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**Radiološka zaščita - Minimalna merila za spektroskopijo z elektronsko paramagnetno resonanco (EPR) za retrospektivno dozimetrijo ionizirnega sevanja - 1. del: Splošna načela (ISO 13304-1:2020)**

Radiological protection - Minimum criteria for electron paramagnetic resonance (EPR) spectroscopy for retrospective dosimetry of ionizing radiation - Part 1: General principles (ISO 13304-1:2020)

Strahlenschutz - Mindestanforderungen an die Elektronenspinresonanz (EPR-Spektroskopie) für die retrospektive Dosimetrie ionisierender Strahlung - Teil 1: Allgemeine Grundsätze (ISO 13304-1:2020)

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Radioprotection - Critères minimaux pour la spectroscopie par résonance paramagnétique électronique (RPE) pour la dosimétrie rétrospective des rayonnements ionisants - Partie 1: Principes généraux (ISO 13304-1:2020)

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13.280	Varstvo pred sevanjem	Radiation protection
17.240	Merjenje sevanja	Radiation measurements

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Radiological protection - Minimum criteria for electron  
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General principles (ISO 13304-1:2020)

Radioprotection - Critères minimaux pour la  
spectroscopie par résonance paramagnétique  
électronique (RPE) pour la dosimétrie rétrospective  
des rayonnements ionisants - Partie 1: Principes  
généraux (ISO 13304-1:2020)

Strahlenschutz - Mindestanforderungen an die  
Elektronenspinresonanz (EPR-Spektroskopie) für die  
retrospektive Dosimetrie ionisierender Strahlung - Teil  
1: Allgemeine Grundsätze (ISO 13304-1:2020)

This European Standard was approved by CEN on 18 December 2022.

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## European foreword

The text of ISO 13304-1:2020 has been prepared by Technical Committee ISO/TC 85 "Nuclear energy, nuclear technologies, and radiological protection" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 13304-1:2022 by Technical Committee CEN/TC 430 "Nuclear energy, nuclear technologies, and radiological protection" the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2023, and conflicting national standards shall be withdrawn at the latest by June 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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### Endorsement notice

The text of ISO 13304-1:2020 has been approved by CEN as EN ISO 13304-1:2022 without any modification.



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**Radiological protection — Minimum  
criteria for electron paramagnetic  
resonance (EPR) spectroscopy for  
retrospective dosimetry of ionizing  
radiation —****Part 1:  
General principles**

*Radioprotection — Critères minimaux pour la spectroscopie par  
résonance paramagnétique électronique (RPE) pour la dosimétrie  
rétrospective des rayonnements ionisants —*

*Partie 1: Principes généraux*

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# ISO 13304-1:2020(E)

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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This document was prepared by Technical Committee ISO/TC 85, *Nuclear energy, nuclear technologies, and radiological protection*, Subcommittee SC 2, *Radiological protection*.

A list of all parts in the ISO 13304 series can be found on the ISO website.

This second edition cancels and replaces the first edition (ISO 13304-1:2013), of which it constitutes a minor revision. The changes compared to the previous edition are as follows:

- inclusion of bibliographic references in the text;
- informative reference to ISO 13304-2 added;
- update of Bibliography.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

Electron paramagnetic resonance (EPR) has become an important approach for retrospective dosimetry in any situation where dosimetric information is potentially incomplete or unknown for an individual. It is now applied widely for retrospective evaluation of doses that were delivered at considerable times in the past (e.g. EPR dosimetry is one of the methods of choice for retrospective evaluation of doses to the involved populations from the atomic weapon exposures in Japan and after the Chernobyl accident) and has received attention for use for triage after an incident in which large numbers of people have potentially been exposed to clinically significant levels of radiation<sup>[1] to [12]</sup>. Various materials may be analysed by EPR to provide information on dose<sup>[13] to [41]</sup>. Thus, EPR is a versatile tool for retrospective dosimetry, pertinent as well for acute exposures (past or recent, whole or partial body) and prolonged exposures. Doses estimated with EPR were mainly used to correlate the biological effect of ionizing radiation to received dose, to validate other techniques or methodologies, to manage casualties, or for forensic expertise for judicial authorities<sup>[42]</sup>. It uses mainly biological tissues of the person as the dosimeter and also can use materials from personal objects as well as those located in the immediate environment. EPR dosimetry is based on the fundamental properties of ionizing radiation: the generation of unpaired electron species (often but not exclusively free radicals) proportional to absorbed dose. The technique of EPR specifically and sensitively detects the amount of unpaired electrons that have sufficient stability to be observed after their generation; while the amount of the detectable unpaired electrons is usually directly proportional to the amount that was generated, these species can react, and therefore, the relationship between the intensity of the EPR signal and the radiation dose needs to be established for each type of use. The most extensive use of the technique has been with calcified tissue, especially with enamel from teeth<sup>[43] to [50]</sup>. An IAEA technical report was published on the use for tooth enamel<sup>[51]</sup>. To extend the possibility of EPR retrospective dosimetry, new materials possibly suitable for EPR dosimetry are regularly studied and associated protocols established. This document is aimed to make this technique more widely available, more easily applicable and useful for dosimetry. Specifically, this document proposes a methodological frame and recommendations to set up, validate, and apply protocols from sample collection to dose reporting. The application of this document to ex vivo human tooth enamel dosimetry is described in ISO 13304-2<sup>[52]</sup>.

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