Workshop on sampling validation, quality control and uncertainty estimation

Christian Grøn, DHI, Denmark, chg@dhigroup.com

The first international workshop on validation, quality control and uncertainty estimation of sampling was held in Hillerød, Denmark April 14-15, 2007. The purpose of the workshop was to present and discus a new Nordtest handbook on uncertainty from sampling. The workshop was attended by 60 experts from 15 European countries.

The Nordtest handbook

The Nordtest handbook is an extract of and based upon the principles, methods and text of the recently published Eurachem/EUROLAB/ CITAC/Nordtest/AMC Guide: Measurement uncertainty arising from sampling: a guide to methods and approaches (available at http://www.eurachem.org). The handbook provides practical guidance on sampling uncertainty estimation in the Nordtest handbook format and will be available at the Nordtest web site at http://www.nordicinnovation.net/nordtest.cfm, under NT technical reports, report number NT tec 604. Until the final report is available on the Nordtest web site, a final draft of the Nordtest handbook is available at http://www.samplersguide.com. This handbook is the latest in a series of handbooks on validation, quality control and uncertainty estimation of laboratory analysis and field measurements, all available from the Nordtest web site.

The main message of the handbook is that uncertainty from sampling can be estimated with reasonable efforts and following steps that are comparable to those used in quality assurance of laboratory analysis: method validation and quality control. The most useful tools in sampling uncertainty estimation are replicate measurements (random errors) and sampler proficiency tests or method studies (systematic errors).

Illustration of the combined use of validation and quality control of sampling.

	One method used for many sampling targets	***One method used repeatedly for one sampling target***
Validation	Initial validation yielding generic performance data for the method	Target validation yielding the performance data for the specific target and the method used
Quality control	Quality control with target specific verification of generic method performance data	Spot quality control verifying the performance data consistency over time

Workshop contents

The workshop presentations started with a general introduction to measurement, sampling, and analytical uncertainty. Methods for estimating the uncertainty were listed and discussed. Examples of an empirical method, the duplicate design, were presented more thoroughly and interpretation of the uncertainty estimations and fitness for purpose of the sampling methods were discussed.

After an introduction to the Nordtest handbook, the main general points in the handbook were highlighted:

- Design of the sampling program, including sampling purpose, sampling target, and quality objectives
- Uncertainty in measurements–sources and types of uncertainty
- Principles of quality assurance in sampling–validation and quality control.

Worked examples from the handbook were presented on ground water monitoring, industrial product control of iron ore, food sector control and waste water monitoring.

On the second day of the workshop, two presentations were demonstrating sampling uncertainty as the dominant source of measurement uncertainty: one on sampling of waste water using variography and one on sampling of contaminated soil. For the soil example, it was shown that the evaluation of the contamination level of a site was significantly different when sampling uncertainty was included. The calculation tool used was robust ANOVA, and a calculation program to perform this, ROBAN, was demonstrated.

Finally, group work was done with the aim of giving the participants "hands on" experience of the tools presented.

Participant satisfaction

Feedback demonstrated that the participants were generally satisfied with 4 out of 5 (highest) being the most abundant mark. It is, however, difficult to satisfy all participants because of their very variable expectations, knowledge on the subject and theoretical background.

Perspectives

The workshop demonstrated, that methods and software are now available that allow for estimation of the random contribution to sampling uncertainty. For the systematic uncertainty component, tools such as method studies for method evaluation and sampler proficiency tests for sampler performance evaluation are not readily available, and sampling reference sites for both purposes have only been established for a few matrices.

An additional outcome of the workshop was a groundwater sampler proficiency test. It was organized by workshop participants in Denmark in the autumn of 2007 and further steps along this road are in preparation.

Furthermore, an Eurachem workshop is arranged for April 15-16, 2008 in Berlin entitled Sampling uncertainty and uncertainty for compliance assessment, see www.eurachem.org for more info

Acknowledgements

The contributions of my co-authors of the Nordtest handbook, Bertil Magnusson, SP Technical Research Institute of Sweden, Mikael Krysell, Ulla O. Lund and Kirsten J. Andersen, Eurofins A/S, Denmark and Astrid Norbotten, Food Safety Authority, Norway, as well as the additional contributions as organizers and lecturers at the workshop by Anke Oberender and Jette B. Hansen, DHI, Mike H. Ramsey and Katy Boon University of Sussex and Pentti Minkkinen, Lappeenranta University of Technology, Finland are gratefully acknowledged.

The Nordtest handbook and the workshop were supported by Nordic Innovation Centre/Nordtest under contract 04130.