2024
HSA Statistics
Training Courses Catalogue

Chemical Metrology Laboratory
Health Sciences Authority, Singapore

HSA
Health Sciences Authority

About

Chemical Metrology Division

Health Sciences Authority

HSA is a Designated Institute for Chemical Metrology in the areas of food, healthcare, medical science, pharmaceuticals & health products, and forensics.

Our Chemical Metrology Laboratory (CML) provides metrological services to local chemical testing and clinical laboratories. We offer Certified Reference Materials (CRMs) for method validation, calibration and quality control, as well as Proficiency Testing (PT) programmes for food, water, cosmetics, pharmaceuticals and fuel oil testing laboratories, and an External Quality Assessment (EQA) programme for clinical laboratories. Our quality system is based on **ISO/IEC 17025, ISO 17034** and **ISO/IEC 17043**.

Besides offering CRMs, PT/EQA programmes and value assignment services, we offer training in statistics, method validation and measurement uncertainty as well as onsite customised training and consultancy services.

Statistics Training Courses

Our Training Courses

We offer courses to equip analytical scientists and medical technologists with knowledge on statistics needed for method validation and evaluation of measurement uncertainty. We have over 10 years' experience in delivering training programmes to local and overseas participants. These courses have supported local and overseas chemical testing laboratories, and local clinical laboratories in complying with the requirements for **ISO/IEC 17025, ISO 17034, ISO/IEC 17043**, or **ISO 15189** accreditation. We deliver a suite of training courses as well as provide customised, online, or onsite training to meet different organisation's needs.

We offer both directed and self-directed learning. Directed learning will be conducted face-to-face or online via video conferencing. Participants will receive copies of the lecture notes, worked exercises and practice questions in the form of spreadsheets. For self-directed learning via a digital platform, e.g. Moodle, participants will receive electronic copies of the lecture notes and gain access to worked exercises and practice questions in the form of spreadsheets and online quizzes. Video presentations of the lecture notes narrated by the Trainer will be available on the online platform for unlimited access during the period of the online course.

Directed learning

Basic Statistical Tools

Objectives

Like most toolboxes, statistics are essential part of any scientist's toolbox – from routine analysis to analytical method development and quality assurance. Applying the right statistical tools enable meaningful data collection, proper data analysis and presentation. Basic statistical tools form the foundation of a modular course that includes method validation and measurement uncertainty. In this course, participants will be introduced to fundamental concepts and tools in statistics needed to apply in chemical and environmental testing. Descriptive and inference statistics will be taught to describe, summarise and present data in a meaningful way, and to draw inferences about the population.

This course aims to demonstrate to participants how to apply and select the appropriate statistical tools through worked examples and exercises, in a spreadsheet environment. From this course, participants will be equipped with the essential tools to further their learning in two other courses on method validation and measurement uncertainty in chemical testing.

Pre-requisites

Participants should have knowledge of chemical measurement and testing with basic proficiency in Microsoft Excel.

If you would like to enquire on the details of the Basic Statistical Tools course, request for its schedule or pricing, please email us at **HSA_CML@hsa.gov.sg** or click/scan the **QR code** below.

Syllabus

- Descriptive statistics
- Probability distribution
- Outlier's test – Dixon's Q test and Grubbs' test
- Significance testing – F-test and Student's t-test
- One-way analysis of variance (ANOVA)
- Linear regression
- Worked examples and exercises

Feedback from Past Participants

"The trainer uses simple, everyday examples to illustrate the application of statistical tools. He uses simple and straightforward language which is very useful in enhancing my understanding. He is an excellent trainer. Thanks!"

"It is not easy to teach a topic so dry like statistics. The trainer has presented it in an engaging and interesting manner. His knowledge on the subject is definitely very good and he imparted the knowledge in a way easy to understand for people like me with weak statistics."

"Good delivery of the course. Learned a lot about statistical tools in excel."

"Useful and helpful course. Easy to comprehend with the worked examples and exercises."

Who Should Attend?

Technical staff of laboratories, managers and others who are interested in understanding or need a refresher on basic statistical tools used for data analysis in chemical and environmental testing. This course is a pre-requisite for participants who wish to attend courses on method validation and measurement uncertainty but have previously not attended any of these training courses.

