Maria Sklodowska-Curie
National Research
Institute of Oncology

RAD eleven
Eleventh International Conference on Radiation,
Natural Sciences, Medicine, Engineering, Technology and Ecology
June 19 - 23, 2023 | Hunguest Hotel Sun Resort | Herceg Novi | Montenegro

TLD postal dose audit in Poland – 2022 results

W. Ślusarczyk-Kacprzyk, I. Grabska, M. Szymański

The Secondary Standards Dosimetry Laboratory, Department of Medical Physics,
Maria Sklodowska-Curie National Research Institute of Oncology, Warsaw, Poland

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

Maria Skłodowska-Curie
National Research
Institute of Oncology

RAD eleven

Introduction

Currently, i.e. at the end of 2022, Polish legislation does not impose any obligation on radiotherapy centres to undergo dosimetry audit. However, in accordance with good dosimetry practice, audits will continue to be organized by the SSDL in Warsaw for radiotherapy centres in Poland.

In Poland, the first postal dose audit was organized by the Secondary Standards Dosimetry Laboratory (SSDL) of the Institute of Oncology in Warsaw in 1991.

The aim of the thermoluminescent dosimetric audits in radiotherapy centers is to assure proper calibration of radiotherapy beams to avoid mistreatment of cancer patients and prevent radiation accidents. The Polish 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*). The SSDL in Warsaw is the only laboratory in Poland performing postal TLD dose audit.

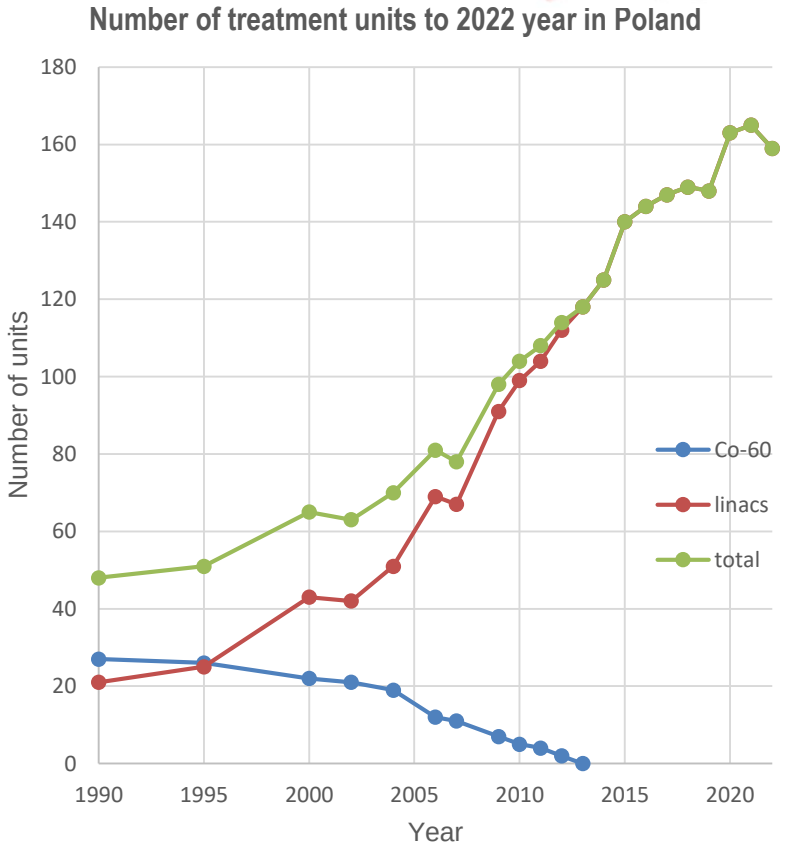
* an actual scope of accreditation No AB 1499 is available on the PCA website: www.pca.gov.pl

Maria Skłodowska-Curie
National Research
Institute of Oncology

RAD eleven

Materials and methods

In 2022, 42 radiotherapy centres located in Poland participated in this audit. In this centres there were 159 linear accelerators installed. These treatment units generated 490 high energy photon beams and 492 electron beams. Most of radiotherapy centres requested an audit for more than one beam quality. Total number of audited radiation beams was 144, including 134 photon beams (15 beams in non-reference conditions) and 10 electron beams.

