ENHANCING RADIATION SAFETY THROUGH OCCUPATIONAL RADIATION PROTECTION IN NIGERIA

G.B. Ekong, Y.U. Idris, I. Sambo

Nigerian Nuclear Regulatory Authority
Abuja, FCT, Nigeria

Emails: gobass04@yahoo.com; godwin.ekong@nnra.gov.ng

EXTENDED ABSTRACT

Introduction: Occupational exposure is refers to a cumulative exposure to workers in ionizing radiation facilities during their daily work routines, according to the IAEA safety standards. The United Nations Scientific Committee on the Effects of Atomic Radiation, has outlined techniques of occupational dose assessment which entails categorizing type of practices and radiation environment employed [1,2]. Individuals working in both radiological and nuclear facilities are often exposed to sources of ionizing radiation resulting in some level of occupational dose, in which depending on amount of doses incurred has likelihood for radiological hazards. However, having an effective radiation protection in place enhances dose reduction to the barest minimum.

Radiation workers in facilities such as fuel cycle facilities, diagnostic radiology, nuclear medicine, industrial radiography, and nuclear power plants etc, are always exposed to radiation both internal and external dose in varying amounts of radiation, depending on their jobs and sources with involved. The human body interacts with radiation particles either internally or externally and thus resulting in biological damaging effect. It is pertinent to note that these radiation particles ionize living cells of the body either directly or indirectly thereby breaking chemical bonds of DNA biological molecule. The resultant effect of this may likely cause impairment, permanent alteration and death of the cell [3,4].

The evaluation of annual average effective exposure doses data reported in this paper relates to dose received by the occupationally exposed workers in various practices in Nigeria. In this regard, the Nigerian Nuclear Regulatory Authority (NNRA) has in place strong regulatory framework to ensure occupational exposure for all practices involving the use of ionizing radiation is safe; Exposure is kept As Low As Reasonably Achievable (ALARA Principle) and dose limits specified for individuals does not exceed. To ensure the dose limits are not exceeded and in line with IAEA safety standard, the NNRA has recommended dose limits of occupational exposures to radiation workers was stipulated as 20 mSv per year (averaged over a period of 5 consecutive years) [5,6,7]. The purpose of occupational radiation dose assessment program has been to provide facts on the capability of protection measures, considered as key input for operative assessments related to principle of optimisation and also to validate compliance with relevant recommended international standards [8].

Method: Employers of radiation workers engage the services of an accredited Dosimetry Service Provider (DSP) who monitors and report doses of radiation workers to the NNRA in quarterly and summary report in annual basis. Different dosimeter products like calibrated Thermos-Luminescent Dosimeters (TLDs), Optimum Stimulated Dosimeters (OSLs), Ion Exchange Dosimeters (Instadose), for occupational dose monitoring were used to monitor and report doses of radiation workers to the NNRA. A yearly Proficiency Test is carried out by Secondary Standard Dosimetry Laboratory (SSDL) to ascertain the reproducibility, linearity etc of dosimeter used credibility of dose reports by the DSPs [9].

Result: The annual average effective doses ($Hp_{[10]}$ and $Hp_{[0.07]}$) collation of occupational radiation workers from Industrial Uses, Medical Uses, Education and Research and other Activities and practices submitted from 2012 to 2016 were collated and analyzed. Range of average doses were found to be (0.31–2.48)mSv/yr for 2012, (0.30 – 1.44)mSv/yr for 2013, (0.14 – 2.34)mSv/yr for 2014, (0.23 – 2.42)mSv/yr for 2015 and (0.04 – 2.07)mSv/yr for 2016 of facilities within an occupational groups, which are presented in Table 1. Also, a collective doses of 0.56manSv for

2012, 0.50manSv for 2013, 0.71manSv for 2014, 1.52manSv and 0.72manSv 2016 of all occupational groups. This shows that the risk due to radiation exposures low and also below the regulatory limits [5,6,7,10].

