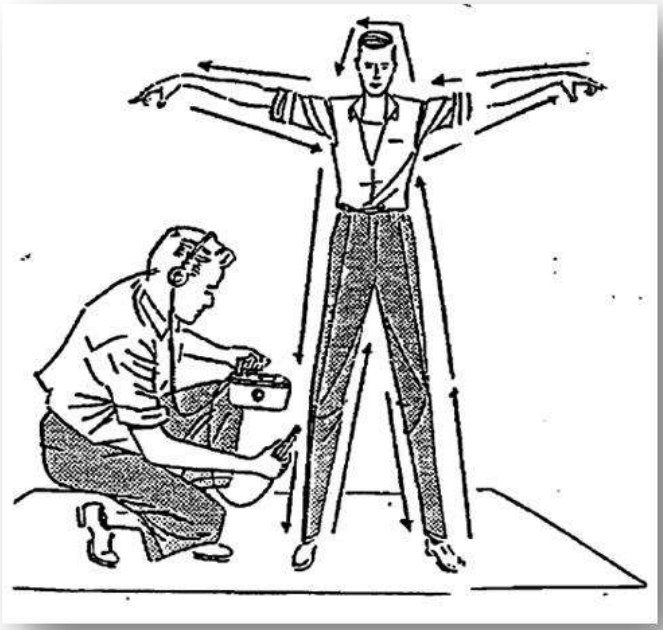

Fig. 1: Monitoring of surface contamination on the body and clothing using Frisking technique.

Development of Internal Dosimetry Laboratory Using Whole Body Counter in Nuklear Malaysia (3/4)

External decontamination procedure

Decontamination procedure is required in order to remove external contamination before measuring using whole body counter. 90% of surface radiation contamination is usually removed by shedding all clothing and the remainder will usually remove by showering. It is advice to perform up to three times decontamination and survey cycles to be performed in order to remove most of the external contamination. The decontamination method and technique for skin, hands and body is shown in Table 1.

Table 1: The decontamination method and technique for skin, hands and body.

Method	Technique	Remarks
1. Soap and Water	Wash 2—3 minutes and check activity levels. Repeat washing 2 times	Wash hands, arms and face in sink, use showers for the rest of body
2. Soap, soft brush and water, dry abrasives such as cornflower	Use light pressure with heavy lather. Wash for 2 minutes, 3 times, rinse and monitor. Use with care, avoid eroding the skin	After decontamination apply hand cream to prevent from chapping
3. Soap powder or similar detergent, standard industrial skin cleaner	Make into a paste. Use with additional water and a mild scrubbing action. Use with care, avoid eroding the skin	After decontamination apply hand cream to prevent from chapping

Development of Internal Dosimetry Laboratory Using Whole Body Counter in Nuklear Malaysia (4/4)

Body Scanning using WBC

A personel undergo scanning process need to lay on the bed for about 40 minutes as shown in Fig. 2. In addition, measurement of background radiation will be made as close as possible to the body scanning, ideally just before and just after. The results of body scanning from the Renaissance 32 software will be analysed to identify types of radionuclide and quantify the radioactivity present in the personel body. In the end, the MONDAL3 software will be used to estimate the committed effective dose.

Fig. 2: Body scanning using Whole Body Counter.

Conclusions

As whole body counter is important in order to measure the dose from radionuclides that deposited inside the body, this development is believed could strengthen and ensure the safety of the personnel especially who are handling the radioactive material and also the public. Furthermore, it is an essential component in emergency preparedness and respond for radiological accident in the country.