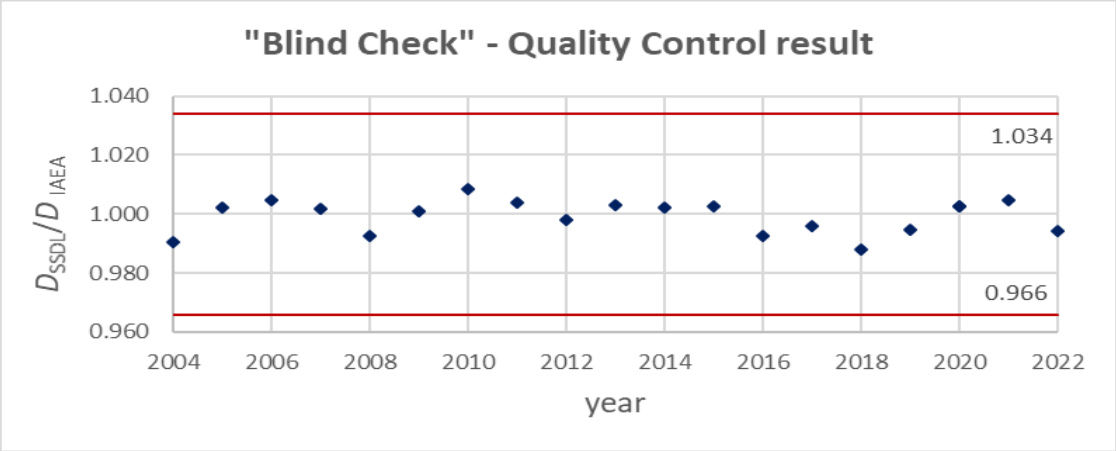


Maria Skłodowska-Curie
National Research
Institute of Oncology

RAD eleven

Materials and methods

One of the requirements of the ISO / IEC 17025 standard is to monitor the validity of the results. In Polish SSDL it includes e.g. participation in interlaboratory comparisons with the IAEA. A set of TL detectors is delivered to the IAEA and is irradiated with a radiation dose unknown to SSDL. An unknown dose value is determined in the same manner as for the radiotherapy dosimetry audits. The obtained result (D_{SSDL}) is forwarded to the IAEA. Finally, the IAEA reports to the Polish SSDL the dose value that the dosimeters have been irradiated (D_{IAEA}).



Maria Skłodowska-Curie
National Research
Institute of Oncology

RAD eleven

Materials and methods

Thermoluminescent dosimeters (TLD) of Li-F MT-F type (Institute of Nuclear Physics, Cracow, Poland) 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.

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 whole scheme of this postal dose audit is shown on the next slide.

Maria Skłodowska-Curie
National Research
Institute of Oncology

RAD eleven

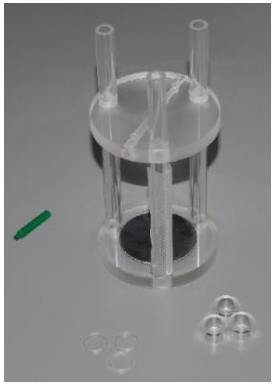
The scheme of postal dose audit using the TLD method

SSDL : TL powder anilation → registration of audit applications → Blind Check by the IAEA → preparation of detectors for dispatching to participants → irradiation of reference and control detectors → reading out of detectors → results: calculation and double check → certificate: preparation double check, sending out

PARTICIPANT : sending an application for the audit → irradiation of TL detectors according to the instructions → sending the detectors to the SSDL

measuring window

Holders for irradiation of TL detectors:



Fimel PCL 3 TL reader

The deviation of the dose reported by the participant and the dose measured by the SSDL was calculated as follows:

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

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

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

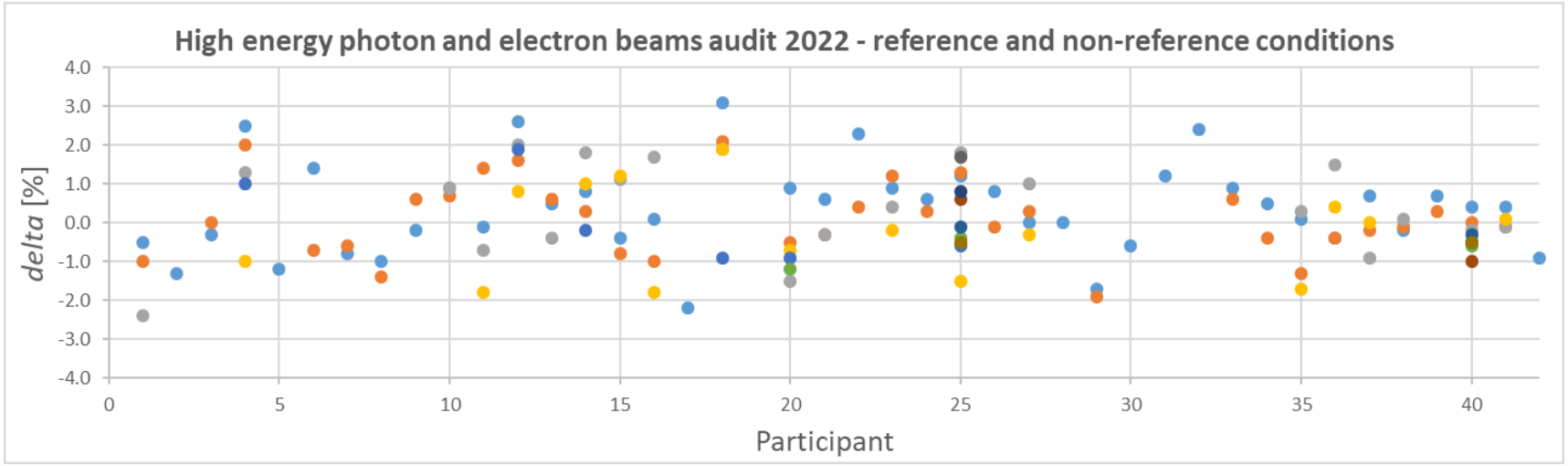
where:
M [counts] – the TL detector response;
N [cGy/counts] – calibration coefficient of the TLD system;
f_{lin} – non-linearity dose response correction factor;
f_{en} – energy correction factor;
f_{fad} – fading correction factor;
f_{hol} – holder correction factor.

Maria Sklodowska-Curie
National Research
Institute of Oncology

RAD eleven

Results

The biggest difference found between the dose estimated by the SSDL and the dose declared by the participant was 3.1%. The average delta value for all beams was 0.18%. The uncertainty of audit methods was 3.4%.



Maria Sklodowska-Curie
National Research
Institute of Oncology

RAD eleven

Conclusions

Postal dose audits in radiotherapy confirm:

- the calibration of the beam,
- the correctness of the geometric reproducibility of the beam,
- the correctness of the data entered into the TPS,
- the precision of the calculated dose distributions.

TLD postal dose audits organized by The Secondary Standards Dosimetry Laboratory in Maria Sklodowska-Curie National Research Institute of Oncology are an important element of ensuring safe and effective radiotherapy in Poland.