Directed learning

Method Validation for Chemical Testing

Objectives

Method validation is the process of evaluating the performance of a test method. Validation of methods is a requirement for **ISO/IEC 17025** accredited testing and calibration laboratories for non-standard methods, laboratory designed/developed methods, standard methods used outside their intended scope, as well as, modifications of standard methods.

This course offers participants an understanding of the principles of method validation, how to develop a validation protocol/plan, and decide on the method performance parameters to evaluate in the context of chemical testing. Throughout the course, participants are expected to draw on the basic statistical tools, learnt in previous course, for the statistical evaluation of key performance parameters. From there, participants will learn how to use validation data to evaluate measurement uncertainty. Worked exercises and practice questions in the form of spreadsheets will be provided to reinforce concepts and to enable the participants to apply what they have learnt to their work.

Pre-requisites

Participants should have the knowledge on basic statistical tools used for data analysis in chemical testing and their applications.

If you would like to enquire on the details of the Method Validation for Chemical Testing course, request for its schedule or pricing, please email us at **HSA_CML@hsa.gov.sg** or click/scan the **QR code** below.

Syllabus

- Fundamental principles of analytical method validation
- Building a validation protocol
- Performance parameters
  - *Selectivity/specificity, precision, bias, linearity and working range, limit of detection, limit of quantification, robustness, ruggedness*
- Using validation data to evaluate measurement uncertainty
- Verification of standard methods
- Documentation and report
- Worked examples and exercises

Feedback from Past Participants

"The trainer is very clear in the explanation and very patient as well."

"Good course structure, ease of learning."

"Very useful - where there was a huge amount of info delivered. But all very relevant and I certainly go away with a better understanding plus resources to help me apply to my lab. Thanks!"

"Very useful that answers to exercises were provided as a separate document."

Who Should Attend?

Technical staff of laboratories, managers and others, who are interested to learn how method validation is carried out and data are analysed or needs to perform method validation in their laboratories.

Directed learning

Measurement Uncertainty for Chemical Testing

Objectives

Providing measurement uncertainty for quantitative testing results is part of the requirements for laboratories accredited to **ISO/IEC 17025**. This course aims to elucidate the concepts in measurement uncertainty based on the **ISO GUM** principles and help participants to understand the different terminologies such as "standard uncertainty, expanded uncertainty, relative uncertainty, absolute uncertainty, etc." This course enables the participants to understand the methods of both the "bottom-up" and "top-down" approaches to evaluating measurement uncertainty.

Participants will also be taught how to quantify uncertainties from various processes related to the testing and subsequently to combine them and provide an overall uncertainty associated with their test result. Worked exercises and practice questions in the form of spreadsheets will be provided to reinforce concepts and to enable the participants to apply what they have learnt to their work.

Pre-requisites

Participants should have the knowledge on basic statistical tools used for data analysis in chemical testing and their applications.

If you would like to enquire on the details of the Measurement Uncertainty for Chemical Testing course, request for its schedule or pricing, please email us at **HSA_CML@hsa.gov.sg** or click/scan the **QR code** below.

Syllabus

- Measurement uncertainty and reasons for evaluating measurement uncertainty
- Measurement errors and propagation of random errors
- Bottom-up approach to evaluating uncertainty using ISO GUM measurement uncertainty principles
  - *o Specification of measurand*
  - *o Identify sources of uncertainty*
  - *o Quantify the components of uncertainty*
  - *o Convert uncertainty data into standard uncertainties*
  - *o Evaluate combined uncertainty and expanded uncertainty*
- Top-down approach to evaluating uncertainty
  - *o Specification of measurand*
  - *o Identify sources of uncertainty*
  - *o Quantify precision*
  - *o Quantify bias*
  - *o Evaluate combined uncertainty and expanded uncertainty*
- Report results and uncertainty
- Decision rule and evaluating uncertainty from sampling (New requirements in ISO/IEC 17025:2017)

Feedback from Past Participants

"The availability of course is important to maintaining/improving competency of people new to the testing industry."

"Thanks for arranging the course. After training that I have gained strong knowledge to calculate MU, compare reading material by myself. Trainers are friendly, knowledgeable and helpful."

"This is very good training course to fulfill knowledge for basic statistic and know more about uncertainty of the test measurement how we can get it from and interpret and implementation to apply in our test result."

"Appreciate the trainer tailored the examples of exercise to the test that the team is doing for certification. Thanks to the attention to details. Also, the guidance to the test methods that we are certifying with the external references, really appreciated."

