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Determination of the characteristic limits (decision threshold, detection limit and limits of the confidence interval) for measurements of ionizing radiation — Fundamentals and application

Détermination des limites caractéristiques (seuil de décision, limite de détection et extrémités de l'intervalle de confiance) pour mesurages de rayonnements ionisants — Principes fondamentaux et applications

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Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 11929 was prepared by Technical Committee ISO/TC 85, *Nuclear energy*, Subcommittee SC 2, *Radiation protection*.

This first edition of ISO 11929 cancels and replaces ISO 11929-1:2000, ISO 11929-2:2000, ISO 11929-3:2000, ISO 11929-4:2001, ISO 11929-5:2005, ISO 11929-6:2005, ISO 11929-7:2005 and ISO 11929-8:2005, which have been technically revised, specifically with reference to the type of statistical treatment of the data.

Introduction

The limits to be provided according to this International Standard by means of statistical tests and specified probabilities allow detection possibilities to be assessed for a measurand and for the physical effect quantified by this measurand as follows:

— the "decision threshold" gives a decision on whether or not the physical effect quantified by the measurand is present;

— the "detection limit" indicates the smallest true value of the measurand which can still be detected with the applied measurement procedure; this gives a decision on whether or not the measurement procedure satisfies the requirements and is therefore suitable for the intended measurement purpose;

— the "limits of the confidence interval" enclose, in the case of the physical effect recognized as present, a confidence interval containing the true value of the measurand with a specified probability.

Hereinafter, the limits mentioned are jointly called "characteristic limits".

Since measurement uncertainty plays an important part in this International Standard, the evaluation of measurements and the treatment of measurement uncertainties are carried out by means of the general procedures according to ISO/IEC Guide 98-3; see also References [1, 2]. This enables the strict separation of the evaluation of the measurements, on the one hand (Clause 5), and the provision and calculation of the characteristic limits, on the other hand (Clause 6). This International Standard is based on Bayesian statistics according to References [6 to 19], such that uncertain quantities and influences, which do not behave randomly in measurements repeated several times or in counting measurements, can also be taken into account.

Equations are provided for the calculation of the characteristic limits of an ionizing radiation measurand via the "standard measurement uncertainty" of the measurand (hereinafter "standard uncertainty"). The standard uncertainties of the measurement, as well as those of sample treatment, calibration of the measuring system and other influences are taken into account. However, the latter standard uncertainties are assumed to be known from previous investigations.