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CASE REPORT
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A Case of Non-genuine Overexposure at Radiotherapy Facility

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ABSTRACT

A case of overexposure came to light after the annual dose record report came out as a result of a slightly higher dose recorded by a TLD badge being used by a radiation professional. A report was sought by Atomic Energy Regulatory Board (AERM), Mumbai, regarding the reasons for this overexposure incident. After a thorough investigation by the local administration, it emerged that the reason behind this overexposure was the negligent approach of the concerned radiation professional, who somehow left the TLD badge during the process of movement of the patient to the radiation delivery room, where radiotherapy, as well as exposure to the TLD badge, continued to happen. Ultimately, this case involves a non-genuine exposure in which no remedial actions were taken except a warning to take care of TLD badges, including not to repeat such action in future.

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WHY IS OCCUPATIONAL SAFETY NECESSARY?

In recent decades, the use of ionizing radiation has grown significantly in the health care sector due to associated reasons, including many other reasons, such as facilitation of relatively greater information, comparatively less time required, non-invasive procedures in nature, etc. Radiation use in healthcare has been shown to have positive effects on both people and society. However, because of the characteristics of ionizing radiation, it may also pose health hazards to those who are exposed, such as patients, medical professionals, and the general public. Radiation exposure also affects the personnel and others providing care and comfort for the patients.

At this point, it is important to note that patients who undergo ionising radiation-based operations and are outweighed for the benefit have no control over the radiation dose as long as it is not detrimental. Though the therapeutic and diagnostic modalities, based on ionising radiation, is now becoming the backbone of contemporary modern medicine, there is still need(s) of a very controlled as well as judicial use of ionising radiation with adequate protection.

ISSUE IN THE FOCUS

In day-to-day practice, for monitoring of the radiation dose received by the radiation professionals (RP) such as medical physicists, radiation oncologists, radiotherapy technologists, caregivers directly involved in the management of patients such as nurses, ward boys, radiologist, interventionist, clinicians working with ionising radiation are provided a device known as the thermoluminescence dosimeter to each of them. No matter the way a health care radiation facility or radiation professional uses ionising radiation, they all abide by the AERB-mandated radiation dose limit, which is listed in figure (1).

Dose Limitations		
Part of the body	**Occupational Exposure**	**Public Exposure**
Whole body (Effective dose)	20 mSv/year averaged over 5 consecutive years; 30 mSv in any single year	1 mSv/y
Lens of eyes (Equivalent dose)	150 mSv in a year	15 mSv/y
Skin (Equivalent dose)	500 mSv in a year	50 mSv/y
Extremities (Hands and Feet) Equivalent dose	500 mSv in a year	–
For pregnant radiation workers, after declaration of pregnancy 1 mSv on the embryo/fetus should not exceed.		

Figure 1: Dose limits as prescribed by AERB, India
(Source: https://www.aerb.gov.in/english/radiation-protection-principle)

ROLE AND IMPORTANCE OF TLD BADGE

These TLD badges coupled with the crocodile jaw type clip, as shown in figure 2 are issued to each of the RP with unique ID, which is non-transferable.

The TLD badge should be worn at the chest level all the time while involved with the operations using the ionising radiation or present in the radiation premises, irrespective of the type of procedures, e.g., therapeutic or diagnostic, to ensure the recording of the doses received, if any. The type of badge and the quantity of badges may also vary depending on the medical procedures involved. However, in standard radiation therapy process, one badge at the chest level is recommended.

Figure 2: TLD badges for Radiation Professional (RP)

Although the radiation therapy facility offers adequate radiation safety to professionals and the general public, there is provision for personal monitoring of each individual RP using TLD badges to keep an eye on any accidental or emergency situations that could expose them to significantly higher radiation doses. The objective lies behind the fact that by whatever amount radiation exposing the person wearing the TLD badge at chest level will also be sensed by the detector volume. This ultimately detects the amount of radiation dose received by the concerned personnel.

These TLD badges are read out quarterly by an AERB-recognized TLD readout facility and the result of the readout, i.e., the amount of radiation dose absorbed by the TLD badge of the individual RP is reported to the Radiation Safety Officer of the concerned radiation facility as well.

If a dose recorded by any of the RP is significant then it comes in the purview of investigation of the reason(s) and action is taken accordingly inline of action plan of AERB in consultation with the other stakeholders of the facility such as employer, licensee, radiation safety officer and other administrative personnel.

CASE DESCRIPTION

Here, a case of slightly higher, compared to previous years, radiation dose received by one of the RP is being presented, which took place in the brachytherapy facility. In the year 2021, a slightly higher radiation dose, of the first quarter, i.e., Jan-March period, to one of the health care providers came in the notice only after the annual TLD dose record report was presented. This was quite shocking as the radiation facility itself, by means of its construction-design and layout, as well as built-in safety of the equipment, including standard work practices, facilitates adequate radiation safety to each of the Radiation professionals.

However, after an in-depth investigation into the cause of the incident, it was found that inadvertently somehow the person concerned left the TLD badge in the brachytherapy room during the process of moving the patient, and later forgot the place where it was left. After this, radiation delivery to the cancer patients in the brachytherapy room continued to happen there, which resulted, i.e., non-genuine radiation dose to TLD badge and hence to the concerned RP. Thereafter, the concerned RP continued searching for it and eventually found it and started using it again, as he was using before this incident, which was later recalled and disclosed by the concerned RP during interrogation. However, this was not

to the level that required chromosomal aberration testing. Ultimately, this case involves a non-genuine exposure in which no remedial actions were taken except a warning to take care of TLD badges, including not to repeat this action in future.

LESSONS LEARNED FROM THE CASE

- The TLD badge should be kept at out of radiation field and designated places only.
- Each radiation worker while working in the field of radiation must always wear their own TLD badge.
- The TLD badge should not be exchanged among Radiation Professionals.
- TLD cards should be changed quarterly.
- The regular monitoring of the radiation dose record should be included in standard Operating Procedure (SOPs).
- Any inadvert scenario occurring with the TLD badges should be immediately brought under the notice of RSO/ administration.
- Periodically, all the radiation professionals, including newly joined, should be given awareness training about Dos and don't related to TLD badge usage.
- TLD badge should always be worn under the apron at chest level, in case of working in x-ray diagnostic facility.

REFERENCE

1. Available from https://www.aerb.gov.in/