TABLE 1: OCCUPATIONAL DOSE ASSESSMENT FOR NIGERIAN RADIATION WORKERS

Occupational Groups	Effective Dose 2012 (mSv/yr)	Effective Dose 2013 (mSv/yr)	Effective Dose 2014 (mSv/yr)	Effective Dose 2015 (mSv/yr)	Effective Dose 2016 (mSv/yr)
IR	0.57	0.54	0.50	1.10	0.79
DR	1.1	0.47	1.64	1.41	0.58
WL	0.34	0.30	0.14	2.42	0.85
RR	2.48	1.44	2.34	1.11	1.86
GIF	0.95	0.86	-	1.45	2.07
RT	1.22	0.35	0.55	0.92	0.41
NM	-	-	-	1.84	0.04
Ac	0.31	0.40	0.36	0.23	0.15
NG	1.26	0.71	0.25	0.64	0.87
Average	**0.56**	**0.50**	**0.71**	**1.52**	**0.72**

Evaluation of the dose records submitted from 2012 – 2016 in cumulative and collective for each occupational groups were below regulatory limits.

Conclusion: Exposure from sources of radiation in radiological and nuclear facilities delivers occupational doses in Nigeria. Different products (dosimeters) for occupational dose monitoring were used to monitors and report doses to the NNRA. The regulations requires that employers of radiation workers engage the services of an accredited DSP who monitors and report doses of radiation workers and submits report in to the NNRA in quarterly and annual basis. Also, an Occupational Radiation Protection Appraisal Service (ORPAS) mission conducted on Nigeria's legislative, regulatory infrastructure as regards to Occupational Radiation Protection and practical implementation by technical services and facilities against the international safety standards shows the presence of an effective regulatory oversight, strong awareness level on radiation protection and compliance with the national and international requirements. It is however recommended that the present standards of Occupational Radiation Protection in Nigeria be maintained and constantly improved upon.

References

[1]. Masood, K., Zafar, J., Zafar, T., & Zafar, H., (2013). Assessment Of The Occupational Radiation Exposure Doses To Workers At INMOL PAKISTAN (2007–11), Radiation Protection Dosimetry, 155(1)110– 114

[2]. Cember, H. (1996). Introduction to Health Physics, Fourth Edition, McGraw-Hill. Incorporation, Toronto, Canada, 220-231.

[3]. Martin A., Harbison, S., Beach K., & Cole, P. (2012). An Introduction Radiation Protection. Fifth Edition, Hodder Arnold, an imprint of Hodder Education, Hachette UK, 6 -209.

[4]. Nigerian Nuclear Regulatory Authority (NNRA) (2004a). Nuclear Safety and Radiation Protection, Act 19, 1995, Law of the Federal Republic of Nigeria, Cap N145.

[5]. Nigerian Nuclear Regulatory Authority (NNRA) (2004b). Nigerian Basic Ionizing Radiation Regulations (NIBIRR) 2003, Law of the Federal Republic of Nigeria, Cap N145.

[6]. International Atomic Energy Agency (IAEA), (2011). Radiation Protection and Safety: of Radiation Sources: International Basic Safety Standards. Interim Edition. General Safety Requirements Part 3 (interim). IAEA.

[7]. Muhogora,W. E., Byorushengo, E., Lema,U., Mboya,S. G., Ngatunga,J. B., Sawe,S., Katsidzita,N. M., Mikidadi,S., Chuma, F., Marco A. & Hamed,M. I. (2013). Occupational Radiation Exposure In Tanzania (1996–2010): Status And Trends W. E. Radiation Protection Dosimetry, 153(4)403–410

[8]. International Atomic Energy Agency (IAEA), (2007b).Intercomparison of Personal Dose Equivalent Measurements by Active Personal Dosimeters, IAEA-TECDOC-1564, IAEA.

[9]. International Commission on Radiological Protection (ICRP), 2007. The 2007 recommendations of the ICRP Publication 103. Ann. ICRP 37(2–4).

[10]. United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), 2000. Report to the General Assembly. United Nations.