Occupational Dose Assessment for Radiation Workers at Centre for Energy Research and Training, Zaria-Nigeria

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ABSTRACT

As part of the measures to ensure the radiation protection of technical staff, CERT have saddle the responsibility of Dosimetry monitoring of its radiation workers on quarterly bases even before the commissioning of NIRR-1. Assessment of the annual effective dose of radiation workers for 14 years was carried out for the period the Reactor was operated on HEU core. The result shows that the doses were below the acceptable limit as set by both national and international regulations (NNRA, ICRP and IAEA)

Introduction:
Centre for Energy Research Training (CERT), Ahmadu Bello University Zaria is nuclear research institute established in 1984 for training and research in nuclear technology. It has many nuclear facilities including Research Reactor (NIRR-1), Am-Be Source, Neutron Generator, XRF, Liquid Scintillation counter (LSC) Gross Alpha-Beta Multidetector Radioactive Waste Management Facility (RWMF) among others.
NIRR-1 is an MNSR research reactor which achieved its first criticality on 3rd February 2004 and in 2018, NIRR-1 was converted from HEU to LEU. All the technical staff at the Centre were monitored using thermoluminescent dosimeter (TLD) as per required by the Nigerian Regulatory Authority of Nigeria (NNRA) and IAEA.

Table 1: dose limits of occupational workers

Body Part	Dose limits (NNRA/IAEA)**	CERT Administrative Reference Limit
Whole body	20 mSv averaged over 5 years, max. 50 mSv in a single year	Annual effective dose shall be 10 mSv.
Lens of the eyes	20 mSv/yr	10 mSv/yr
Skin, extremities	500 mSv/yr	250 mSv/yr

*** IAEA GSR part-3 (July 2014)

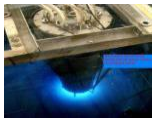

Fig.1NIRR-1 in Operation

Fig.2 NIRR-1 Reactor Hall

Materials and Methods
TLD Badges were used to monitor the personnel dose at CERT. The Badges are calibrated bi-annually at Secondary Standard Dosimetry Laboratory (SSDL) of Nigeria, Ibadan. Harshaw TLD Reader (Model 4500) was used to read the Badges. All the radiation workers are issued personal bar-coded whole-body Thermoluminescent dosimeters (TLD-100). The workers are monitored on quarterly basis. Analysis of the annual effective dose for 14years was carried out from commissioning to decommissioning of the reactor with HEU fuel rods

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Fig,3 TLD Reader 4500

Fig. 4 TLD Chips Irradiator

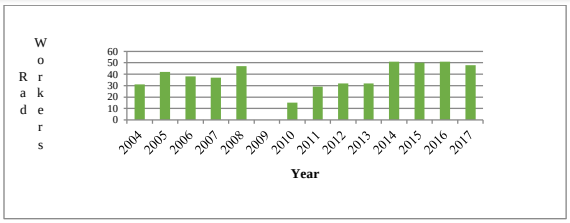

Fig.5 Occupational Workers monitored from 2004-2017

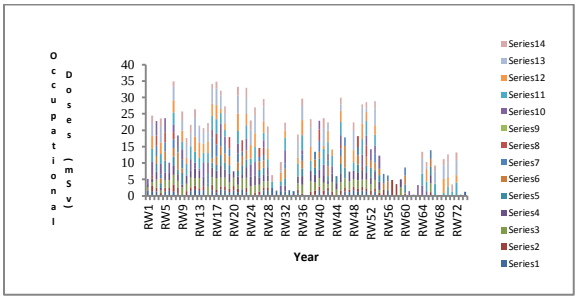

Fig.6 Annual maximum Dose Received by individual worker from 2004 -2017

Results and Discussion:
The annual doses received by the workers from 2004 to 2017 were in the range: (0.21-3.13), (0.85-4.77), (0.69-6.08), (0,19-5.36), (0.18-4.43), (no data), (1.04-3.53), (0.47-6.12), (1.36-6.58), (0.66-3.58), (0.21-3.62), (0.20-3.62), (0.2-4.86) and (0.32-2.40) respectively. For the 14 years of operations with highly enriched uranium (HEU) fuel rods, there was no incidence of an occupational dose exceeding the annual regulatory limit of 20mSv/yr. This indicates a proper implementation of the radiation protection protocol in compliance with regulatory bodies (ICRP, IAEA and NNRA).

Conclusion and Acknowledgement:
This study is mainly conducted to assess the effective dose of radiation workers at CERT. The effective dose was found to be below the prescribed dose limit as per requirement of the Nigerian Nuclear Regulatory Authority (NNRA). Though the effective dose is below the limit, there is still the need to reduce the dose received by Workers as low as possible (ALARA)
I wish to acknowledge the assistance and guidance provided by IAEA in terms of Radiation Protection & Radiation Dosimetry Facilities, and regular training of CERT staff.

REFERENCES:

[1].Final Safety Analysis Report of Nigeria Research Reactor-1 (FSAR), Technical report: CERT/NIRR-1/FSAR-01. Centre for Energy Research and Training, Ahmadu Bello University, Zaria, Nigeria, (2005).

[2].Nigerian Basic Ionizing Radiation Regulation 2003 http://www.vertic.org/media/National%20Legislation/Nigeria/NG_Nigerian_Basic_Ionizing_Radiation_Regulations_2003.pdf

[3].International Commission on Radiological Protection, 1990 Recommendations of the International Commission on Radiological Protection, ICRP Publication 60, Ann. ICRP 21 (1-3) (1991)

[4].EUROPEAN COMMISSION, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR ORGANIZATION, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, UNITED NATIONS ENVIRONMENT PROGRAMME, WORLD HEALTH ORGANIZATION, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3, IAEA, Vienna (2020