Maria Sklodowska-Curie
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INTERNATIONAL CONFERENCE
ON RADIATION APPLICATIONS
In Physics, Chemistry, Biology,
Medical Sciences, Engineering
and Environmental Sciences
RAP24
June 10-12, 2024 | University of Granada | Spain

TLD postal dosimetry audit in Poland – 2023 results

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Laboratory accredited by the Polish Centre for Accreditation, accreditation No. AB 1499*

* an actual scope of accreditation No. AB 1499 is available on the PCA website: www.pca.gov.pl

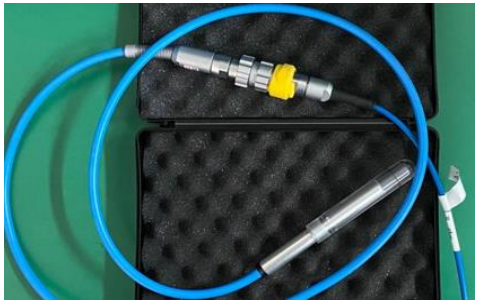
Ensuring safe radiation therapy is an important task for medical physicists. At the national level, it is carried out, among other things, by conducting dosimetry audits.

The importance of dosimetry audits in radiotherapy is set very clearly by the IAEA in its publication HUMAN HEALTH SERIES No. 31: "Accuracy Requirements and Uncertainties in Radiotherapy." In the aforementioned publication, a recommendation is given that for each new radiotherapy machine, an independent dosimetry audit should be conducted before irradiating patients. In addition, regular audits should be performed remotely or on-site at the audited facility.

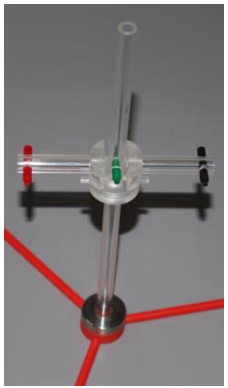
The aim of these audits conducted to radiotherapy centres is to:

- assure proper calibration of radiotherapy beams,
- avoid mistreatment of cancer patients,
- prevent radiation accidents.

Polish Secondary Standards Dosimetry Laboratory (SSDL) offers dose measurement in water, for which it is accredited by the Polish Centre for Accreditation for compliance with the ISO/IEC 17025 standard (accreditation No. AB 1499). SSDL in Warsaw is the only laboratory in Poland performing postal TLD dose audit.

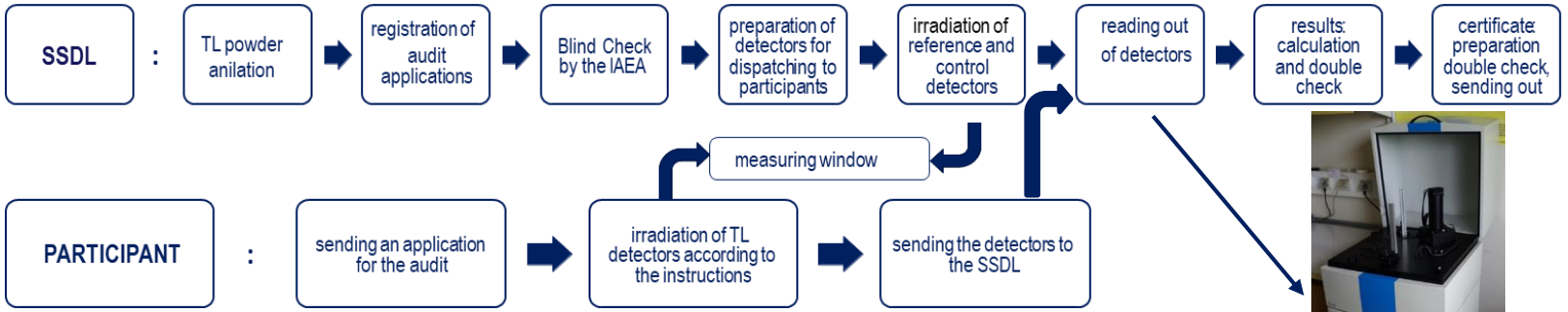


Electrometer + ionization chamber



Holders for irradiation of TL detectors

In 2023, 43 radiotherapy centres located in Poland participated in this audit. Total number of audited radiation beams was 145, including 138 photon beams and 7 electron beams. Thermoluminescent dosimeters (TLD) of Li-F MT-F type were mailed to each participant. The participants were instructed to irradiate three TL detectors for each beam with a dose of 2.0 Gy in reference conditions. After irradiation the detectors were sent back to the SSDL. At the same time, set of reference detectors was irradiated with known doses at the SSDL. All detectors were read out at the SSDL with a Fimel PCL 3 TLD reader.



