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**National Research
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TLD postal dose audit in Poland – 2021 results

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

Introduction

The regulation of the Ministry of Health on safe use of ionizing radiation for medical exposures (18 February, 2011) makes it obligatory for all radiotherapy centers in Poland to participate in external dosimetric audits. In Poland, the first postal dose audit was organized by the Secondary Standard 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.

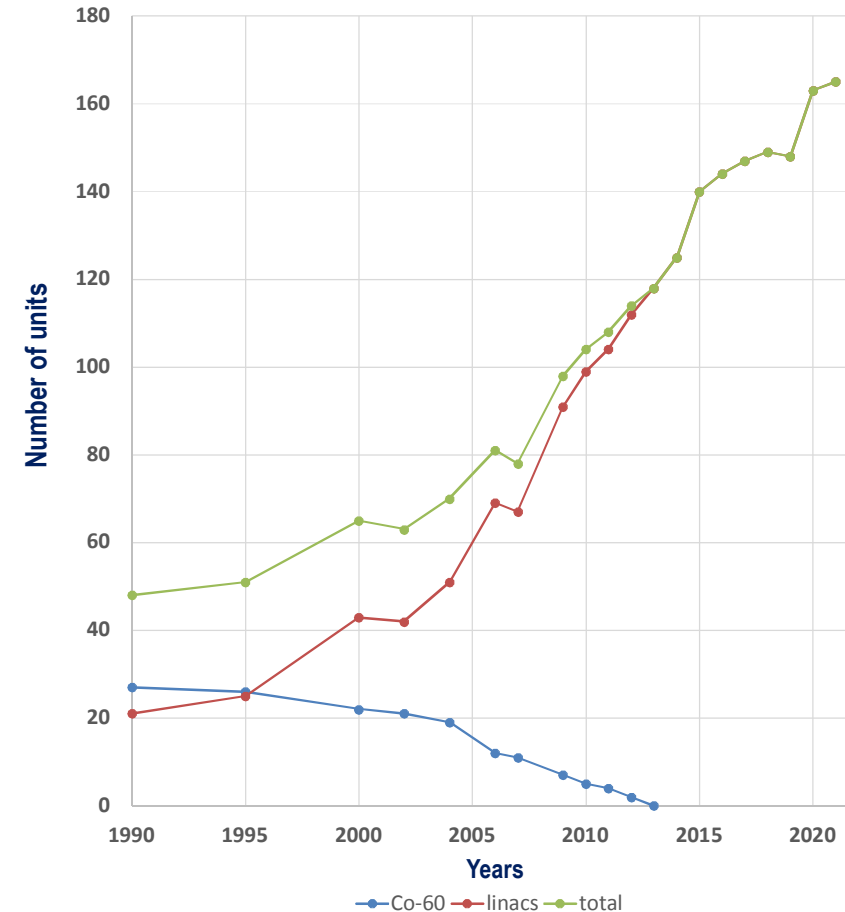
* an actual scope of accreditation No AB 1499 is available on the PCA website: www.pca.gov.pl

Materials and methods

In 2021, there were 165 teleradiotherapy linacs installed in Poland. These treatment units generated 443 high energy photon beams and 512 electron beams. 42 radiotherapy centres participated in the last year audit. Most of them requested an audit for more than one beam quality.

In total, 135 radiation beams were audited, 130 photon beams (including 14 beams in non-reference conditions) and 5 electron beams.