"Especially liked the work examples at the end as it is closer to a real-life example we will face in our work."

Who Should Attend?

Technical staff of laboratories, managers and others, who want to gain knowledge, improve their understanding, or be able to apply the appropriate statistical tools in their evaluation of measurement uncertainty.

Directed learning & Self-Directed Learning

Measurement Uncertainty for Clinical Laboratories

Objectives

Providing measurement uncertainty for quantitative clinical results is part of the requirements for laboratories accredited to ISO 15189. This course aims to elucidate evaluation of measurement uncertainty in the analytical phase of the total testing process, from re-visiting basic statistical tools to key performance parameters in method validation, and finally evaluating measurement uncertainty in accordance with the **ISO GUM** principles and/or a more practical "top-down" approach.

Participants will be taught how to quantify uncertainties from various processes, which includes estimating uncertainty from method performance data, internal quality control and external quality assurance programmes, and subsequently to combine all uncertainty components and provide an overall uncertainty associated with their test result. Worked exercises and practice questions in the form of spreadsheets will be provided to reinforce concepts and to enable the participants to apply what they have learnt to their work.

The online self-learning course enables the participants to access to the course materials using a digital platform, e.g. Moodle, which offer flexibility and progression at own pace. Participants will receive electronic copies of the lecture notes and be able to gain access to worked exercises and practice questions in the form of spreadsheets and online quizzes. Video presentations of the lecture notes narrated by the Trainer will be available on the Moodle platform for unlimited access during the period of the online course. The access period for the online course is typically one to two month(s).

Pre-requisites

Participants should have the knowledge on the use of Microsoft Excel and basic statistical tools used for data analysis in clinical testing.

If you would like to enquire on the details of the Measurement Uncertainty for Clinical Laboratories course, request for its schedule or pricing, please email us at **HSA_CML@hsa.gov.sg** or click/scan the **QR code**.

Syllabus

- Descriptive statistics, outlier's test
- Significance tests, linear regression
- Fundamental principles of analytical method validation
- Performance parameters: selectivity, precision, bias, linearity, limit of detection and limit of quantification
- Measurement uncertainty and reasons for evaluating measurement uncertainty
- Bottom-up approach to evaluating uncertainty using ISO GUM measurement uncertainty principles
  - *o Specification of measurand*
  - *o Identify sources of uncertainty*
  - *o Quantify the components of uncertainty*
  - *o Convert uncertainty data into standard uncertainties*
  - *o Evaluate combined uncertainty and expanded uncertainty*
- Top-down approach to evaluating uncertainty
  - *o Specification of measurand*
  - *o Identify sources of uncertainty*
  - *o Quantify precision using internal quality control data*
  - *o Quantify bias using certified reference materials and external quality assurance data*
  - *o Evaluate combined uncertainty and expanded uncertainty*
- Report results and uncertainty
- Measurement uncertainty target/goal
- Application of uncertainty to result interpretation

Feedback from Past Participants

Directed Learning

"The course was well organised with worked examples to help participants understand the content. I also found the worked examples given to the participants useful because there are formulas that I can use to plug and play my data."

"The trainer explained concepts very well and have very good knowledge specially to respond to our questions. Thanks!"

"Trainer has been very helpful and give many applicable examples."

Self-Directed Learning

"Thank you for this great opportunity. I really appreciate it. I gain so much knowledge, and I'll be implementing it in my diagnostic laboratory."

Who Should Attend?

Technical staff of clinical laboratories, managers and others, who want to gain knowledge, improve their understanding, or be able to apply the appropriate statistical tools in their evaluation of measurement uncertainty.

Directed learning

Statistical Methods for Use in Interlaboratory Comparisons

Objectives

Interlaboratory comparisons (also commonly known as Proficiency Testing, PT or External Quality Assessment, EQA) serve as a mean for laboratories to compare against their peers. It is in fact one of the only few ways for a laboratory to evaluate their bias. **ISO/IEC 17025** accredited laboratories must routinely participate in these interlaboratory comparisons to support their accreditations. The provision of interlaboratory comparisons is conducted in accordance with **ISO/IEC 17043** and **ISO 13528** in order to provide an objective evaluation of the laboratory's performance. This course focuses on the processes and statistics involved in organising an interlaboratory comparison starting from preparing the candidate material to evaluation of participating laboratories' performance.

