Occupational Radiation Dose to X-ray workers in Radiological units in South Eastern Nigeria

*C.C. Nzotta and N.O. Chiaghanam

Department of Radiography/Radiological Sciences, Faculty of Health Science and Technology, College of Health Sciences, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria.

(Received January 05, 2010; Revised January 28, 2010; Accepted February 01, 2010)

X-Ray workers are exposed to very high radiation risk in Nigeria because of great dependence on refurbished x-ray equipment. The refurbished units have outputs higher than the European Community Reference values. There is significant variance between the set factors and the actual output of these refurbished units. This is as a result of irregular quality control practices, poor equipment maintenance and non compliance to Radiation protection rules and regulations. The occupational dose to the workers is measured in this work. The dose received by the x-ray workers in three hospitals in southern Nigeria is measured using Thermo Luminescent disc for three years. The reading is taken every quarter. There was regular quality control test and measurements on equipment and facilities. The shielding materials (both source and structural) were assessed for adequacy. The dose received by the workers in the three centres within three the years range from 0.41mSv to 5.29mSv per annum the background radiation level for the three hospitals are 1.23mSv, 1.19mSv and 1.21mSv. The dose distribution for the various occupational groups show that the technicians received more annual doses in the three hospitals. A mean value of 5.15mSv, 4.66mSv and 3.31mSv. The clerical staff received the lowest annual mean dose value of 1.87mSv, 2.12mSv and 2.27mSv. Radiographers and Radiologists received relatively lower values except for a few unusual high values. The highest individual cumulative annual dose values of 5.29mSv and 4.88mSv were received by the resident Radiologists. These values are below the recommended one third ($\frac{1}{3}$) of the permissible dose of 20mSv per annum for the category of staff.

1. Introduction

There is little documented information about the Radiation protection and monitoring in Radiology departments in Nigeria [1,2] only about 25% of radiation workers in Nigeria are monitored as at 1999 [3] the high cost of x-ray and C.T. units have greatly increased the use of refurbished X-Ray equipment. These units produce higher percentage variance between set exposure factors and actual output [4]. Their output is higher than the European community (EC) reference values [5]. Scatter radiation is responsible for the major part of the radiation exposure to staff in radiology [6,7]. This is emitted more by these refurbished machines [5]. In addition to the problem of poor equipment maintenance and irregular quality control tests and measurements, there are very poor radiation protection practices [5].

2. Materials and Method

The occupational radiation exposure to staff of three Nigeria hospitals: Hospital 1: [University of Benin Teaching Hospital]: Total staff monitored: Thirty nine (39). Hospital 2: (Federal Medical Centre Umuahia): Total staff monitored; Eleven (11). Hospital 3: (Federal Medical Centre Owerri): Total staff monitored; (9). were measured every quarter, from 1st January 2005 to 30th December 2007 for the various category of staff working in the centres. The occupational group distribution is as shown in table 1. below.

This represents 87% of the total radiology staff of the centres. 13% of the staff...
were not regular in returning there badges for reading. The TLDs were worn groin, fixed to the belt or attached to the pocket of the lab coat. All the badges are stored in one compartment at the end of each day. This compartment is monitored regularly to ensure that there is no extraneous radiation emission. The workers did not take the badges out of the department to ensure that only radiation from the Department is what is received by the badges. Every staff of the x-ray department received the badge. There is quarterly environmental radiation monitoring and survey to ensure that the level of radiation in and around the department is not abnormal. The results are not considered here. There were regular quality control tests and measurements on the equipment and facilities. The shielding materials (Source and structural) are assessed for adequacy.

The tube leakage tests were conducted quarterly to ensure the there were no extraneous radiation from the tube.

A collection schedule was posted at the departmental staff notice board. The days of badge collection were specified so that staff on leave, off duty or on secondment would ensure compliance. The TLDs were read with solaro dual channel TLD reader (model 680, NE technology ltd 1991 series) Proper wearing and care of the dosimeter is necessary for the radiation monitoring data to be accurate [6,8].

3. Result and Discussion

The values obtained show that the minimum dose received by the staff within the three years is 0.11mSv and the highest dose value received is 5.29mSv. The measured background radiation level for the three hospitals are 1.23mSv, 1.19mSv and 1.21mSv for the hospital 1, 2 and 3 respectively. The dose distribution for the various occupational groups show that the technicians (x-ray and dark rooms technicians) received more radiation in the three hospital, an average of 2.5mSv, 1.66mSv and 1.31mSv for the hospital 1, 2 and 3 respectively. The clerical staff received the lowest dose value of 1.87mSv, 2.12mSv and 2.27mSv for hospital 1, 2 and 3 respectively. They have no direct contact with the exposure rooms. The Radiographers and the radiologist received normal values in the three centres. Probably due to adherence to the recommended radiation protection rules and regulation. However in hospital 1 the values are relatively high for all the Occupational groups. This could be accounted for by the high work load of the department. The highest individual annual dose values of 5.29mSv and 4.88mSv were received by junior resident. This could be accounted for by frequent contact to fluoroscopy room and Hysterosalpingography examination.

Regulatory dose limit for radiation workers do not apply to medical irradiation received by the patients. Therefore, when a radiation worker becomes a patient, only patient considerations are applicable and any exposure received is not part of occupational radiation exposure [6].

The result presented suggests the approximate radiation exposure to the personnel in the de-

<table>
<thead>
<tr>
<th>Occupational group</th>
<th>Hospital 1</th>
<th>Hospital 2</th>
<th>Hospital 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiologist</td>
<td>3.11</td>
<td>1.87</td>
<td>1.82</td>
</tr>
<tr>
<td>Radiographer</td>
<td>2.86</td>
<td>1.93</td>
<td>1.15</td>
</tr>
<tr>
<td>Technicians</td>
<td>5.15</td>
<td>4.66</td>
<td>3.31</td>
</tr>
<tr>
<td>Other departmental staff</td>
<td>1.87</td>
<td>2.12</td>
<td>2.27</td>
</tr>
</tbody>
</table>

Table 2: Mean annual dose distribution for the various occupational groups
partment. The highest cumulative reading per annum of 5.29mSv is below the recommended 1/3 of the permissible dose of 20mSv per annum for this category of staff as set by international commission on radiological protection [1].

The general low values recorded could be explained more by not wearing the dosimeter regularly rather than by compliance to regulation.

4. Conclusion

The low awareness of the radiation regulations among radiology staff in Nigeria is greatly responsible for the low corporation received from the staff. However it is observed that the higher the departmental work load, the higher the annual dose value for all category of staff. The highest individual cumulative annual dose value of 5.29 is lower than the ICRP (International Commision and radiological protection) recommended 1/3 of the permissible dose of 20mSv /yr for this category of staff.

Reference.