Number of treatment units to 2021 year in Poland



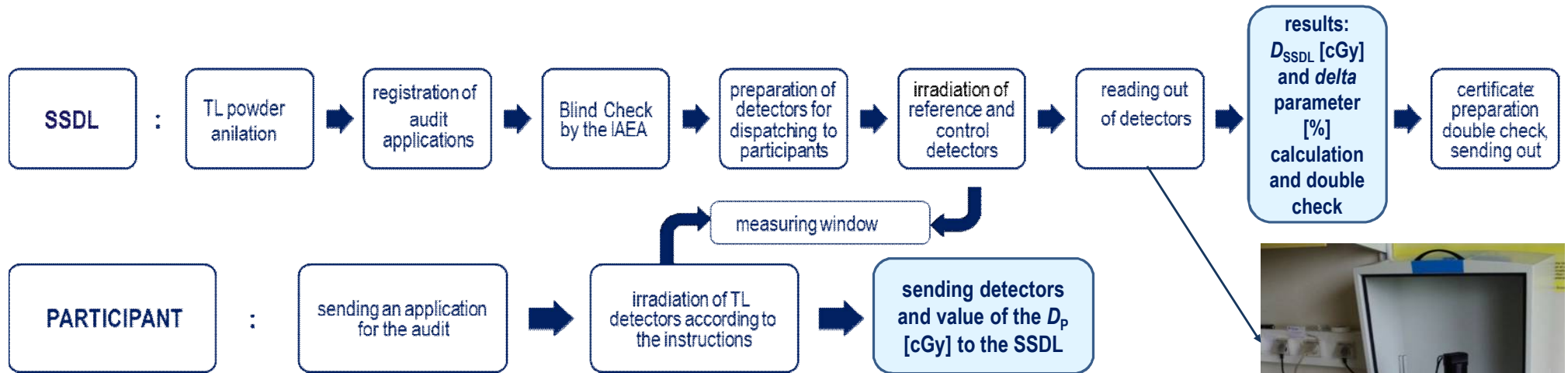
Materials and methods

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 calculated as a percentage value. It is customary to assume that the audit result is correct when the delta is $\leq \pm 3.5\%$.

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

The scheme of postal dosimetric audit using the TLD method



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:

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

where:

D_P [cGy] – dose reported by the participant;

D_{SSDL} [cGy] – dose determined by the SSDL as follows:

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

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;

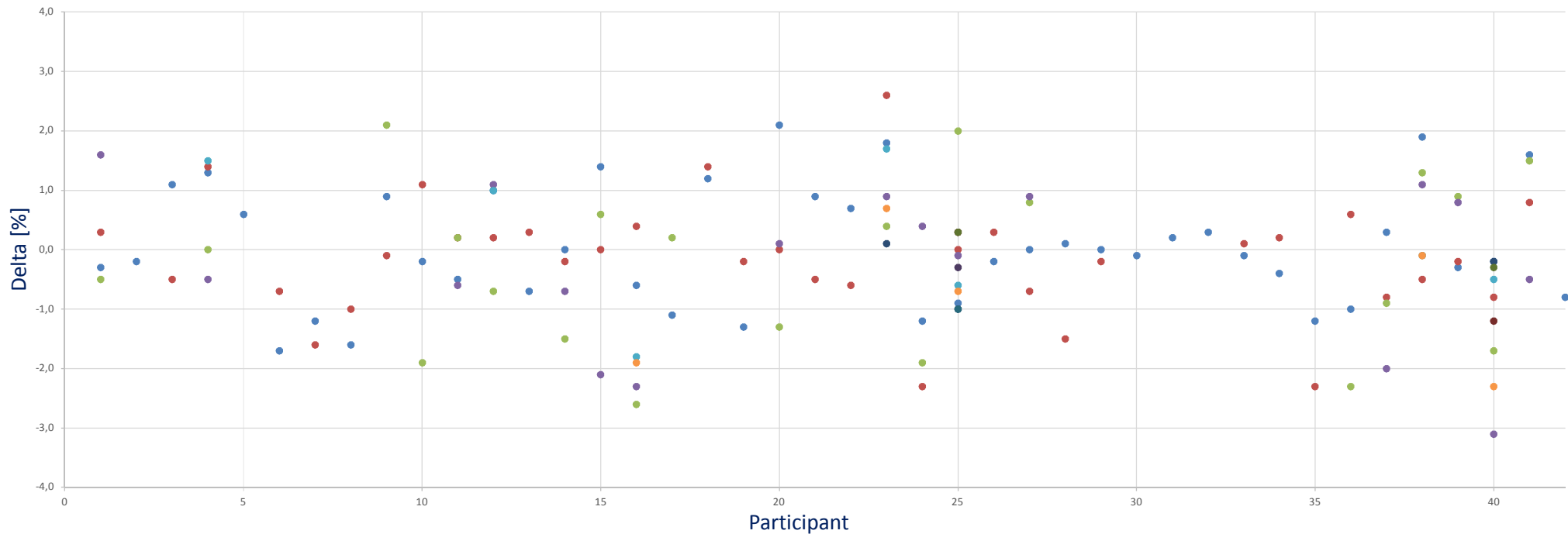
f_{fad} – fading correction factor;

f_{hol} – holder correction factor.

Results

The biggest difference found between the dose estimated in SSDL and the dose declared by the participant was +2.6% and -3.1%. The average delta value for all beams was - 0.17%.

High energy photon and electron beams audit 2021 - reference and non-reference conditions



Conclusions

The results obtained were very good. For each audited beam, the *delta* value did not exceed $\pm 3.5\%$.

At the time of COVID-19 pandemic, TLD postal dose audits was an important element of ensuring safe and effective radiotherapy in Poland.