Pre-requisites

Participants should have basic knowledge in statistics, normal distributions, ANOVA, linear regression and the use of Microsoft Excel.

If you would like to enquire on the details of the Statistical Methods for Use in Interlaboratory Comparisons course, request for its schedule or pricing, please email us at **HSA_CML@hsa.gov.sg** or click/scan the **QR code** below.

Syllabus

- Homogeneity testing
- Sampling
  - *o Random Sampling*
  - *o Stratified Random Sampling*
- Significance test
- Linear regression
- Stability testing
  - *o Classical Stability Testing*
  - *o Isochronous Stability Testing*
- Standard deviation for proficiency assessment
- Scoring systems used in PT
  - *o z-scores*
  - *o z'-scores*
  - *o zeta-scores*
  - *o En scores*
- Graphing

Feedback from Past Participants

"Trainer is knowledgeable, helpful and passionate in teaching. Despite having the training conducted via the online platform due to COVID-19, the trainer has tried to make the training sessions engaging. He also takes the extra mile to prepare materials that meet the students' needs and made sure that the class understands the materials taught."

"Trainer is very knowledgeable in the subject matter and helpful in providing clear explanations to those in doubt."

"This course was taught extremely well and provided grateful information. It provided information that was useful in the actual context of work.

Who Should Attend?

Technical staff and managers of proficiency testing providers, managers who want to gain knowledge on how interlaboratory comparisons are organised and their evaluation scores are computed.

Directed learning

Statistical Methods for Production of Certified Reference Materials

Objectives

Certified reference materials (CRMs) are measurement standards used to check the quality and validity analytical measurement methods, or for the calibration of instruments. CRMs play an important role in establishing metrological traceability of analytical results. The certification process of the CRMs generally complies with the requirements/guidelines set out in **ISO/IEC 17025, ISO 17034** and **ISO Guide 35**. This course aims to elucidate the statistical methods for production of CRMs based on **ISO Guide 35**, starting from re-visiting some essential basic statistical tools to illustrating the statistics required in the certification process of CRMs, i.e. homogeneity, stability and characterisation of the materials. Participants will also be taught how to quantify uncertainties from various processes related to the certification, and subsequently to combine all uncertainty components and provide an overall uncertainty associated with the certified value of the CRM. Worked exercises and practice questions in the form of spreadsheets will be provided to reinforce concepts and to enable the participants to apply what they have learnt to their work.

Pre-requisites

Participants should have the knowledge on basic statistical tools used for data analysis, the use of Microsoft Excel and fundamental knowledge on **ISO/IEC 17025** and **ISO 17034**.

If you would like to enquire on the details of the Statistical Methods for Production of Certified Reference Materials course, request for its schedule or pricing, please email us at **HSA_CML@hsa.gov.sg** or click/scan the **QR code** below.

Syllabus

- Basic statistical tools
  - *o Statistics of repeated measurements*
  - *o Outlier's tests*
  - *o Significance testing*
  - *o Analysis of one-way variance (one-way ANOVA)*
  - *o Linear regression*
- Introduction to measurement uncertainty
- Rules to combining standard uncertainties
- Basic model for characterising of CRM
- Homogeneity study
  - *o Concept of homogeneity*
  - *o Sampling strategies*
  - *o Trend analysis*
  - *o Evaluating a homogeneity study*
  - *o Handling outlying results*
  - *o Between-bottle homogeneity study using one-way ANOVA*
  - *o Insufficient repeatability of the measurement method*
  - *o Evaluating uncertainty due to homogeneity*
- Stability study
  - *o Types of (in)stability*
  - *o Design of experiments*
  - *o Evaluation of stability study using trend analysis*
  - *o Uncertainty evaluation in the absence of trend*
  - *o Determination of shelf life in relation to the long-term stability*
  - *o Stability monitoring of CRM*
- Characterisation of CRM
- Determination of property values and their uncertainties

Feedback from Past Participants

"The Trainer is a very good trainer we ever have this year. We are really satisfied and happy to have such a good trainer from HSA. We may consider inviting her again to give us different training subject."

Who Should Attend?

Technical staff of reference material/certified reference material producers, managers and others, who wish to gain knowledge, strengthen their understanding and capability, or be able to apply the appropriate statistical methods in CRMs production.