Fimel PCL 3 TL reader

The delta parameter was defined as the quotient of the difference between dose value reported by the participant and dose value estimated by the SSDL to the dose value estimated by the SSDL. The *delta* parameter was calculated as a percentage value.

$$\text{delta} = \frac{D_P - D_{SSDL}}{D_{SSDL}} \cdot 100\ [\%]$$

where:
D_P [cGy] – dose reported by the participant;
D_{SSDL} [cGy] – dose determined by the SSDL as follows:

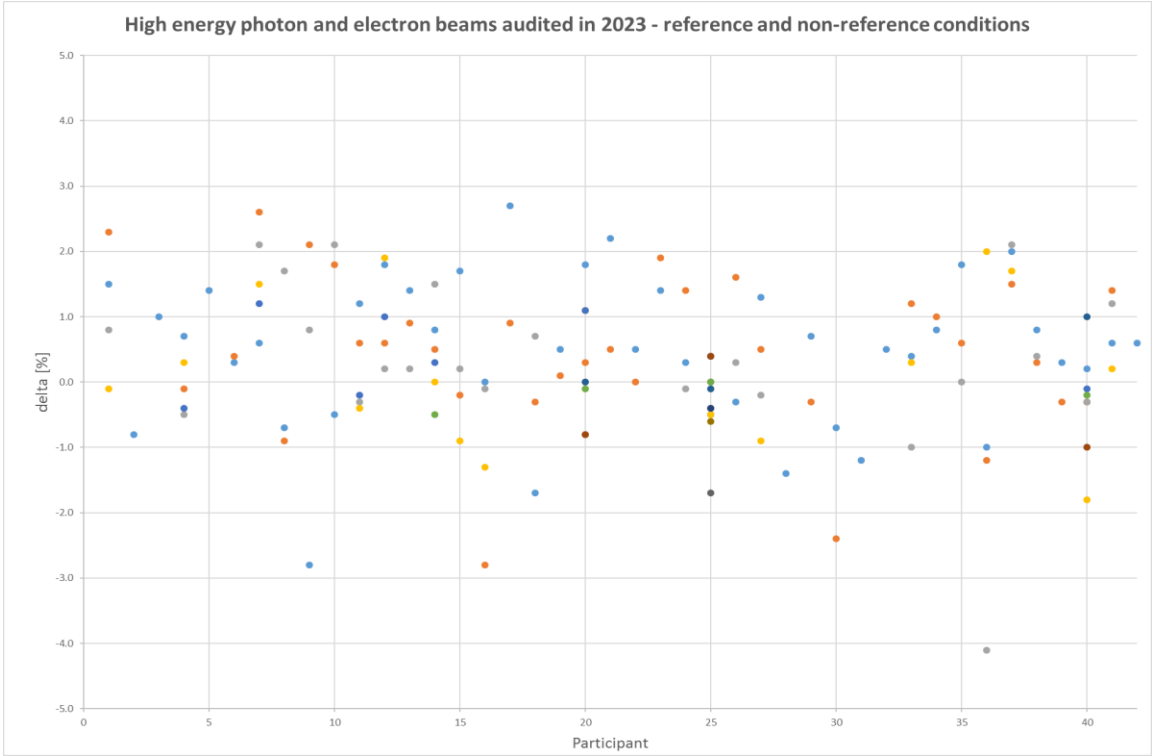
$$D_{SSDL} = M \cdot N \cdot f_{lin} \cdot f_{en} \cdot f_{fad} \cdot f_{hol}$$

where:
M [counts] – the TL detector response;
N [cGy/counts] – calibration coefficient of the TLD system;
f_{lin} – non-linearity dose response correction factor;
f_{en} – energy correction factor;
f_{fad} – fading correction factor;
f_{hol} – holder correction factor.

The biggest absolute delta value found between the dose estimated by the SSDL and the dose declared by the participant was 4.1%.

The average delta value for all beams was 0.32%.

The uncertainty of audit methods was 3.4%.



Dosimetry audits performed in radiotherapy:

- allow confirmation of the dosimetric and geometric parameters;
- are crucial to quality management programs in radiotherapy, since the accuracy of dosimetry in radiotherapy is essential to achieve the intended goal of treatment with high-energy ionizing radiation with minimal risk of error in clinical work;
- play an important role in detecting gross deviations from standards, especially in identifying dosimetric systematic errors.

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Thank you for attention.