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Quality Management System – Policy and Programme Support Section					
MEASUREMENT UNCERTAINTY					

1. PURPOSE

To specify possible ways of expressing the uncertainty in values reported to the customer.

2. SCOPE

This procedure applies to any value reported to the customer and, in order to do this, it also applies to all intermediate measurement values incorporated into the reported value.

3. RESPONSIBILITIES

Service Group Leader

- To devise the total sum of uncertainties — the “uncertainty budget” — for the measurement method
- To select a mathematical model for the calculation of the combined measurement uncertainty
- To keep all ensuing records.

Laboratory Technician

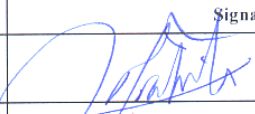


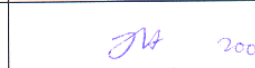

- To perform the necessary measurements.

Quality Manager (upon request of the Service Group Leader)

- To recommend the most applicable mathematical method
- To assist in finalizing the calculations.

4. ADDITIONAL INFORMATION

- [EA-04/2](#) Expression of the Uncertainty of Measurement in Calibration
- [EA-04/16](#) EA guidelines on the expression of uncertainty in quantitative testing

	Function	Name	Signature and Date
Authorized	Section Head	K. Mrabit	 2005/06/28
Approved	Unit Head	Pascal Deboodt	 2005-07-27
Approved	Service Group Leader	R. Cruz-Suarez	 2005-07-28
Approved	Service Group Leader	John Hunt	 2005-06-21
Registered	Quality Manager	J. Zeger	 24-May-2005

If printed valid only on 2011-09-26, for valid copy refer to
s:\quality management\quality management documentation\general technical procedures\ PR-14-
OP_Measurement_uncertainty_V1.doc

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- [ILAC-G17:2002](#) Introducing the Concept of Uncertainty of Measurement in Testing in Association with the Application of the Standard ISO/IEC 17025
- [NIST Technical Note 1297](#), 1994 Edition Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results
- [UKAS Publication ref: LAB 12](#) The Expression of Uncertainty in Testing

5. DESCRIPTION

As it is never possible to measure the “true” value of any measurand, it is very important to report not only the measured value but also the uncertainty of this value together with the confidence level of the uncertainty interval.

There are two methods to arrive at the final uncertainty value:

Type A is applicable if there is the possibility of standardization, repeated measurements of the same measurand on the same sample and application of statistical mathematics to different results.

If statistical methods as described in Type A are not applicable, the final uncertainty value has to be reached according to **Type B**, by applying expert scientific knowledge.

The **Service Group Leader** shall decide which method is to be applied to the specific measurement problem.

Generally, there are two routes that must be evaluated and combined in order to arrive at the final value of measurement uncertainty:

Calibration	Sample
Certified uncertainty of the standard	Uncertainty of sampling
Statistical uncertainty of standard measurement	Uncertainty of sample aliquoting
	Uncertainty of sample preparation
	Statistical uncertainty of sample measurement

The human factor also must not be disregarded when evaluating totally combined measurement uncertainties. Therefore, the measurement uncertainties for each person working on a certain measurement problem should be investigated, if possible on different days.

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As an alternative to this extensive and time-consuming investigation, the **Service Group Leader** may use the results of control sample treatment. Control samples are often introduced into real sample batches for statistical evaluation of “human induced” measurement uncertainties.

These different single uncertainties must be combined mathematically into one overall measurement uncertainty, which is reported to the customer. As there are different routes for mathematical combination, this procedure cannot provide the correct route for an individual measurement problem. Therefore, further procedural descriptions may be used as guidance for developing an acceptable method for solving individual measurement problems:

- Relevant IAEA Safety Guides as applicable to the measurement methods
- ISO Guide to the Expression of Uncertainty in Measurement (GUM); 1995
- American National Standard for Expressing Uncertainty; ANSI/NCSL Z540-2-1997
- Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results; NIST Technical Note 1297
- Expression of Uncertainty of Measurement in Calibration; European Co-operation for Accreditation; EA – 4/02; December 1999.

Whenever the Service Group Leader sees need for it, the Unit Head and/or Quality Manager may be asked for help in the process of evaluating the combined measurement uncertainty of some measurement problem.

In general, this procedure for estimating a combined measurement uncertainty needs to be performed only once — preferably at the time of validating a measurement method. It needs to be repeated only if one or more of the components change. These may be:

- standard
- measurement equipment
- environmental surroundings
- method of sampling
- sample preparation method
- operator.

In cases of change, the whole or part of the evaluation process must be repeated to arrive at a new consolidated measurement uncertainty.

6. RECORDS

Description of the procedure and documentation of used measurement values to arrive at a combined measurement uncertainty for a specific measurement method, to be kept by the **Service Group Leader**.