Directed learning

Customised Basic Statistical Tools

Objectives

This course is specially catered for customised training request from a company. The course content follows that of the Basic Statistical Tools course with an option where participants can share their applications with the trainers for more in-depth discussion. Participants can also have the option to request for specific topics to be covered/removed.

Example Syllabus

- Data Types and Data Visualisations
- Descriptive Statistics
- Probability Distributions
- Significance Testing
- ANOVA
- Linear Regression

Contact Us

If you would like to enquire on the details of the Customised Basic Statistical Tools course, request for its schedule or pricing, please email us at **HSA_CML@hsa.gov.sg** or click/scan the **QR code** below.

Feedback from Past Participants

"Thanks for conducting this useful and informative course and I definitely learnt a lot from it"

"Thank you for taking the time to teach us the basic statistical tools course virtually. Overall, the online course, made us understand the relevant inferential statistics to analyse cases from a normal distribution. The trainer has put in efforts to provide working examples to make us comprehend the purpose of each statistic."

"Thank you for the insightful course."

We conducted a customised Basic Statistical Tools Course for Health Products Regulation Group of Health Sciences Authority. The course was designed to equip their officers with basic general statistics knowledge to help them with their work.

Future Training Courses / Customised Courses

It is our plan to offer two new online self-learning courses on Basic Statistical Tools and Method Validation for Chemical Testing in 2024.

Contact Us

If you would like to enquire on the details of the new training courses or if you have new requests, please email us at **HSA_CML@hsa.gov.sg** or click/scan the **QR code**.

Our Trainers

Ms Cheow Pui Sze

Ms Cheow obtained her MSc (Chemistry) degree from the National University of Singapore in 2008. She is a Consultant Scientist and Team Leader of the Organic Chemistry Section in the Chemical Metrology Laboratory (CML), Health Sciences Authority (HSA). Ms Cheow has over 10 years' experience in providing statistical training to analysts in HSA, as well as local and overseas laboratories. She has also provided a number of consultancy services on statistics to testing laboratories. Ms Cheow serves as SAC-SINGLAS Technical Assessor and was also a member of a working group tasked to develop the SAC Technical Guide 4 – A Guide on Measurement Uncertainty in Medical Testing. She is involved in the method validation and evaluation of measurement uncertainty in international and regional comparative studies participated by HSA CML and is also largely responsible for the implementation of statistical methods in proficiency testing programmes organised and certified reference materials produced by the laboratory. Ms Cheow's experience covers GC-MS, GC-FID/ECD, HPLC-DAD, HPLC-CAD, HPLC-MS, GC-MS/MS, ion chromatography, Karl Fischer coulometry, thermogravimetry and isotope dilution mass spectrometry. She represents Singapore Standards Council in ISO/CASCO Working Group (WG) 57 on Conformity Assessment - General Requirements for Proficiency Testing and ISO/TC 334 WG 16 on Reference Material Value Assignment.

Dr Benny Tong Meng Kiat

Dr Tong received his PhD degree from the Nanyang Technological University in 2014. He is a Senior Scientist in HSA CML. He first joined the Inorganic Chemistry Section in 2015 and later joined the Organic Chemistry Section in 2019. He is also a SAC-SINGLAS Technical Assessor. Dr Tong has been involved in new method development and validation for the HSA CML, in which the methodologies were used in proficiency testing programmes and external quality assessment programmes organised for testing laboratories. Dr Tong has over 5 years' experience in providing statistical training to analysts in local and overseas laboratories. In the past years, he has been actively involved in performing method validation and evaluation of measurement uncertainty, organising/participating in international and regional comparative studies participated by the Laboratory. Dr Tong's experience covers isotope dilution mass spectrometry and standard additions techniques. He is experienced in various instrumentation such as ICP-MS, GC/LC-MS, TGA and NMR. Dr Tong is also interested in data analytics.

Dr Ng Sin Yee

Dr Ng obtained her PhD (Chemistry) degree from the National University of Singapore in 2006. She is a member of the Inorganic Chemistry Section in the Chemical Metrology Laboratory, HSA. She has been actively involved in the development and validation of new measurement capabilities in the field of inorganic metrology. These include the measurement of a broad range of elements, species, and anions in a variety of matrices such as food, water, pharmaceutical and biological samples. She has also been involved in the production of certified reference materials, proficiency testing programme and external quality assurance programme, evaluation of measurement uncertainty, and participation in international and regional comparative studies.